TESIS DE LA UNIVERSIDAD DE ZARAGOZA
2024
450

Adrian Espinosa Gracia

Innovation and income distribution since 1929. Changes in scientific, institutional, and technological paradigms, and empirical analyses in input-output models

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ISSN 2254-7606

Prensas de la Universidad
Universidad Zaragoza

Universidad de Zaragoza
Servicio de Publicaciones

ISSN 2254-7606

Universidad Zaragoza
1542

Tesis Doctoral

INNOVATION AND INCOME DISTRIBUTION SINCE 1929. CHANGES IN SCIENTIFIC, INSTITUTIONAL, AND TECHNOLOGICAL PARADIGMS, AND EMPIRICAL ANALYSES IN INPUT-OUTPUT MODELS

Autor

Adrian Espinosa Gracia

Director/es

Sánchez Chóliz, Julio
Sánchez Hormigo, Alfonso

UNIVERSIDAD DE ZARAGOZA
Escuela de Doctorado

Programa de Doctorado en Economía

2022

Repositorio de la Universidad de Zaragoza – Zaguan http://zaguan.unizar.es

Innovation and income distribution since 1929. Changes in scientific, institutional, and technological paradigms, and empirical analyses in input-output models

Doctor of Philosophy in Economics

Adrián Espinosa Gracia

PhD advisors: Dr. Julio Sánchez Chóliz
Dr. Alfonso Sánchez Hormigo

Department of Economic Analysis
Faculty of Economics and Business
University of Zaragoza (Spain)
2022

Estaba muy desigual el suelo, porque a las puertas de los poderosos, que son los ricos, había unos grandes montones que relucían mucho.

¡Oh, qué de oro! – dixo Andrenio.

Y el Quirón: Advierte que no lo es todo lo que reluce.

Llegaron más cerca y conocieron que era basura dorada.

Al contrario, a las puertas de los pobres y desvalidos había unas tan profundas y espantosas simas, que causaban horror a cuantos las miraban; y assí, ninguno se acercaba a mil leguas: todos las miraban de lexos. Y es lo bueno que todo el día, sin cessar, muchas y grandes bestias estaban acarreando hediondo estiércol y lo echaban sobre el otro, amontonando tierra sobre tierra.

¡Cosa rara – dixo Andrenio -, aun economía no hay! ¿No fuera mejor echar toda esta tierra en aquellos grandes hoyos de los pobres, con que se emparejara el suelo y quedara todo muy igual?

Assí había de ser para bien ir – dixo el Quirón -. Pero ¿qué cosa va bien en el mundo? Aquí veréis platicado aquel célebre impossible tan disputado de los filósofos, conviniendo todos en que no se puede dar vacío en la naturaleza; he aquí que en la humana esta gran monstruosidad cada día sucede. No se da ya en el mundo a quien no tiene, sino a quien más tiene. A muchos se les quita la hazienda porque son pobres, y se les adjudica a otros porque la tienen. Pues las dádivas, no van sino a donde hay, ni se hazen los presentes a los ausentes. El oro dora la plata y ésta acude al reclamo de otra. Los ricos son los que heredan, que los pobres no tiene parientes; el hambriento no halla un pedaço de pan y el ahíto está cada día convidado; el que una vez es pobre, siempre es pobre: y desta suerte, todo el mundo hallaréis desigual.

Baltasar Gracián, *El Criticón* (1651), Primera parte, Crisi VI.

A mis sobrinos, Naia y Luka,
les dedico este libro que, parafraseando a Pessoa,
es producto de mi cobardía.
Perseguid lo que queráis lograr en la vida,
aun cuando os ciegue el signo del infortunio.

Agradecimientos

El proceso de realización de una tesis es arduo y largo, y requiere un nivel de trabajo elevado y constante, que podría ajustarse perfectamente a la máxima de César Augusto, *festina lente*. La dificultad de este trabajo haría prácticamente imposible que llegáramos al final del camino sin recibir ningún tipo de ayuda. De ahí que sea de justicia que el documento vaya encabezado por una sección de agradecimientos a todos aquellos que lo han hecho posible.

En primer lugar, deseo manifestar mi eterno agradecimiento a mis directores de tesis y, si se me permite la licencia, mis 'padres intelectuales', Julio y Alfonso. A Alfonso le debo que me introdujera el interés por la Economía, y que me ayudara a madurar intelectualmente con sus charlas, siempre fructíferas, aun en temas profanos, tales como la Filosofía, la Literatura, o el Arte en general. Por su parte, a Julio le debo su transmisión de la devoción por la Ciencia y de valores tan importantes como la ética y el cuidado en la investigación. También me gustaría agradecerle que nunca se haya dado por vencido conmigo y que haya mantenido su fe en mí, cuando ni yo mismo creía.

También agradezco en general a todo el personal del Departamento de Análisis Económico, así como a la Coordinación del Programa de Doctorado en Economía de la Universidad de Zaragoza, por su disposición a resolver todas las cuestiones que han ido surgiendo a lo largo de estos cinco años. Dentro del Departamento, merece mención especial el grupo de investigación que me ha acogido con los brazos abiertos, Crecimiento, Demanda y Recursos Naturales (CREDENAT). Gracias especialmente a Rosa Duarte por su capacidad de liderazgo y gestión, así como por sus constantes comentarios de mejora y colaboración en trabajos. Asimismo, debo estar agradecido por la oportunidad de haber podido establecer lazos con miembros de este grupo, que van más allá de lo profesional. Primero, he de admitir que probablemente no estaría aquí de no ser por Sofía Jiménez y Raquel Langarita. Mil gracias por haber estado siempre dispuestas a echarme un cable y a ser incluso mis 'segundas directoras', he aprendido mucho con vosotras. Gracias, Sofía, por ser como eres, una amiga, una madre, e incluso una psicóloga. Gracias, Raquel, por tu sonrisa eterna y tu actitud positiva, haciendo que todo parezca que está siempre en su sitio. Segundo, no quiero dejar fuera a dos personas con las que también he compartido trabajo y más, Miguel Ángel Almazán y Lucía Bolea. Gracias, Miguel Ángel, por estar siempre dispuesto a debatir, pero también a alejarnos

las preocupaciones de la mente; y gracias, Lucía, por tu compañerismo durante buena parte de este proceso.

El desarrollo de la tesis también me ha brindado la oportunidad de realizar una estancia de investigación en la Universidad de Groningen. En este sentido, debo dar las gracias a Erik Dietzenbacher y Bert Steenge, ya no sólo por la oportunidad de trabajar con ellos, sino también por deslumbrarme con su conocimiento, su altura intelectual y su amabilidad. *Dank je wel!*

Debo agradecer también la recepción de financiación que ha hecho posible llevar a cabo este trabajo, especialmente la asociada al contrato predoctoral FPU17/03785, otorgada por el Ministerio de Universidades. Aparte de la financiación, el contrato nos permite también formarnos como docentes. En este apartado, gracias especiales a Francisco Fatás, Héctor Bellido y Gemma Larramona, por vuestra ayuda en la impartición de las asignaturas de Macroeconomía.

Permítase ahora cambiar de registro para pasar del ámbito profesional al personal. En primer lugar, gracias especiales a todos los compañeros con los que he compartido despacho en la Sala de Becarios 1 de la Facultad de Economía y Empresa, por contribuir a que las jornadas de trabajo sean menos duras y hacer que los días más duros a nivel profesional merezcan la pena. En especial, gracias a aquellos que me han aceptado como amigo, además de compañero. Gracias a Jorge Velilla, por ser siempre un espejo en el que fijarse, tanto en lo profesional como en lo personal. También a Álvaro García y Pablo Vilas, por acompañarme en las últimas etapas del proceso, las más duras, pero también las más divertidas, gracias a vosotros.

Finalmente, gracias a mis personas más allegadas, que al fin y al cabo son las que han tenido que aguantarme en el día a día, en épocas de frustración y agotamiento. Gracias, por lo tanto, a mi familia y a mis amigos. No hace falta que os nombre, sabéis perfectamente quienes estáis en este párrafo.

Acknowledgements

The process of carrying out a dissertation is a long and hard one. It requires a constant level of hard work, which brings to mind Caesar Augustus' motto, *festina lente*. The difficulties we find while working on it are such, that it would be barely impossible to finish without some helping hands. Thus, it seems mandatory to start this document with an acknowledgements section, in order to recognize all the assistance received.

First, I would like to express my eternal gratitude to my advisors and intellectual forefathers, Julio and Alfonso. To Alfonso I owe my initial contacts with Economics, as well as my intellectual maturation, thanks to our conversations about profane topics, such as Philosophy, Literature, or Art in general. To Julio I owe the transmission of his devotion for Science, associated to important values, such as professional ethics and being precise when conducting research. I would also like to thank him for believing in me, even when I was not capable myself.

I would also like to express my thanks to the Department of Economic Analysis, as well as to the PhD program in Economics at the University of Zaragoza, for their help in solving bureaucratic and other questions. I would specially like to thank the research group that has taken me under its wings, CREDENAT. Many thanks to Rosa Duarte for her leadership and management, as well as for her constant efforts in trying to improve our work and letting me collaborate with her and other members of the group. In this sense, there are also special mentions to those members with whom I have worked and also established bonds that go beyond professional relations. First, I have to admit that I would probably not be writing this now if it were not for the help provided by Sofía Jiménez and Raquel Langarita. Many thanks for being able to act as, I would dare to say, my 'secondary advisors'. Thanks, Sofía, for being as you are, a friend, a mother, and even a shrink. Thanks, Raquel, for your everlasting smile and your positive attitude, always making things seem right. Second, I would also like to thank another two colleagues, Miguel Ángel Almazán and Lucía Bolea. Thanks, Miguel Ángel, for always being able to start a debate, but also for helping us to deviate our thoughts from work; and thanks, Lucía, for your companionship during a great part of this process.

The development of this thesis has also given me the opportunity to carry out a research stay in the University of Groningen. In this sense, I would like to thank Erik Dietzenbacher and Bert Steenge for their collaboration and their astonishing knowledge. Thank you very much also for your kindness. *Dank je wel!*

This thesis would also not have been possible if it were not for the funding received, associated to the pre-doctoral grant FPU17/03785 from the Spanish Ministry of Universities. Besides the funding, this grant also offers the advantage of letting us train as lecturers. Here, I would like to thank Francisco Fatás, Héctor Bellido, and Gemma Larramona, for their help and collaboration when I was preparing my lectures in Macroeconomics.

I would now like to change the tone of this section, if I may, from profession to more personal terms. First, I would like to thank all my colleagues from the Sala de Becarios 1, for making it worth to wake up each morning and come to work with a smile on the face. I would specially like to thank those that have accepted me as a friend. Thanks to Jorge Velilla for being an example both at professional and personal levels. Thanks also to Álvaro García and Pablo Vilas, for their friendship during the last phase of the thesis, which was toughest, but also the most enjoyable, thanks to their presence.

Finally, thanks to my family and friends, which have been present in my ordinary life, bearing with my temper, my anxiety, and frustration. There is no need to say names here, if you belong in this paragraph, you will surely know.

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Capítulo I: Introducción, estado de la cuestión y metodología.

1.1. Temática general

La presente tesis va a versar, a grandes rasgos, sobre la distribución de la renta en las últimas décadas y, por consiguiente, el estudio de su desigualdad y su evolución será uno de sus ejes principales, siendo otro el crecimiento económico a largo plazo. A su vez, ello supondrá tener en cuenta aspectos relacionados con el crecimiento en los sistemas productivos contemporáneos, así como los cambios estructurales de las economías y los marcos socioeconómicos en que éstas han evolucionado. Como resultado del estudio en profundidad de estos temas, esperamos comprender mejor los mecanismos del crecimiento contemporáneo y su fuerte ligadura con los patrones distributivos. De hecho, las relaciones entre distribución y crecimiento han sido un tema siempre presente en Economía desde Smith y Ricardo, y sigue siendo un tema candente todavía en la actualidad (Caiani et al., 2019; Cynamon & Fazzari, 2016; da Silveira & Lima, 2021; Onaran & Obst, 2016; Ostry et al., 2014; Palley, 2017; Patriarca & Sardoni, 2017; Tridico, 2018).

Consideraremos un amplio período de estudio que se extenderá desde 1929, coincidiendo con el inicio de la Gran Depresión, hasta la reciente crisis de 2008, aunque avanzaremos también tanto como podamos hasta nuestros días. En el análisis empírico, nos centraremos especialmente en su segunda mitad, desde 1980 en adelante. En este largo período, el conocimiento tecnológico, las condiciones productivas, así como las institucionales y científicas, han cambiado mucho, afectando dichas alteraciones a las condiciones de distribución de la renta y al nivel de vida de la población, y esto ha ocurrido tanto en los países desarrollados como en el resto del mundo. Así, según datos del Banco Mundial, el PIB mundial fue en 2021 en torno a 50 veces mayor que en 1960. Un dato impresionante, tanto más teniendo en cuenta que un incremento tan grande de la tarta a repartir no ha supuesto un reparto más igualitario, al menos en las últimas décadas. Atendiendo a datos de la World Inequality Database, el percentil superior de la distribución de la renta mundial pasó de ostentar un 17% de la renta en 1980, a un 20% en 2021, manteniéndose la proporción de renta del primer decil más o menos constante en torno al 52%; por otra parte, los cuatros deciles siguientes en su conjunto pasaron de un 42% a un 40%. La renta en manos del 50% inferior aumentó, por lo tanto, en 2 puntos porcentuales, representando actualmente sólo el 8% del total. Aun siendo conscientes de que la definición de desigualdad siempre implica, en cierto grado, la admisión de juicios

de valor, creemos que los datos son lo suficientemente ilustrativos como para admitir, que esta panorámica global muestra una situación actual donde la renta está distribuida de forma no igualitaria, así como un empeoramiento de las condiciones distributivas desde los años 80, lo cual es una de las motivaciones de esta tesis.

La mención de juicios de valor hace necesaria una mención con respecto a este carácter, hasta cierto punto, subjetivo de la desigualdad. El análisis de los fundamentos de la teoría económica y de la distribución de rentas, ha contribuido recientemente al debate (Allen, 2021). Desafortunadamente, no parece existir un consenso con respecto a qué tipo de desigualdad es relevante, ni a partir de qué valores es necesario considerarlo un tema preocupante (Scanlon, 2021). No obstante, a pesar de la falta de acuerdo, muchos filósofos coinciden, junto con Rawls (1971), en que las desigualdades se vuelven injustificables si y solo si impiden un aumento del nivel de bienestar de los más desfavorecidos (Van Parijs, 2021). Es ante niveles de desigualdad tales, cuando las desigualdades económicas han de ser denunciadas.

En nuestro largo periodo de estudio, que parte de 1929 y está caracterizado por una impresionante mejora de la productividad, veremos que la distribución de la renta ha tenido dos tendencias muy diferentes: hasta mediados de los años setenta, la desigualdad dentro de los países disminuyó claramente, mientras que creció en las últimas tres décadas (Decancq et al., 2009; Piketty, 2014, 2020), teniendo lugar ambas evoluciones en contextos socio-institucionales muy diferentes. Todo ello nos llevará a fijarnos, por una parte, en las dinámicas económicas, sociales e institucionales, tanto de medio como de largo plazo; y, por otra, en el carácter co-evolutivo de esas dinámicas, así como en las causas subyacentes de esas evoluciones. Esta observación nos hará plantearnos la existencia de dos ondas largas en ese período (capítulo II), yendo la primera desde 1930 hasta 1975 aproximadamente, y otra posterior desde 1975 hasta 2010. Estas ondas presentan paradigmas evolutivos muy distintos, y nos dan una panorámica global general de los mecanismos estructurales de la distribución de la renta durante el último siglo. Un caso específico de cómo se han plasmado estas evoluciones en la segunda onda nos lo dará el caso de España (capítulo IV), al que nos aproximaremos mediante el uso de tablas input-output.

En lo que antecede, hemos estado hablando sobre todo de desigualdades *intra regionem*. Sin embargo, en una economía globalizada, donde los procesos productivos son fenómenos mundiales, la desigualdad toma necesariamente un cariz mundial. Para

hablar de desigualdad mundial, no debemos dejar de lado el componente inter-país, que ha decrecido en las últimas décadas, revelando una cierta convergencia (Chancel et al., 2022). Como resultado de estas dos fuerzas contrapuestas, es resultado sobre la desigualdad global no es tan claro, por lo que consideramos que es también objeto digno de estudio. Por ello, abordaremos su estudio mediante el uso de tablas input-output multirregionales para la economía mundial (capítulo V), poniendo el foco en nuestra segunda onda, que se corresponde con los años más intensos de globalización.

Al tratar de abarcar estos diversos temas, tendremos en mente estas preguntas: ¿cómo debemos afrontar los efectos de la crisis de 2008 y de la más reciente, la generada por la COVID-19?, ¿cómo salir de ellas con una sociedad más justa y sostenible?, ¿cómo afecta a la distribución de la renta mundial que los fenómenos productivos sean cada vez más globales? A continuación, y, como una primera aproximación a este estudio, veamos con algo más de detalle las motivaciones que nos han llevado a interesarnos en estos temas. Trataremos, además, de explicar mejor los hilos conductores de la investigación.

1.2. Motivación y objetivos

La reciente crisis económica – la denominada Gran Recesión, iniciada en 2008 -, ha puesto de relieve una serie de desafíos económicos. Uno de ellos, que reaparece periódicamente, es precisamente el de la recurrencia de las crisis. De hecho, el problema de la ciencia económica por antonomasia, desde el mismo surgimiento del capitalismo industrial, parece ser el de si esta recurrencia periódica es evitable o no; cuestión que, hacia inicios del siglo XXI, muchos economistas creían superada (Bernanke, 2004; Clark, 2009; Stock & Watson, 2003) porque pensaban que, con los instrumentos de gestión monetaria, económica y política, era posible neutralizar las crisis y mantener un crecimiento relativamente estable.

A partir de mediados de los años 80 comenzó la Gran Moderación, que fue un período de relativa estabilidad macroeconómica. Como consecuencia del período inflacionario que siguió a la crisis del petróleo, se estableció la prioridad de perseguir una tasa de crecimiento de los precios estable – y, por tanto, una tasa estable de crecimiento de la oferta monetaria, que debía también ayudar a conformar las expectativas de los agentes económicos (Lucas & Sargent, 1979; Taylor, 1993). La base de ello fue la confianza en las expectativas racionales de los agentes. En definitiva, se estableció la creencia de que

la política monetaria y las medidas políticas asociadas podían asegurar la estabilidad macroeconómica a perpetuidad. Cabe imaginar el estupor con el que la mayoría de la comunidad científica vivió el estallido de una crisis en 2008, teóricamente imprevista[1], de la magnitud de la Gran Recesión, y con ciertos paralelismos con la Gran Depresión de 1929. Todo ello, sumado a las consecuencias distributivas que van asociadas a una crisis de tal calado, hace que, en esta tesis, estemos interesados en todas las razones que hubo detrás de las crisis de 2008 y en las posibles ondas largas que conectan entre sí las grandes crisis económicas. Este interés será el que justifique el contenido del capítulo II de la tesis, cuyo objetivo principal será establecer los patrones evolutivos que hay detrás de estas ondas largas, conectando con las diferentes tendencias a largo plazo de la desigualdad, comentadas previamente. Una vez establecido un marco de referencia, buscaremos profundizar en cuestiones teóricas relacionadas con distribución de la renta, lo que constituirá el contenido del capítulo III.

Las claras debilidades del conocimiento científico-económico para explicar los hechos ocurridos durante la Gran Recesión son tanto más graves cuando nos fijamos en las consecuencias a nivel social y medioambiental; esto es, cuando se constata que el modelo económico puede acabar siendo insostenible porque presenta continuamente tasas crecientes en los niveles de desigualdad y en el uso de recursos no renovables. Y no sólo eso, sino que además el propio desarrollo de la crisis ha contribuido a empeorar la situación de los más desfavorecidos, como ha sido el caso de España, donde, según estadísticas del Banco Mundial, el porcentaje de la población que se encontraba por debajo del umbral de la pobreza, de 1,90 dólares diarios, era más del doble en 2013 que en 2008 (pasó de un 0,5% a un 1,2%). En esta línea, en el capítulo IV abordaremos la evolución de la distribución de la renta en España, que constituye un buen ejemplo de un país desarrollado especialmente golpeado por la crisis, y en el V trataremos algunos aspectos de la distribución de la renta en la economía global.

Parece evidente, a partir incluso de la propia experiencia de todo economista, que existe una relación entre las crisis económicas y la evolución de la desigualdad y de la pobreza. De ahí, que un objetivo de esta investigación sea relacionar las dinámicas a largo plazo de los procesos económicos con las tendencias, también a largo plazo, de distribución

[1] De hecho, en términos probabilísticos, otro de los errores cometidos fue la identificación, en la práctica, de un hecho altamente improbable como un hecho con una probabilidad nula de que suceda. La Gran Recesión es un claro ejemplo de estos hechos que, por ser difícilmente previsibles, no están exentos de su ocurrencia, lo que se ha dado a conocer como un 'cisne negro', en la terminología de Taleb (2007).

de la renta. Los cambios en estos procesos están fuertemente ligados a las características sociales, institucionales, y tecnológicas que imperan en cada momento; y, a su vez, estas características determinan cómo se distribuye el producto entre los distintos agentes que participan en el proceso productivo. Por ello, el análisis de la dinámica económica en el periodo, 1929-2010, que podemos identificar con dos ondas largas, la consideración de los cambios estructurales a través de tablas input-output en la economía española y en la economía global, así como el reparto de rentas entre capital y trabajo y el papel de los patrones de consumo en su distribución, serán algunas de nuestras guías en la investigación a realizar.

De acuerdo con todo lo comentado, la tesis tendrá dos partes claramente diferenciadas. Una primera parte tratará de dar respuesta a todas estas preguntas desde una perspectiva más teórica, y lo hará a través del estudio de las ondas largas y de la explotación de algunos modelos multisectoriales formales. La segunda tendrá un carácter más empírico y en ella trataremos de explicar los patrones de la distribución de rentas y la evolución de su desigualdad en las últimas décadas, tanto para la economía española como para la economía mundial, apoyándonos para ello en tablas input-output de España y en modelos multirregionales input-output de la economía global.

A continuación, resumimos los principales objetivos a perseguir en el marco de esta tesis:

a) Realizar una revisión profunda del estado de la cuestión en lo relativo a la distribución de la renta, así como de los instrumentos que se han usado hasta ahora para su análisis.
b) Fijar el concepto de dinámica co-evolutiva que se asume, sobre todo, en la parte teórica del trabajo, mostrando sus relaciones con las ondas largas y con la evolución, en el medio y largo plazo, de los procesos de distribución de la renta.
c) Revisar los tres modelos multisectoriales a usar. Un modelo formal multisectorial, con sus ecuaciones de precios, que permite profundizar teóricamente en la distribución primaria de la renta y su relación con los patrones de consumo. El modelo input-output tradicional de Leontief, que se aplicará al análisis empírico de la distribución en España. Y finalmente, la extensión multirregional del modelo input-output, que usaremos para los análisis de distribución de la renta en la economía mundial.

d) Analizar las dinámicas económicas de largo plazo y procesos de distribución de la renta en el mundo desarrollado durante el siglo XX y XXI, mostrando el profundo cambio que tiene lugar a mediados de los 70.
e) Profundizando en esa misma línea, estudiar la evolución económica de los países más desarrollados en el periodo 1929-2010, mostrando la existencia de dos ondas largas en este periodo a través de la contrastación empírica y de la caracterización de sus paradigmas co-evolutivos.
f) Estudio empírico de las tendencias distributivas, en las cuatro últimas décadas en España, confirmando el incremento de la desigualdad en el período 1980-2014. Se usará una serie anual de tablas input-output, así como medidas de desigualdad más tradicionales, tipo Sen (1976) o Gini (1921).
g) Continuando con el análisis empírico, se pretende replicar el análisis anterior desde una perspectiva global, incluyendo desigualdades entre países y en el interior de los mismos. Investigaremos si se ha producido un cierto cierre de la brecha con los países ricos, al menos en ciertas regiones. Para ello usaremos tablas multirregionales de la economía mundial y nos apoyaremos en las Cadenas Globales de Valor y en sus indicadores de participación y posición.
h) Y finalmente, exploraremos, en la medida de lo posible, las características de la posible nueva onda que arranca en torno a 2010: nuevas tecnologías emergentes, tendencias en la equidad de las rentas, cambios en el mercado de trabajo, nuevas tendencias de globalización, etc… Todo lo anterior hará que, además, nos encontremos en una posición ventajosa para hacer recomendaciones de política con el ánimo de corregir las desigualdades tanto dentro de los países, como entre ellos.

1.3. Estado de la cuestión

Tras exponer de forma breve los objetivos y motivaciones de la tesis, a continuación, vamos a revisar la literatura existente sobre distribución, dinámica y ondas largas, temas sobre los que gira nuestra investigación, ello nos servirá también para situar nuestro trabajo en su debido contexto.

1.3.1. Evolución y economía: el estudio de las dinámicas largas y sus determinantes

Haremos una breve aproximación a los fundamentos teóricos que han dado origen a lo que hoy conocemos como Economía evolutiva, que es una base metodológica fundamental para abordar, en nuestra opinión, el estudio de las dinámicas a largo plazo y las ondas largas.

Podría señalarse la figura de Thorstein Veblen (1899) como uno de los padres fundadores de la Economía evolutiva. Su concepción acumulativa de los procesos de cambio institucional es una de las patas en que se basan, no sólo corrientes alternativas del estudio de las instituciones como el neo-institucionalismo (Myrdal, 1978), sino también la Economía evolutiva contemporánea. El análisis de la instituciones y de los cambios que generan sobre los procesos económicos fue retomado medio siglo después por Karl Polanyi (1944), quien trató las transformaciones socioeconómicas que tuvieron lugar con posterioridad a la Segunda Revolución Industrial, estableciendo comparaciones con el entorno cambiante del primer tercio del siglo XX[2]. Las instituciones son claves en nuestra visión, ya que juegan un papel importante en la determinación de los patrones evolutivos de crecimiento y distribución – pensar, por ejemplo, en el papel del Estado de Bienestar en la reducción de desigualdades vía redistribución.

La otra pata de estos cimientos teóricos de la Economía evolutiva puede ser atribuida a Schumpeter (1939), que también se ocupó de estudiar el cambio de los sistemas económicos desde una perspectiva más relacionada con la innovación, y asumiendo que la evolución toma la forma de ondas de larga duración (Kondratieff, 1935). Los ciclos económicos son fundamentales para explicar la evolución de la distribución de la renta, pero su análisis depende, en buena medida, de qué factores se consideren como los causantes de las fluctuaciones. Nosotros nos centraremos en las teorías que, a partir de Schumpeter y Kondratieff, toman el cambio tecnológico y la "destrucción creativa" como uno de los determinantes de la evolución. No obstante, no podemos olvidar el otro eje de la Economía evolutiva, las instituciones: a este respecto, existen también teorías

[2] El análisis de Polanyi (1944) también es interesante porque muestra cómo surgió la percepción social de la pobreza en la Inglaterra de finales del siglo XVIII, con el establecimiento de las Leyes de Pobres de Speenhamland (1795). La pobreza empezó entonces a ser considerada como un problema social recurrente, por lo que este puede ser señalado también como el momento en que la sociedad empezó a percibir las crisis económicas como un problema que reaparecía periódicamente.

del ciclo que se ocupan del estudio de las fuerzas del mercado y que, por lo tanto, tienen en cuenta el componente institucional (Tinbergen, 1935).

Podemos concluir, pues, que estos dos ejes reúnen los fundamentos de lo que posteriormente cristalizó en la Economía evolutiva contemporánea (Nelson & Winter, 1982). En esta vertiente, podemos diferenciar también varios bloques de referencias principales: aquellos análisis que se ocupan en mayor medida del componente tecnológico (Dosi, 1984; Freeman, 1996; Metcalfe, 2002), y aquellos que se centran principalmente en el estudio del cambio institucional (Hodgson, 1999; Nelson, 2008). Por último, aunque no vaya a ser objeto de estudio en nuestra tesis, creemos importante mencionar la existencia del campo de la teoría de juegos evolutiva (Maynard Smith, J.; Price, 1973; 1974), como referente metodológico en el desarrollo de este campo.

Como se ha podido ver, el concepto de cambio va a ser clave en el estudio de dinámicas de largo plazo. La literatura ha tratado, muchas veces, este tema mediante la definición del concepto de paradigma, utilizado para designar el conjunto de características que determinan la evolución de un sistema económico. La noción de paradigma que utilizaremos ha sido estudiada sobre todo a partir de los años 80 (Dosi, 1982; Forrester, 1985; Freeman, 2008). Aquí es importante también introducir la concepción evolutivo-materialista de Bunge (1985) que, como se verá más adelante, nos permitirá relacionar los conceptos de paradigma y mecanismo y reforzar el concepto de co-evolución, que dará un apoyo teórico y sociológico a nuestro esquema de ondas largas del periodo 1929-2010.

Las referencias utilizadas hasta ahora cubren una buena parte de las principales referencias en cuanto a aportaciones teóricas. En el plano de las aplicaciones empíricas, la identificación de las ondas largas y del cambio estructural han sido ampliamente tratadas por la econometría convencional, ya sea mediante la aplicación de tests (Chow, 1960), de filtros para separar la tendencia de la serie cíclica (Hodrick & Prescott, 1997; Baxter & King, 1999), o, más recientemente, por otra serie de métodos estadísticos (Silverberg & Verspagen, 2003). También, otra de las vías por las que la Economía evolutiva se ha acercado a este análisis, es mediante la definición de una serie de curvas sigmoideas que hacen referencia al proceso de innovación, donde se pueden identificar los puntos de estancamiento de las curvas con momentos de crisis económica y cambio estructural (Jarne et al., 2007; Sanchez-Choliz et al., 2008).

Para finalizar, no debemos pasar por alto la proliferación de literatura que tuvo lugar durante las décadas de los 80 y los 90, a partir de los debates sobre la teoría de la onda larga (Freeman, 1996). Por ejemplo, existen estudios que se han centrado en debatir si es posible confirmar la existencia de ondas largas con un carácter de Kondratieff, es decir de entre unos 50 y 60 años de duración media; o, si por el contrario, se parecen más a las descritas por Kuznets (1940) y se extienden durante periodos más cortos, de alrededor de 20 años (Solomou, 1986, 1988). Tampoco existe un consenso muy extendido acerca de si las ondas largas pertenecen más al campo de la producción, o si se manifiestan más bien en las series de precios (Ewijk, 1982). No obstante, pese a esta explosión de literatura, la onda 1975-2010 y la evolución de la distribución de la renta en su marco no han sido temas ampliamente investigados, por lo que esperamos contribuir a este respecto. En resumidas cuentas, el debate teórico ya no sólo se reduce a la determinación de la existencia o no de las ondas largas, sino que se extiende a las particularidades de sus manifestaciones. Siendo conscientes de que estos problemas han sido reducidos en numerosas ocasiones a una cuestión de 'creer', adquirimos el compromiso de huir de todo fundamentalismo y dogmatismo, y tratar simplemente de utilizar estas herramientas para alcanzar un conocimiento más profundo del funcionamiento de los sistemas económicos y de sus evoluciones estructurales.

1.3.2. Distribución de la renta y desigualdad

La teoría de la distribución ha ocupado un lugar importante dentro las principales discusiones desde la constitución de la Economía como Ciencia. Uno de los debates más conocido es el enmarcado en las llamadas "Controversias de Cambridge" (Harcourt, 1969), que tiene lugar en los años cincuenta y sesenta, donde se discutieron temas relacionados con las teorías del capital, del valor y de la distribución. Se enfrentaron, por una parte, los representantes del Cambridge norteamericano, entre los que se pueden destacar Arrow (Arrow & Debreu, 1954), Solow (1955), o Samuelson (1962); frente a los representantes del Cambridge británico, donde destacaríamos a Sraffa (1960), Kaldor (1960), o Robinson (1969). En lo referente a la teoría de la distribución, una de las principales diferencias entre ambos grupo, se encuentra en el hecho de que los economistas americanos, afines a la concepción neoclásica, defendían la identificación de las retribuciones de los factores productivos con sus correspondientes productividades marginales y, por lo tanto, independientes entre sí (Ferguson, 1969); mientras que, frente a ellos, los economistas británicos postularon una relación de

dependencia inversa entre salarios y beneficios, de modo que, tomadas como proporciones sobre la renta nacional, una variable no puede crecer si no es a costa de un decrecimiento de la otra. Más aún, consideraron que estas variables distributivas estaban fuertemente ligadas al marco socio-institucional, y que no son determinadas exclusivamente por relaciones técnicas o productividades marginales, conectando parcialmente con los planteamientos de Ricardo (1817) y Marx (1867-1894). A lo largo de la tesis nos moveremos en estas mismas posiciones.

David Ricardo situó la determinación de las leyes de la distribución de la renta como el principal problema de la Economía Política – y, por primera vez, como un conflicto entre diferentes clases sociales, a diferencia de Smith (1776), que defendía la independencia de las variables distributivas. No obstante, su conflicto se reducía a la confrontación de los terratenientes con el resto de la sociedad. Partiendo de Ricardo y de su concepto de valor trabajo, Marx fue el primero en tratar el conflicto distributivo en las sociedades capitalistas, defendiendo la relación inversa entre salarios y beneficios, y la confrontación de los intereses de trabajadores y empresarios. Aunque la existencia de una fuerte correlación inversa entre salarios y beneficios es confirmada por los datos, también estos muestran que el conflicto distributivo puede ser atenuado o modulado por el cambio tecnológico (Okishio, 1961; Vegara, 1977), o por el marco institucional – pensar, por ejemplo, en cómo la aparición del Estado de bienestar durante la primera mitad del siglo XX ha podido suavizar este conflicto. Este último hecho es importante porque ha puesto de relieve los nexos importantes que existen entre innovación, distribución e instituciones.

Dentro de las referencias citadas en el Cambridge británico, quizás una de las más singulares e influyentes ha sido la de Piero Sraffa. Sus aportaciones, en clave de modelos multisectoriales de economías que se reproducen con (o sin) excedente, han sido discutidas, extendidas, y ampliadas en desarrollos contemporáneos (Pasinetti, 1977; Kurz & Salvadori, 1995; Chiodi & Ditta, 2007; Ciccone et al., 2011a, 2011b; Sinha, 2016). A pesar de su singularidad, no podemos olvidarnos de las aportaciones en marcos también multisectoriales de von Neumann (1945) y Goodwin (1967, 1983), que tratan conjuntamente temas de crecimiento y ciclos económicos, e incluso distribución, de forma indirecta.

Otra aportación muy significativa, aunque metodológicamente diferente, es la de Roemer (1982), que aborda la distribución no igualitaria a través de modelos de

equilibrio general, en los que juega un papel fundamental el marco institucional. Sus modelos parecen seguir el camino abierto años antes por Morishima (1973), como pionero en la consecución de una formalización seria y científicamente fundamentada de las teorías del valor y del crecimiento de Marx, en el ámbito de modelos multisectoriales. En concreto, los modelos de Roemer consisten en el análisis de las distintas estructuras distributivas que han estado presentes en los diferentes sistemas organizativos del proceso económico a lo largo de la historia – principalmente, economías feudales de subsistencia, economías capitalistas de acumulación, y economías socialistas. Así, se llega a la conclusión principal de que toda estructura de propiedad no igualitaria del capital cristaliza en situaciones de desigualdad – entendida ésta como la no proporcionalidad entre renta recibida y recursos aportados -, que se manifiestan en desigualdades en la esfera del consumo.

Creemos que las últimas líneas comentadas, que nos van a servir de guía, tienen el rasgo común de que se tratan de "enfoques de reproducción y excedente" con entradas y salidas (input-output) y de que analizan la producción de forma desagregada (sectores, regiones…). El concepto de reproducción será clave para nosotros, ya que nos permitirá conectar con dos de nuestros instrumentos metodológicos básicos, los modelos multisectoriales y el análisis input-output, y nos ayudará también a introducir y desarrollar nuestra visión evolutiva.

Por último, consideramos que no podemos hablar de desigualdad sin hacer tres últimas referencias a Sen (1973), Deaton (2013) y Piketty (2014; 2020); la primera porque Sen fue quizás uno de los primeros en situar el incremento de la desigualdad como uno de los principales desafíos sociales surgidos a finales del siglo XX, y las otras por su impacto reciente. Sen fue un pionero en los análisis de desigualdad y pobreza, denunciando la utilización del PIB per cápita como indicador de bienestar, y proponiendo la inclusión de dimensiones adicionales a la monetaria para calcular índices de pobreza (Foster et al., 1984; Sen, 1976), e inspirando los Índices de Desarrollo Humano calculados por la ONU. Por su parte, Deaton sitúa la desigualdad como un resultado ineludible del progreso económico; no obstante, la experiencia vivida entre los años 30 y los años 70 nos conduciría a pensar que no siempre es así, y que podríamos admitir la existencia de ciertos mecanismos emergentes que pueden conducir a atenuar dicho resultado. Finalmente, Piketty estudia la evolución histórica de la distribución del capital – o, alternativamente, de la riqueza – en el mundo desarrollado desde el siglo

XIX hasta la actualidad, concluyendo que, en las últimas décadas, el capital se ha ido concentrando progresivamente en el percentil superior de la distribución de la renta y, como consecuencia, la clase media va siendo cada vez menos representativa, la distribución de la renta se va polarizando, y la desigualdad aumenta. Esta evolución contrastaría con aquella que se puede percibir entre los años 30 y mediados de los 70, donde la desigualdad disminuyó, debido a los arreglos institucionales que se pusieron en marcha tras la Gran Depresión, y a los efectos devastadores de la II Guerra Mundial en términos, ya no sólo humanos, sino de capital físico.

Lo que más nos interesa de Piketty es su mensaje, que supuso en su momento un fuerte aldabonazo en el mundo académico, despertando conciencias sobre el tema de la creciente desigualdad, problema que todavía se ha ido empeorando más a partir del estallido de la Gran Recesión. Dicho esto, somos plenamente conscientes de las limitaciones que el análisis de Piketty presenta desde un punto de vista formal o analítico. Su aportación en *El capital en el siglo XXI* (2014) se focaliza en dos sencillas ecuaciones, las denominadas 'leyes fundamentales del capitalismo', para mostrar las tendencias distributivas de las últimas décadas. Este análisis es complementado por una profunda revisión histórica y sociológica de los sistemas distributivos y de sus estructuras sociales, pero sin entrar tampoco en su modelización (Piketty, 2020). Teniendo esto en cuenta, podría decirse que uno de los compromisos que adquirimos al asumir los resultados de Piketty, es el de probar, con modelos más robustos desde el punto de vista analítico (modelos input-output y modelos multisectoriales), que sus afirmaciones sobre el aumento de la desigualdad son ciertas.

1.3.3. Modelos multisectoriales y multirregionales y el marco input-output

Para finalizar esta sección acerca del estado de la cuestión, hemos de hablar de otro marco metodológico en el que nos vamos a apoyar para el análisis empírico, como justificaremos más profundamente en la próxima sección. Nos referimos al marco input-output y a sus aplicaciones al campo de la distribución. Los modelos input-output tienen multitud de aplicaciones (ver Miller & Blair (2009)), sobre todo en lo referente al análisis multisectorial de impactos medioambientales, de cambios tecnológicos y del crecimiento. Sin embargo, estos modelos han sido mucho menos utilizados para analizar los temas de la distribución de la renta, aunque creemos que tienen importantes ventajas para este tipo de análisis, porque permiten analizar tanto el reparto del valor añadido entre los distintos agentes económicos como la estructura desagregada de la demanda

final. Concretamente, los modelos input-output nos pueden dar información sobre las rentas recibidas por los distintos tipos de trabajadores, sobre las distintas partidas de la retribución del factor trabajo, sobre el papel de las importaciones, así como sobre el destino de esas rentas: consumo de subsistencia, consumo de lujo o inversión. Además, la consideración de modelos multirregionales input-output también tiene sentido si pensamos en el contexto global de la cadena productiva y la creciente fragmentación de las cadenas de valor a consecuencia de la globalización, lo cual afecta sin duda a los mecanismos de distribución.

En cuanto a los antecedentes históricos de la concepción intelectual de las tablas input-output, se suele señalar que el primer intento de establecer una tabla de origen y destino corresponde al *Tableau Économique* del fisiócrata François Quesnay (1757, 1766). Aquí, Quesnay intentó establecer los diferentes flujos de transacciones entre los distintos sectores económicos, para tratar de demostrar que la agricultura era el único sector productivo, ya que el poder de generar valor añadido correspondería exclusivamente al fruto de la tierra. También se suele señalar, en el apartado de padres fundadores del input-output, a Marx. Es posible que su concepción de la economía como un proceso circular o un sistema que se reproduce a sí mismo, en contraposición a la descripción clásica como un proceso lineal, constituya uno de los cimientos intelectuales del esquema input-output. También tenemos que incluir como uno de sus fundamentos el concepto de equilibrio general de Walras (1874), las tablas input-output verifican el equilibrio oferta-demanda en cada uno de sus sectores.

Pero una vez vistos los antecedentes históricos, no podemos pasar por alto la figura de Wassily Leontief (1941) como el fundador *de facto* de la metodología input-output. El modelo básico de Leontief, las tablas simétricas, así como el marco input-output y la estructura de las tablas de uso y destino, serán comentadas en más detalle en la sección de metodología. Igualmente comentaremos las tablas input-output multirregionales, que usaremos para analizar distribución en la economía global; éstas conservan la estructura esencial de las tablas input-output, pero incorporan como diferentes los sectores de las diferentes regiones.

Volviendo a lo que nos ocupa, los primeros pasos en el estudio de la distribución de la renta en un marco input-output se pueden encontrar en los multiplicadores de Miyazawa (1976), aunque se trata de un tipo de análisis bastante alejado de los que vamos a realizar en esta tesis. Otros desarrollos e investigaciones en este campo, muy extendidos en la

actualidad, son los asociados con la construcción de Tablas de Contabilidad Social o SAMs, cuyo antecedente más inmediato puede situarse en Meade & Stone (1941), pero cuya primera concreción completa y totalmente fundamentada podemos situar en Pyatt & Thorbecke (1976). Estas tablas son realmente la extensión natural del marco input-output cuando se incorporan todos los flujos de renta entre los distintos agentes económicos, especialmente los flujos con el Gobierno, las empresas, los hogares y el sector exterior. Otra línea importante de trabajo sobre la desigualdad con estos modelos, se fija en su relación con la desigual distribución de los impactos medioambientales (López et al., 2016, 2020). Por último, también se puede señalar que hay investigadores que intentan integrar los fundamentos del modelo multisectorial de Sraffa en el esquema básico de Leontief, con el propósito, similar al nuestro, de aproximarse a la problemática de la distribución (Steenge & Serrano, 2012). Aunque nuestra referencia multisectorial básica será el modelo input-output de Leontief, la visión de Sraffa (1960) nos permite precisar algunas de las limitaciones, que queremos superar en nuestro análisis, al enmarcar el conflicto distributivo entre salarios y beneficios en un contexto institucional y tecnológico y muy ligado a los patrones de consumo.

1.4. Marco metodológico general

En esta sección, vamos a describir los principales rasgos metodológicos de la tesis, aunque cada uno de los capítulos presentará extensiones, que serán comentadas más adelante. Primero expondremos nuestra concepción de las dinámicas económicas de largo plazo y de la distribución, para entrar después en los modelos multisectoriales extendemos a un largo periodo. La primera nos ayudará a estudiar las dinámicas evolutivas a largo plazo en el periodo 1929-2010, mientras los segundos nos permitirán un análisis empírico de la segunda mitad de ese periodo, de 1980 en adelante. El nexo más fuerte entre ambos dos tipos de metodologías, muy distintas *a priori*, es el concepto de la reproducción y la posibilidad de su solapamiento temporal. El concepto de reproducción es totalmente compatible con la visión sectorial del input-output; además, también es esencial en toda visión dinámica y evolutiva. Recíprocamente, la mayoría de los investigadores que defienden una visión co-evolutiva, defienden la necesidad del análisis sectorial y del estudio del cambio estructural y tecnológico, y este tipo de informaciones es en las series de modelos input-output donde mejor se recogen.

1.4.1. Dinámicas económicas largas e innovación.

En esta tesis, adoptamos la visión de la dinámica de la economía como un proceso evolutivo, esto es, un proceso de cambio y adaptación permanente, que se estructura en torno a la sucesión de ondas con fases de prosperidad y crisis. El concepto clave en este proceso es el de cambio: de forma análoga a lo postulado por Darwin en *The Origin of Species* (1859), tomando al sistema económico como un organismo, la única forma de garantizar su supervivencia es a través de un continuo proceso de cambio y adaptación a las nuevas condiciones que va imponiendo el entorno. Así, cada crisis económica de una onda pondría de manifiesto una necesidad de cambio y de ruptura con el período anterior, dando inicio a una nueva onda con unas características diferentes – la cual, además, trae consigo una mejora de la capacidad de la sociedad para superar y ampliar sus metas. En particular, nos centraremos en el estudio de las características científicas, institucionales y tecnológicas de cada onda o período distintivo, y en su evolución y el sentido de los cambios. A este conjunto de características particulares de cada período lo llamaremos paradigma. Más adelante, cuando pasemos a describir el contenido de los capítulos, en concreto del capítulo II, explicaremos en qué consiste este paradigma tecno-económico y cómo se puede abordar el estudio de sus componentes.

En nuestro esquema evolutivo, asumimos que las dinámicas largas en Economía son procesos no lineales y no deterministas. Para justificar nuestra visión, tomamos inspiración en las teorías de Mario Bunge (1979, 1997). De acuerdo con ello, asumimos la existencia de cuatro sistemas interrelacionados y parcialmente autónomos: económico, científico, institucional, y tecnológico, cada uno con sus propios mecanismos. La integración de estos sistemas formaría el sistema social, que presentaría propiedades particulares, algunas de ellas emergentes y no presentes en los sistemas componentes. Así, consideraremos la distribución de la renta como algo inherente al sistema co-evolutivo social y económico y que, por ello, presenta características que van más allá de las puramente económicas o productivas – lo cual justifica el hecho de que no se pueda estudiar exclusivamente como un fenómeno relacionado con productividades marginales o con cambios estrictamente económicos[3].

[3] Una prueba de esto es que el análisis de la distribución debe de considerar algo más que los pagos salariales. En concreto, no puede olvidarse de la redistribución que supone el Estado de bienestar, que no es una consecuencia económica, sino un resultado conjunto de los componentes económicos y de los institucionales.

Por otro lado, debemos asumir que la interrelación de varios subsistemas va a dar como resultado una serie de relaciones complejas, que raramente van a poder ser consideradas lineales. La instrumentación de estas relaciones complejas en ondas largas puede dar cuenta de estas dinámicas no lineales. Estas ondas largas serían también manifestaciones del sistema social, recogiendo, por tanto, aspectos productivos, institucionales y tecnológicos, a diferencia de los ciclos más cortos (ciclos de Juglar o Kitchin), que serían esencialmente manifestaciones de tipo económico-productivo. En consecuencia, las ondas largas no tienen un carácter económico determinista, porque están determinadas también por otros componentes sociales y porque la complejidad de las interrelaciones hace que el puro determinismo tenga poca capacidad explicativa. En definitiva, consideraremos que estas ondas son fenómenos emergentes, con componentes económicos, institucionales y sociales, lo que obliga a que su investigación tenga en cuenta todas estas facetas – y, probablemente, el no hacerlo haya sido una de las razones de que el conocimiento científico sobre las anteriores ondas no haya avanzado todo lo que hubiera sido deseable.

Esta perspectiva evolucionista nos permite enlazar también con Schumpeter (1939), en el que nos basaremos inicialmente para el análisis de la evolución de las ondas y de los ciclos subyacentes – especialmente, en la parte descriptiva. Además, seguimos a Juglar (1862) y a Kondratieff (1935), al defender tanto una confirmación estadística como histórica de estas ondas (Tylecote, 1992).

En la línea de Schumpeter, consideramos que el perfil de las ondas está compuesto principalmente por la alternancia de fases de prosperidad y crisis; no obstante, a éstas se añade lo que Schumpeter denomina la ola secundaria, que aparece como consecuencia del estado de ánimo de los agentes económicos, cuyo optimismo o pesimismo genera efectos acumulativos, haciendo más pronunciadas y duraderas las fases de prosperidad y de crisis. Este hecho hace necesaria la división de las ondas largas en cuatro fases, dos pertenecientes a la fase original de prosperidad – recuperación y expansión -, y otras dos pertenecientes a la fase de crisis – recesión y depresión.

Por otra parte, según Schumpeter, en el crecimiento económico pueden distinguirse tres tipos de ondas, en función de su duración temporal: 1) ondas de Kondratieff u ondas largas, de unos 50-60 años de duración media, que marcan la evolución del proceso económico y que responden a un boom de innovaciones radicales; 2) ciclos de Juglar, de en torno a una década de duración (se asumen 6 en cada onda), relacionados

fundamentalmente con causas tecnológicas pero, en este caso, relativas al desarrollo de innovaciones de carácter incremental y no radical, serían los ciclos económicos asociados con los procesos sucesivos de mejora tecnológica dentro de cada onda larga; y 3) ciclos de Kitchin, con una duración media de unos 18 meses, y que suelen ser identificados con ciclos de inventario. Por último, en lo referente a las causas explicativas, Schumpeter desarrolla una teoría endógena del ciclo, conocida como "destrucción creativa", en la que postula que la innovación y el cambio tecnológico son las fuerzas motrices de la evolución y los cambios de los procesos económicos - aunque también se admite la presencia puntual de factores exógenos que pueden afectar a la evolución del ciclo como, por ejemplo, el estallido de conflictos bélicos. Esta "destrucción creativa" es su particular visión de los procesos de cambio, adaptación y crecimiento de la visión evolutiva antes comentada.

Aunque seguimos a Schumpeter en lo comentado anteriormente, hemos de hacer hincapié en varios aspectos de nuestra metodología que no se hallan, al menos explícitamente, en la obra del economista austríaco. Tomamos a Schumpeter como punto de partida, pero somos conscientes de las limitaciones de su enfoque (Kuznets, 1940), y una parte de nuestro trabajo también puede ser entendido como una cierta revisión a varios niveles. En primer lugar, nuestra explicación de las causas endógenas del ciclo no admite la innovación como única causa. Algunos autores han señalado las deficiencias de esta teoría (Rosenberg & Frischtak, 1984). Como hemos explicado antes, los contextos científico e institucional han de ser tenidos en cuenta juntamente con la tecnología. Por otra parte, no podemos admitir el esquema determinista de Schumpeter en cuanto la duración de las ondas, su perfil, su recurrencia, o el número de ciclos subyacentes. En tanto en cuanto consideramos que estamos tratando con procesos económicos emergentes y no aditivos (Lloyd Morgan, 1923), no podemos admitir ningún patrón determinista *a priori*. La aparición de elementos estocásticos, en los procesos que vamos a describir, así como la importancia de la incertidumbre en Economía – que no ha de ser reducida a la noción de probabilidad (Ramsey, 1926) -, impide que, en modo alguno, podamos desarrollar un esquema determinista rígido. Para nosotros la longitud de las ondas largas puede variar, siendo mayor o menor que los 50-60 años sugeridos por Schumpeter, también el número de ciclos Juglar por ondas pueden no ser seis y, finalmente, creemos que los conflictos sociales o las guerras son aspectos importantes de las propias ondas.

Aterrizamos ahora en lo que va a ser una parte importante de nuestro trabajo específico. Teniendo en mente el concepto de onda larga como clave para la comprensión de las fluctuaciones económicas, partiremos de la hipótesis inicial de que existen dos ondas de Kondratieff (u ondas largas) en el periodo que estamos analizando, 1929-2010: la primera duraría desde el inicio de la Gran Depresión hasta la crisis del petróleo de mediados de los años 70; y la segunda abarcaría desde los años 70 hasta después de la Gran Recesión, que sería a su vez, probablemente, el arranque de una tercera onda. Por lo tanto, seguiremos a Bieshaar & Kleinknecht (1984) al asumir la existencia *a priori* de dos ondas largas cuya existencia ha sido largamente discutida en la literatura previa (Grübler & Nowotny, 1990; Metz, 1992). Más aún, contrastaremos a través de las técnicas econométricas de análisis de ruptura estructural (Chow, 1960), la existencia de estos dos periodos claramente diferentes. Y tras ello, usando técnicas de filtrado (Baxter and King, 1999), probaremos la existencia de ciclos de Juglar dentro de cada una de estas ondas. Estos ciclos responden a fluctuaciones asociadas con las mejoras básicas del boom tecnológico de la onda – es decir, con innovaciones de carácter incremental.

Debemos señalar, además, aunque el concepto de onda larga será una herramienta de apoyo útil para fundamentar nuestro análisis, que no consideramos que nuestro objetivo sea contribuir principalmente al debate de las ondas largas, sino más bien a la teoría de la distribución.

Como hemos dicho, estos subperíodos ya han sido tratados en la literatura, y se han clasificado según las tecnologías características de cada período: la primera onda sería la 'onda del automóvil y del petróleo' y la segunda, la 'onda de las tecnologías de la información' (Freeman, 2008); o bien atendiendo a una clasificación más institucional, estas ondas también han sido denominadas 'la onda del capitalismo regulado' y 'la onda del capitalismo neoliberal', respectivamente (Bertocco, 2017). Una vez establecida esta división temporal y sus estructuras internas de ciclos Juglar, nos dedicaremos a estudiar las diferentes características de los subsistemas económico, científico, institucional, y tecnológico en cada uno de los dos períodos. Probaremos que cada uno de ellos tiene características propias que los definen como unidades económicas e históricas diferentes, esto es, como ondas distintas. En concreto, veremos la muy diferente evolución de sus tendencias de distribución, es decir, la disminución de la desigualdad en el primer período, y el incremento de la desigualdad en el segundo.

Recapitulando todo lo dicho anteriormente, la metodología relativa a esta parte, esencialmente el capítulo II, va a tener dos partes diferenciadas, pero complementarias. En primer lugar, nos ocuparemos del estudio del subsistema económico desde una perspectiva más empírica, que consistirá en ver la ruptura estructural en las series de datos del periodo 1929-2010, así como en el filtrado de estos datos para identificar los ciclos de duración intermedia (entre 7 y 11 años). En segundo lugar, seguiremos un punto de vista más histórico-descriptivo para determinar los subsistemas científico, institucional, y tecnológico, que identifican y personalizan cada una de las ondas.

Una vez aclarados los aspectos sobre el enfoque que vamos a utilizar para encarar nuestra investigación sobre ondas, podemos pasar a comentar los aspectos metodológicos del otro gran bloque que va a componer la tesis: el estudio de la distribución y la desigualdad mediante el uso de modelos multisectoriales input-output.

1.4.2. Modelo input-output de Leontief y modelos multirregionales

Como ya hemos comentado en la sección anterior, nuestro análisis de la distribución, al menos para las aplicaciones empíricas, va a estar también estrechamente basado en el análisis input-output y en el modelo de demanda de Leontief (1936, 1941), admitiendo la presencia de tintes "neo-ricardianos"[4]. De manera muy simplificada, se puede decir que estas tablas input-output y los modelos de doble entrada muestran, a un nivel detallado por sectores, las compras y ventas tanto de inputs intermedios como finales, lo que permite analizar, en una doble vertiente (y entre otras cosas), el valor generado y los flujos de éste a través de toda la estructura económica. Asimismo, nos serán útiles porque nos permitirán obtener información sobre salarios, patrones de consumo, excedentes empresariales, heterogeneidad de la distribución real, transferencias de rentas entre regiones y países (en los modelos multirregionales o modelos MRIO), o información sobre impuestos y transferencias del Estado (en las matrices de contabilidad social o SAMs). En resumen, el uso de estos modelos nos permitirá integrar tanto cuestiones técnicas como institucionales en nuestros análisis.

A continuación, vamos a exponer brevemente en qué consisten los fundamentos de la metodología input-output. Como paso previo a la obtención de una tabla input-output simétrica, se ha de hablar de las tablas de origen y destino. A grandes rasgos, las tablas

[4] Denominamos "neo-ricardiano" a nuestro enfoque porque podemos encontrar rasgos comunes a nuestro planteamiento en la obra de Ricardo (1817), que sirvió de base para las teorías distributivas de Marx (1867-1894) y Sraffa (1960).

de origen muestran de qué sector procede cada uno de los bienes producidos en una economía, mientras que las tablas de destino permiten ver qué sector o industria consume cada uno de los bienes producidos. Una tabla input-output simétrica se construye a partir de la reorganización de estos dos tipos de tablas (Eurostat, 2008), y su estructura genérica se puede ver en la Tabla 1.1, a continuación. Como puede verse, la estructura de las tablas input-output simétricas incorpora datos cruciales para el estudio de la distribución: la descomposición del valor añadido en rentas factoriales, por una parte, y la distribución de la demanda final entre sus distintos componentes, por otra. Las partidas de rentas en filas y de demandas finales en columnas constituyen una parte fundamental de la visión de Leontief.

Tabla 1.1. Estructura general y agregada de una tabla input-output simétrica

<table>
<tr><td></td><td></td><td colspan="3">Sectores (consumo)</td><td colspan="4">Demanda final</td></tr>
<tr><td></td><td></td><td>Agricultura</td><td>Industria</td><td>Servicios</td><td>Consumo de los hogares</td><td>Formación bruta de capital</td><td>Consumo del Gobierno</td><td>Exportaciones brutas</td></tr>
<tr><td rowspan="3">Sectores (producción)</td><td>Agricultura</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Industria</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Servicios</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Valor añadido</td><td>Empleados</td><td colspan="3">Salarios</td><td colspan="4" rowspan="4">PRODUCTO INTERIOR BRUTO</td></tr>
<tr><td rowspan="2">Propietarios de capital</td><td colspan="3">Beneficios</td></tr>
<tr><td colspan="3">Amortización de capital fijo</td></tr>
<tr><td>Gobierno</td><td colspan="3">Impuestos</td></tr>
<tr><td>Sector exterior</td><td></td><td colspan="3">Importaciones</td><td colspan="4"></td></tr>
</table>

Fuente: Elaboración propia

En el capítulo IV, se usarán series de tablas de este tipo para el análisis empírico de la distribución y de la desigualdad en la economía española en el periodo 1980-2014. Para ello, entre otros cambios, la fila de Salarios se desagregará según niveles de cualificación de los trabajadores y la columna de Consumo de los hogares en consumo de los distintos tipos de trabajadores, asumiendo patrones de consumo diferentes.

Partiendo de las tablas simétricas, se construyen los modelos input-output, que permiten describir los flujos de producción entre todos los sectores de una economía, estableciendo relaciones entre las actividades domésticas y del exterior, así como los

flujos económicos entre sectores, instituciones, y consumidores finales[5]. Un modelo básico de demanda tipo Leontief constaría, por una parte, de un sistema de ecuaciones que haga referencia a la producción final por sectores. En una economía de *n* sectores:

$$x_1 = z_{11} + \cdots + z_{1j} + \cdots + z_{1n} + f_1$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$x_i = z_{i1} + \cdots + z_{ij} + \cdots + z_{in} + f_i \qquad (4.1)$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$x_n = z_{in} + \cdots + z_{in} + \cdots + z_{nn} + f_n$$

donde $\mathbf{x}=(x_i)$ es el vector de output bruto, $\mathbf{Z} = (z_{ij})$ es la matriz de compras intermedias, $\mathbf{A}=(z_{ij}/x_j)$ es la matriz de coeficientes técnicos, que expresa los requerimientos sectoriales unitarios de inputs intermedios, y $\mathbf{f}=(f_i)$ es el vector de demanda final, que expresa el producto final neto o lo que queda disponible para consumo una vez descontados los inputs intermedios. En notación compacta, tendríamos la siguiente expresión:

$$\mathbf{x} = \mathbf{Z} + \mathbf{f} = \mathbf{A}\mathbf{x} + \mathbf{f} \qquad (4.2)$$

Asumiendo que la demanda final es exógena y resolviendo (4.1) para **x**, obtenemos:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f} = \mathbf{L}\mathbf{f} \qquad (4.3)$$

Siendo **I** la matriz identidad y $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = (\propto_{i,j})$ la inversa de Leontief, que representa las necesidades totales (directas más indirectas) de bienes *i* por unidad de demanda final del sector *j*. Este modelo nos permite identificar los impactos totales frente a variaciones exógenas en la demanda. La expresión $\mathbf{x} = \mathbf{L}\mathbf{f}$ muestra cuál es la producción necesaria para satisfacer la demanda final **f**. A partir de (4.3) también podemos escribir $\Delta\mathbf{x} = (\mathbf{I}\text{-}\mathbf{A})^{-1}\Delta\mathbf{f}$, que permitirá calcular el incremento necesario de la producción ante variaciones en la demanda, $\Delta\mathbf{f}$. Por tanto, el modelo input-output permite analizar el impacto sobre la producción de determinadas medidas de política económica. Pero no sólo podemos analizar los cambios sobre la producción, podemos analizar también los cambios sobre otras variables socioeconómicas como, por ejemplo,

[5] Estas están mucho más explícitas en las SAMs, donde aparecen, además de los sectores productivos y del valor añadido, otras cuentas (Sociedades, Gobierno, Sector exterior…) y además hay cuentas que pueden aparecer desagregadas (tipos de trabajo, tipos de hogares, bloques de países en el sector exterior, tipos de impuestos, etc…).

el empleo. El modelo también permite calcular los requerimientos de trabajo, que están dados por:

$$L = \mathbf{l}'\mathbf{x} \tag{4.4}$$

donde L es el empleo total de la economía, **l'** es el vector de coeficientes de trabajo directo, que expresa la cantidad de trabajo requerida por unidad de output en cada sector. Este último vector y la matriz **A** definen, conjuntamente, la tecnología del sistema. Observemos también que podemos calcular el impacto en el empleo de un incremento dado de la demanda, este incremento será:

$$\Delta L = \mathbf{l}'\Delta\mathbf{x} = \mathbf{l}'(\mathbf{I} - \mathbf{A})^{-1}\Delta\mathbf{f} \tag{4.5}$$

Señalemos también que una extensión natural de este modelo sería la construcción de una Matriz de Contabilidad Social (Stone & Brown, 1962; Pyatt & Round, 1985) que incluya, además de los flujos de producción de bienes, los flujos monetarios entre sectores productivos e instituciones (utilizando cuentas referentes a trabajo, capital, consumo de los hogares, ahorros e inversión, impuestos, consumo público y exportaciones netas). Estas matrices capturan, por tanto, todos los flujos de renta de una economía, ampliando la información sobre distribución de la renta que incorporan las tablas input-output simétricas.

Hasta el momento, hemos estado pensando en términos multisectoriales, pero dentro de una sola economía, es decir, en una tabla nacional que presente las compras intermedias entre los sectores de un país determinado. No obstante, sin cambiar la lógica básica de una tabla input-output, es posible dar el salto a un modelo multirregional (MRIO), donde queden expuestas las relaciones entre los distintos sectores de varios países, y que será la base de nuestro análisis global en el capítulo V. La Tabla 1.2 muestra la estructura general de un MRIO, siguiendo un esquema similar al usado en la tabla IO simétrica.

Tabla 1.2. Estructura general y agregada de una tabla input-output multirregional

		Sectores (consumo)					**Demanda final**					
		Región 1	**…**	**Región *r***	**…**	**Región *n***	**Región 1**	**…**	**Región *s***	**…**	**Región *n***	**Empleos totales**
Sectores (producción)	**Región 1**	$\mathbf{X}^{1,1}$	…	$\mathbf{X}^{1,s}$	…	$\mathbf{X}^{1,n}$	$\mathbf{Y}^{1,1}$	…	$\mathbf{Y}^{1,s}$	…	$\mathbf{Y}^{1,n}$	$\mathbf{x}^{1}$
	…	…	…	…	…	…	…	…	…	…	…	…
	Región *r*	$\mathbf{X}^{r,1}$		$\mathbf{X}^{r,s}$		$\mathbf{X}^{r,n}$	$\mathbf{Y}^{r,1}$		$\mathbf{Y}^{r,s}$		$\mathbf{Y}^{r,n}$	$\mathbf{x}^{r}$
	…	…	…	…	…	…	…	…	…	…	…	…
	Región *n**	$\mathbf{X}^{n,1}$	…	$\mathbf{X}^{n,s}$	…	$\mathbf{X}^{n,n}$	$\mathbf{Y}^{n,1}$	…	$\mathbf{Y}^{n,s}$	…	$\mathbf{Y}^{n,n}$	$\mathbf{x}^{n}$
	Valor añadido	$\mathbf{v}^{1}$	…	$\mathbf{v}^{s}$	…	$\mathbf{v}^{n}$						
	Recursos totales	$\mathbf{x}^{1}$	…	$\mathbf{x}^{s}$	…	$\mathbf{x}^{n}$						

Nota: La región *n*, cuando la economía representada es la global, representa frecuentemente el Resto del mundo, las economías no incluidas en las n-1 regiones anteriores

Fuente: elaboración propia

En la Tabla 1.2, las submatrices $\mathbf{X}^{r,s} = \left(x_{i,j}^{r,s}\right)$ representan los inputs intermedios de la economía global, siendo $x_{i,j}^{r,s}$ las ventas del sector *i* de la región *r* al sector *j* de la región *s*; cuando es $s \neq r$, estas ventas son exportaciones de inputs. La demanda final se representa con las submatrices $\mathbf{Y}^{r,s} = \left(y_{i,d}^{r,s}\right)$, que identifican las aportaciones del sector *i* de la región *r* a la categoría de demanda final *d* de la región *s*. En cada región podemos, además, distinguir los componentes de esta demanda mostrados en la Tabla 1.1, a saber: Consumo de hogares, Formación bruta de capital, Consumo del gobierno y Exportaciones brutas. No obstante, es importante tener en cuenta el diferente carácter que tienen aquí las exportaciones de la demanda final, que son únicamente de bienes finales dedicados a consumo de la región, ya que las exportaciones de inputs de una región *r* a otra región *s* están descritas por la matriz $\mathbf{X}^{r,s}$. Por otra parte, $\mathbf{v}^{s} = \left(v_j^s\right)$ es el vector de valor añadido de la región *s*, siendo v_j^s el valor añadido del sector *j* en la región *s*. Finalmente, observemos que en la Tabla 1.2 no aparece ninguna fila de importaciones. Ello es debido a que las importaciones a otra región *s* están de nuevo captadas por $\mathbf{X}^{r,s}$. También, como ocurría en la Tabla 1.1, la fila del valor añadido puede desagregarse en sus componentes: Salarios, Beneficios, Amortización de capital fijo e Impuestos, y los primeros en los distintos tipos de trabajo que se incorporen. Esto se hará en el capítulo V cuando analicemos la distribución en una economía global con estos modelos.

Dado que la Tabla 1.2 representa una economía cerrada (global), las sumas por filas y por columnas deben coincidir siempre:

$$\sum_r \sum_i x_{i,j}^{r,s} + v_j^s = \sum_z \sum_u x_{j,u}^{s,z} + \sum_z \sum_d y_{j,d}^{s,z} \;\; ; \; \forall i,j,r,s,d,u,z \tag{4.6}$$

Para la construcción del modelo formal input-output asociado con la tabla multirregional, obtenemos también la matriz de coeficientes técnicos $\mathbf{A} = (a_{i,j}^{r,s})$, donde $a_{i,j}^{r,s}$ representa las necesidades directas por unidad de output, que tiene el sector *j* de la región *s* (de inputs del sector *i* de la región *r*):

$$a_{i,j}^{r,s} = \frac{x_{i,j}^{r,s}}{x_j^s} \tag{4.7}$$

Si $\mathbf{x}^s = (x_j^s)$, siendo $x_j^s = \sum_r \sum_i x_{i,j}^{r,s} + v_j^s$ el output total del sector *j* de la región *s*, podemos definir un vector $\mathbf{x} = (\mathbf{x}^1, \dots, \mathbf{x}^s, \dots, \mathbf{x}^n)$ de output total de la economía global y, al igual que en la ecuación (4.3), podemos describir la economía global en forma matricial:

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{Y}\mathbf{e} \iff \mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{Y}\mathbf{e} = \mathbf{L}\mathbf{y} \tag{4.8}$$

En (4.7), $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = \left(\propto_{i,j}^{r,s}\right)$ será de nuevo una inversa de Leontief, que representa las necesidades totales (directas más indirectas) por unidad de demanda final del sector *j* de la región *s* (procedente del sector *i* de la región *r*). Por otra parte, $\mathbf{y} = (y_i^r) = \mathbf{Y}\mathbf{e}$ es el vector de demanda final agregado $\left(y_i^r = \sum_s \sum_d Y_{i,d}^{r,s}\right)$. Al igual que en modelo previo, el modelo multirregional nos permite identificar los impactos totales frente a variaciones exógenas en la demanda, así como los impactos en el empleo, en el valor añadido y en otras variables; las expresiones básicas son (4.3) y (4.5), pero usando la inversa y la demanda correspondientes.

1.4.3. Apuntes sobre otros modelos multisectoriales

Además de los modelos input-output comentados y de las matrices de contabilidad social, podemos encontrar en la literatura otros muchos modelos multisectoriales, usados sobre todo para el debate teórico. Todos estos modelos tienen una base común con los modelos input-output, su visión multisectorial y su interés por las ligaduras intersectoriales, el cambio tecnológico, la reproducción económica y el papel de los diferentes agentes. Pero a diferencia de los modelos input-output, que son fuertemente dependientes de su base estadística y que asumen siempre que los precios son unitarios, la mayoría de los modelos multisectoriales teóricos incorporan ecuaciones de precios,

consideran frecuentemente la producción conjunta y situaciones de optimización de renta o de algún tipo de utilidad. Más aún, por su carácter teórico, suelen asumir tasas de beneficio y de crecimiento homogéneas, e incluso en ocasiones incorporar como variables el stock de capital.

El desarrollo de estos modelos más formales ha permitido el análisis teórico o la modelización de cuestiones abiertas, como las que siguen: ¿cuáles son los precios de equilibrio del modelo?, ¿determina el modelo la tasa máxima de crecimiento, dada una determinada tecnología definida por **A** y **l**'?, ¿cómo puede incorporarse el stock de capital o la producción conjunta en el análisis? Las referencias son numerosas, ver por ejemplo Sraffa (1960), Morishima (1973), Pasinetti (1993) y Kurz and Salvadori (1995).

Aunque podrían usarse como arquetipo otros muchos modelos, vamos a presentar brevemente uno sin producción conjunta, que nos servirá de base para las reflexiones teóricas del capítulo III. Asumimos que se verifica una ecuación similar a la (4.2), que relaciona los outputs totales y los consumos intermedios y finales:

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{f} \tag{4.9}$$

Usualmente, en (4.9), la matriz **A** de coeficientes técnicos es constante y no se exige que el precio de cada bien sea unitario. Los precios se obtienen a través de otra ecuación:

$$\mathbf{p}' = \mathbf{p}'\mathbf{A} + \mathbf{v}' \Leftrightarrow \mathbf{p}' = \mathbf{v}'(\mathbf{I} - \mathbf{A})^{-1} \tag{4.10}$$

donde $\mathbf{p}'$ es el vector de precios, $\mathbf{v}'$ representa el vector de coeficientes de valor añadido y $(\mathbf{I} - \mathbf{A})^{-1}$ es de nuevo la inversa de Leontief.

Siguiendo, por ejemplo, a Morishima (1973), podríamos asumir que todo el valor añadido se asigna al pago del trabajo con un salario homogéneo *w*. En ese caso, (4.10) se convertiría en:

$$\mathbf{p}' = \mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - \mathbf{A})^{-1} \tag{4.11}$$

que nos revela la fuerte relación existente entre los precios y la cantidad de trabajo incorporado en cada bien (trabajo necesario directa o indirectamente para obtener el bien). Este hecho permite conectar los modelos Leontief con los modelos de inspiración marxiana, como el de Morishima (1973), o los de inspiración sraffiana.

También en estos modelos podemos suponer que hay una tasa de beneficio sobre el capital adelantado, que en (4.9) podemos considerar que está dado por $\mathbf{p}'\mathbf{A}$. Si así lo hacemos, podemos convertir la ecuación (4.11) en:

$$\mathbf{p}' = (1+r)\mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - (1+r)\mathbf{A})^{-1} \quad (4.12)$$

donde *r* sería la tasa de beneficio uniforme para todos los sectores. En muchas ocasiones se asume, en el análisis teórico, que la tasa de beneficio se identifica con la de crecimiento. Si así lo hacemos, el modelo podrá tener dos ecuaciones básicas, una de cantidades incluyendo su tasa de crecimiento y otra de precios, que serán:

$$\left.\begin{array}{l} \mathbf{x} = (1+r)\mathbf{A}\,\mathbf{x} + \mathbf{f} \Leftrightarrow \mathbf{x} = (\mathbf{I} - (1+r)\mathbf{A})^{-1}\mathbf{f} \\ \mathbf{p}' = (1+r)\mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - (1+r)\mathbf{A})^{-1} \end{array}\right\} \quad (4.13)$$

En el capítulo III se ampliará este modelo básico descrito por (4.11) con dos objetivos: uno, obtener generalizaciones de algunos resultados obtenidos en la literatura, y otro, plantear con un modelo simple los retos que vamos a abordar en los dos capítulos empíricos, IV y V.

1.4.4. Otros indicadores de la distribución y la desigualdad: índices de Gini y Sen

Aunque los modelos input-output son instrumentos empíricos potentes para describir la distribución las rentas, principalmente a través de la información que contienen sobre salarios y consumo de los hogares, hay aspectos de ésta que no se suelen abordar con ellos, por ejemplo, los asociados con niveles de pobreza o con la escala distributiva. Por este motivo, el análisis input-output será complementado, en esta tesis, con otros tipos de medidas de la desigualdad, ya basados en las tablas o en información complementaria. Los índices de Gini (1921), Theil (1979), Atkinson (1970) o Kakwani (1993) son indicadores tradicionales de la desigualdad y son frecuentemente utilizados en estudios de este tipo. En concreto, usaremos indicadores de Gini calculados sobre las tablas input-output y multirregionales usadas en los capítulos IV y V. Estos indicadores los complementaremos con el análisis de las relaciones de propiedad, estudiando para ello la evolución de las proporciones de renta y patrimonio que están concentrados en los percentiles más altos de escala distributiva (Piketty, 2014).

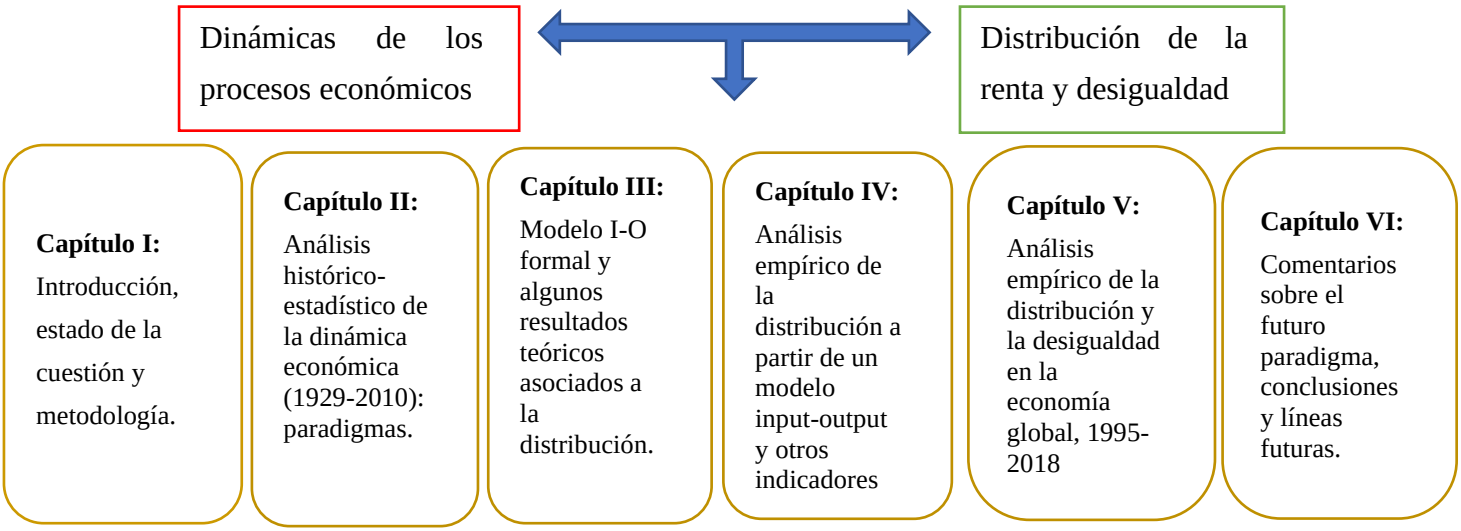
Por otra parte, tanto los indicadores Gini como los que se obtienen de las tablas input-output tienen un sesgo muy claro, al estar basados en datos de tipo esencialmente económicos y medir exclusivamente la distribución de la renta económica, olvidando otros aspectos fundamentales de la desigualdad y de las condiciones reales de vida. Por ello, también plantearemos la construcción y aplicación de indicadores de desigualdad multidimensional tipo Sen (1976), que permitan mejorar el análisis. Estos indicadores, que eran en su origen una medida de pobreza, los adaptaremos para que pueda calcularse

a partir de los propios datos del modelo input-output y de informaciones asociables con él, de modo que se puedan utilizar como medida integral de desigualdad. Asimismo, tendremos en cuenta desarrollos posteriores del índice de Sen, que puedan mejorar la medida de desigualdad en nuestro modelo (Foster et al., 1984).

1.5. Esquema general de la tesis

Una vez expuestos los temas que motivan nuestra investigación, los objetivos generales, y la metodología a seguir, podemos pasar a exponer la hoja de ruta que pretendemos seguir. La tesis, en principio, se va a estructurar en torno a seis capítulos. El capítulo I contiene la introducción donde se exponen las motivaciones de la investigación y la necesidad de realizar, en estos momentos, un análisis profundo de las condiciones y evolución de la distribución de rentas en las economías. En este primer capítulo se hace también la revisión del estado de la cuestión y se describirán las metodologías a usar en la tesis. Los cuatro siguientes capítulos son el núcleo de la investigación y pueden dividirse en dos bloques, uno más teórico y analítico, formado por los capítulos II y III, y otro claramente empírico constituido por los capítulos IV y V, como puede verse a continuación (ver Figura 1.1 más abajo para un esquema de la estructura). El capítulo II se aproxima al problema a través de las ondas largas, el III con el apoyo de modelos multisectoriales formales, y el IV y V a través de modelos input-output, en un caso para la economía española y en el otro para la economía mundial. Finalmente, la tesis se cerrará con un capítulo VI de Comentarios sobre el futuro paradigma, conclusiones y futuras líneas de investigación.

Figura 1.1. Esquema temático de la tesis y de los capítulos que la componen



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Chapter I: Introduction, state of the art, and methodology.

1.1. General topics

The main topic of this dissertation is the distribution of income in the last decades. Thus, the study of its unequal character and its evolution along time is going to be the *leitmotif*, and so, we will also pay attention to economic growth in the long run. Furthermore, this long-run vision implies that structural changes and the evolution of economic systems is going to be key. As a result, we expect that research on these topics will help us reach a better understanding of the mechanisms of contemporary economic growth and its linkages to distributive patterns. In fact, the relationship between income distribution and growth has been a recurring topic in Economics since Smith and Ricardo, and it is still an important line of research nowadays (Caiani et al., 2019; Cynamon & Fazzari, 2016; da Silveira & Lima, 2021; Onaran & Obst, 2016; Ostry et al., 2014; Palley, 2017; Patriarca & Sardoni, 2017; Tridico, 2018).

The framework of this thesis considers a wide timespan, from the start of the Great Depression in 1929, up to the 2008 crisis, although we will expand it to these days when data availability makes it possible. It is because of these limitations of data that our empirical analyses are going to be focused on the period starting in the 1980s. In this long period of study, there have been substantial changes in technologies, production, institutions, and science. These changes have undoubtedly altered income distribution and life standards all around the world, both in developed and developing countries. According to the World Bank, global GDP was in 2021 50 times bigger than 60 years ago. This is an impressive data, even more so considering that such an increase in global income has not necessarily been more equally distributed in the last decades. Namely, according to data from the World Inequality Database, the top 1% incomes have increased their total income shares from 17% in 1980 to 20% in 2021. Besides, the top 10% has kept a constant share of 52% along this period, while the next four deciles suffered a loss, from 42% in 1980 to 40% in 2021. Hence, the bottom 50% increased their share from 6% in 1980 to 8% in 2021. Even we are aware of the degree of subjectivity that the concept of inequality implies, the picture seems clear: global income distribution is not egalitarian, with top incomes concentrating a great portion, and even increasing their shares in the last decades. This worsening of income distribution since the 1980s is going to be one of the main motivations of this thesis.

Concerning the subjectivity of inequality and value judgements, some insights follow. Some recent analyses on economic theory regarding income distribution have contributed to this debate (Allen, 2021). Unfortunately, there not seems to exist a consensus about neither which type of inequality is relevant, nor which are the values of reference to consider it a problem (Scanlon, 2021). However, despite this lack of consensus, some authors agree with Rawls (1971), in the sense that inequality turns unbearable if and only if it the path towards improvement for the poorest is blocked (Van Parijs, 2021). Thus, in such a situation, economic inequalities should be denounced.

In our long period, which starts in 1929 and is characterized by impressive increases in growth and productivity, we will be able to distinguish two different long-term trends in income distribution: from the Great Depression to the mid-1970s, inequality within countries clearly decreased, while it started to rise thereafter (Decancq et al., 2009; Piketty, 2014, 2020). Besides, these two evolutions had place in two very different socio-institutional contexts. Thus, we will have to consider, on the one hand, the dynamics associated to economic, social, and institutional features present in each period, both in the medium and the long run. On the other hand, we will also have to take into account the co-evolutionary character of these dynamics, as well as the subjacent causes to these evolutions. In this context, we will suggest the existence of two long waves during our period (Chapter II), the first one going from 1930 to 1975, and the second one lasting from 1975 to 2010. These waves will be characterized by their own distinctive evolutionary paradigms and will yield general insights about the structural mechanisms of income distribution and their changes during the last century. A specific case of how these evolutions affect income distribution in real economies will be presented for the case of Spain during our second long wave or sub-period (Chapter IV), with an empirical approach using input-output tables.

Up to this moment, we have only been considering inequalities *intra regionem*. However, in a globalized world, where products, value added, and its distribution, are global phenomena, inequality takes a global character. Hence, the inter-country component of inequality should also be considered. According to Chancel et al. (2022), inter-country inequality has decreased since the 1980s, showing signs of global convergence. This result, taken jointly with the aforementioned increasing intra-country inequalities, muddles up the total effect on global inequality during the last decades. Thus, a study of global inequality also constitutes an interesting line of research, and so

will be included in the empirical part of the dissertation. This will be approached using multiregional input-output tables for the global economy (Chapter V), also focusing on our second sub-period, which corresponds to the intensification of globalization.

As a corollary, when approaching all these topics, we will bear in mind the following questions: how should we confront the effects of the 2008 crisis and the most recent one associated to COVID-19, as well as the changes provoked by these processes? How can this be tackled by achieving a more just and sustainable society? How does the increasing fragmentation of productive processes affect income distribution? In the following section, and as a first approach to our study, we are now introducing in more detail the motivations of our research and the guidelines to follow.

1.2. Motivation and objectives

The recent economic crisis, the Great Recession, that started in 2008, had brought about a series of economic challenges. One of them is the recurrence of crises. In fact, the debate of crises being avoidable or not, has been on the minds of economists since the very inception of industrial capitalism. However, at the turn of the twenty-first century, most economists thought that crises were a thing of the past, because the instruments of monetary policy were supposed to maintain a relatively stable growth (Bernanke, 2004; Clark, 2009; Stock & Watson, 2003).

The mid-1980s gave birth to the period known as the Great Moderation, because these were years of macroeconomic stability. As a consequence of the inflationary spiral that followed the oil crisis, the priority for policy-makers was to achieve stable rates of prices growth, by keeping a constant growth in money supply, which would work in a context of rational expectations (Lucas & Sargent, 1979; Taylor, 1993). In short, it was believed that monetary policy was by itself an adequate instrument to attain an everlasting macroeconomic stability. In this context, there is no wonder why the 2008 crisis came as a surprise for many academists, which was a theoretically improbable phenomenon[1], but ended being comparable in magnitude to 1929. The consequences on income distribution of a crisis of such importance, has led us to be interested in the explanations that might have been behind the 2008 crisis, as well as the evolutionary mechanisms that

[1] In fact, in probabilistic terms, another mistake was the identification of a highly improbable event to an event with a null probability of happening. The Great Recession is a clear example of the events that, despite being difficult to predict, are not bound to happen, which has been named as a 'black swan' (Taleb, 2007).

provoke economic busts and the social changes that these unleash. This interest justifies the content of Chapter II, in which the objective will be to establish the evolutionary patterns that are behind long waves (and so, of crises), connecting these to the different long-run trends in inequality, as commented previously. Once established this framework, we will try to go further into theoretical questions related to income distribution, which will constitute the content of Chapter III.

The weaknesses shown by the scientific apparatus in Economics to explain the event of the Great Recession are even more worrisome if we look into its consequences at social and environmental levels; that is to say, once it is assumed that the economic model can end up being unsustainable if it keeps presenting increasing trends in social inequality, as well as in the use of non-renewable resources. Besides, the own development of the post-crisis period has shown signs of a worsening situation for the poorest. Namely, in Spain, according to the World Bank, the percentage of population living under the poverty threshold of $1.90 a day was more than double in 2013 than in 2008 (increasing from a 0.5% to a 1.2%). In this line, in Chapter IV, we will approach the evolution of income distribution in Spain, which can be a good example of a developed country that was heavily affected by the crisis. In Chapter V, these analyses will be opened to a global perspective.

It then seems clear that there exists a relationship between economic crises and the evolution of inequality and poverty. Hence, an objective of our research is to link long-run dynamics of economic processes to inequality trends in the long term. Changes in these processes are strongly linked to the social, institutional, and technological characteristics that are present in each moment of time; and these characteristics determine how income is distributed into the different agents that participate in the process of production. Thus, the analysis of economic dynamics in the period 1929-2010, which is divided into two long waves, as well as the consideration of structural changes by using input-output tables, the distributional conflict between capital and labor, and the role of consumption patterns in income distribution, will constitute some of the guidelines for our research.

According to everything commented above, the thesis will have two clearly differentiated parts: the first one will be dedicated to try and answer all these questions from a theoretical perspective, through the study of long waves and of formal multisectoral models; the second one will have an empirical character, and there we will

study income distribution patterns and the evolution of inequality in the last decades, both for Spain and the global economy, using input-output models.

The main objectives of this dissertation are now summarized as follows:

a) To conduct a deep revision of the state of the art in questions related to income distribution and the instruments used for its analysis.
b) To define the concept of co-evolutionary dynamics that we are assuming in the theoretical part of the thesis, showing its relations to long waves and the evolution of income distribution processes in the medium and long-run.
c) To review the three types of multisectoral models that we are using: 1) a formal multisectoral model with prices equations, which will allow us to theoretically deepen in primary distribution of income and its relationship to consumption patterns; 2) the traditional Leontief input-output model, which will be applied to the empirical analysis of income distribution in Spain; and 3) the extensions to the multiregional input-output model, which will be used for the analysis of global income distribution.
d) To analyze the long-run economic and income distribution dynamics in the developed world during the twentieth and twenty-first centuries, showing the deep changes that were experienced around the mid-1970s.
e) To study the economic evolution in developed countries during 1929-2010, identifying two long waves, using empirical tests as well as the descriptive characterization of their respective co-evolutionary paradigms.
f) To empirically study the income distribution trends in Spain during the last four decades, confirming increases in inequality from the 1980s. A series of annual national input-output tables will be used, as well as traditional inequality measures, such as Sen (1976) or Gini (1921) indexes.
g) To open the previous empirical analysis to a global perspective, analyzing both inequalities within and between countries. We will use multiregional input-output tables for 67 countries, supporting our analysis in the concept of Global Value Chains (GVCs) and their indicators: participation and position.
h) Finally, to explore the characteristics of a possible new long wave that might have started around 2010: new emerging technologies, changes in income distribution trends, new institutional paradigms, etc... This will allow us to make policy

recommendations in order to try and correct the inequalities observed both within and between countries.

1.3. State of the art

Now, we are going to conduct a literature review about the topics around which our research is articulated: income distribution and dynamics and long waves.

1.3.1. Economic evolution: the study of long-run dynamics and their causes

Here, we are approach the theoretical foundations of evolutionary Economics, which is a fundamental base to approach the study of long-run dynamics and long waves.

Thorstein Veblen (1899) could be designated as one of the intellectual forefathers of evolutionary Economics. His cumulative conception of institutional changes is one of the foundations of contemporary evolutionary economics, as well as of alternative streams of though such as neo-institutionalism (Myrdal, 1978). The analysis of institutions and the changes generated by economic processes was continued half a century later by Karl Polanyi (1944). He analyzed the socioeconomic transformations that took place after the second Industrial Revolution, comparing them to the changing environment of the first third of the twentieth century[2]. Institutions are key in our vision, as these play an important role in the determination of growth and distribution evolutionary patterns – let us think, as an example, of the role of the welfare state in the reduction in inequality via redistribution.

The other pillar of the foundations of evolutionary economics can be found in Schumpeter (1939), who studied changes in economic systems related to innovation, assuming that evolution takes the shape of long waves (Kondratieff, 1935). Economic cycles are fundamental for explaining the evolution of income distribution, but this analysis is strongly dependent of which factors are considered the cause of the fluctuations. We are focusing on those theories that, being based in Schumpeter and Kondratieff, put technological change and 'creative destruction' at the center of their analyses. However, we cannot forget the other axis mentioned above, the study of

[2] Polanyi's analysis is also interesting because it shows the inception of the perception of poverty as a social problem in England, towards the end of the eighteenth century, with the establishment of the Speenhamland Act of 1795. Poverty started then to be considered a recurring problem, usually linked to the same recurrence of economic crises.

institutions: in fact, there also exist business cycles theories in which institutions play a key role (Tinbergen, 1935).

We can then conclude that these two axes gather the foundations of what later crystalized in contemporary evolutionary Economics (Nelson & Winter, 1982). Here, we can distinguish between those analyses that majorly deal with the technological component (Dosi, 1984; Freeman, 1996; Metcalfe, 2002), and those that mainly focus on the study of institutional change (Hodgson, 1999; Nelson, 2008). Finally, there is also another important line of research that must be mentioned here as an important methodological reference, despite falling out of the scope of this thesis, that is, evolutionary games theory (Maynard Smith, J.; Price, 1973; 1974).

As we have already commented, the concept of change is going to be key in the study of long-run dynamics. The literature has usually introduced this topic by using the concept of paradigm, understood as the bundle of characteristics that determine evolution in a determined economic system. This notion of paradigm was introduced in the 1980s (Dosi, 1982; Forrester, 1985; Freeman, 2008). Here, it is also important to introduce the evolutionary-materialist vision of Bunge (1985), which will allow us to link the concepts of paradigm and mechanism to strengthen the concept of co-evolution and will give a theoretical and sociological support to our long waves scheme.

After dealing with theoretical contributions, we move on to the field of empirical applications. There, the identification of long waves and structural change have been widely treated by conventional econometrics, either by applying tests (Chow, 1960), filters to obtain the cyclical component (Hodrick & Prescott, 1997; Baxter & King, 1999), or, more recently, by using alternative statistical methods (Silverberg & Verspagen, 2003). Another important approach is that made by assuming that the processes of innovation yield economic evolutions shaped as sigmoid curves, identifying situations of technological exhaustion with economic crises and structural changes (Jarne et al., 2007; Sanchez-Choliz et al., 2008).

Finally, the debates around the concept of long wave that took place in the decades of the eighties and the nineties should also be mentioned (Freeman, 1996). For example, there is a debate concerning the length of these long waves, if these have a Kondratieff character, of around 50-60 years, or if these are more similar to Kuznets' (1940), of an average length of 20 years (Solomou, 1986, 1988). There is also a lack of consensus

concerning the sphere in which these waves manifest themselves, whether in production or in prices (Ewijk, 1982). Nonetheless, despite this boom in the literature, the hypothetical wave of 1975-2010 and its subsequent evolution of income distribution have not been widely researched, so one of our contributions lies here. In short, the theoretical debate is not exclusively reduced to the determination of the existence of long waves but is also extended to particularities of their manifestations. We are aware of the usual reduction of these problems to a question of 'believing' in the existence of cycles. Thus, we acquire the commitment of not being fundamentalist or dogmatic, and trying to make a good use of these tools to reach a deeper knowledge on how economic systems and their structural evolutions work. This will help us to unveil the forces behind the mechanisms of income distribution.

1.3.2. Income distribution and inequality

The theory of income distribution has occupied a prominent place in the main scientific discussions in Economics. One of the most well-known debates is that of the 'Cambridge controversies' (Harcourt, 1969), which took place in the 1950s-60s, and were centered around topics related to capital, value, and income distribution. On one side, the American Cambridge contenders (Arrow & Debreu, 1954; Samuelson, 1962; Solow, 1955), from a neoclassical perspective, defended that factor income compensations were strictly determined by marginal productivities, and that these were independent (Ferguson, 1969). On the other side, the British Cambridge contenders (Kaldor, 1960; Robinson, 1969; Sraffa, 1960), postulated an inverse and antagonistic relationship between wages and profits, so an increase in the income share of a factor provokes a decrease in the share of the other. Furthermore, these distributive variables are strongly linked to the socio-institutional framework, so are not strictly determined by technical relations, which partially connects to the Classical conceptions of Ricardo (1817) and Marx (1867-1894). Our thesis is going to move around the British Cambridge postulates.

David Ricardo considered the determination of the laws of income distribution as the main problem in Political Economy. He also defined this process as a conflict between social classes, in distinction with Smith (1776), who defended the independence of the distributive variables. However, Ricardo's conflict was reduced to the confrontation between landowners and the rest of the classes. Being inspired by Ricardo and his concept of labor values, Marx was the first in treating the distributive conflict in capitalist societies, defending the inverse wages-profits relationship, and confronting

entrepreneurs to workers. Although the inverse correlation between wages and profits has been empirically confirmed, data also show that the distributive conflict can be extenuated by technological change (Okishio, 1961; Vegara, 1977), or by the institutional framework – let us think in the construction of the welfare state during the first half of the twentieth century and its role in modulating this conflict. This fact is important because it displays the important nexus that exist between innovation, distribution, and institutions.

Amid the references cited in the British Cambridge economists above, that of Piero Sraffa (1960) must be highlighted. His multisectoral models representing economies in state of reproduction with (or without) surplus, have been discussed and extended in contemporary research (Pasinetti, 1977; Kurz & Salvadori, 1995; Chiodi & Ditta, 2007; Ciccone et al., 2011a, 2011b; Sinha, 2016). Despite their singularities, other contributions in this line of multisectoral models must be cited, such as those of von Neumann (1945) and Goodwin (1967, 1983), which also treated topics related to economic growth and cycles, and even income distribution, albeit indirectly.

Another significative contribution, although of a very different methodological character, is that of Roemer (1982), who approaches inegalitarian distribution by using general equilibrium models, in which the institutional framework plays a main role. These models are in line with that of Morishima (1973), a pioneer in the scientific formalization of Marx's theories of growth and value, also in a multisectoral context. Specifically, Roemer's models consist of the analysis of distributive structures in different moments of History – feudal economies of subsistence, accumulation capitalisms, and central planification. The main conclusion is that all non-egalitarian distribution of property generates exploitation – understood as inegalitarian income distribution, or non-proportionality between income received and resources introduced in production. Furthermore, these inequalities crystalize in the sphere of consumption, which is another important result for our dissertation.

All the references above, which will be useful guidelines for our research, present the common feature of being 'models of reproduction and surplus', considering use and supply (input-output) and analyzing disaggregated production (by sectors, regions…). The concept of reproduction is going to be key, as it will allow us to connect two of our basic methodological instruments, that is, multisectoral models and input-output analysis, as well as being compatible with out evolutionary vision.

Finally, special mention must be made to three last references: Sen (1973), Deaton (2013), and Piketty (2014; 2020). Sen was one of the first economists to denounce increasing inequality in the last third of the twentieth century, and to situate it as one of the main social challenges of our time. He was also a pioneer in poverty and inequality analyses, invalidating the use of GDP per capita as a welfare measure, and proposing multidimensional measures (Foster et al., 1984; Sen, 1976), inspiring United Nations' Human Development Indexes. Moving on to Deaton, he concluded that inequality was an unavoidable result of economic progress; however, the experience during the period 1930-1970 seems to contradict his hypothesis, leaving room for additional emerging mechanisms that could extenuate this effect. Finally, Piketty studied the historical evolution of the distribution of capital (or wealth) in the developed world since the nineteenth century, concluding that capital has been increasingly concentrating in top incomes. As a result, income distribution has polarized, the middle class is less representative, and inequality has increased. This recent evolution would contrast with that seen between the Great Depression and the oil crisis, when inequality decreased, due to the institutional arrangements put in motion, and the destruction of physical capital resulting from WWII.

Nonetheless, what we think is more interesting about Piketty is his message, which shocked the Academia and arose consciousness about the contemporary problem of increasing inequality, which was aggravated by the Great Recession. This being said, we are aware of the limitations of Piketty's analyses from an analytical point of view. His contribution in *Capital in the 21st century* (2014) focus on two simple equations, the 'fundamental laws of capitalism'. This analysis was complemented by a deep historical and sociological revision of the distributive systems and their associated social structures, without entering into modelization (Piketty, 2020). Bearing this in mind, when assuming Piketty's results as valid, we commit to try and arrive to the same conclusions while achieving a higher degree of robustness from a formal point of view (input-output multisectoral models).

1.3.3. Multisectoral and multiregional models in an input-output framework

This section ends with some comments on one of the fundamental instruments of this thesis, the input-output framework, which will be key in the empirical part of the dissertation. We will focus on its applications to the field of income distribution. In fact, input-output models allow different types of applications (see Miller & Blair (2009)),

the most extended ones being that of the multisectoral analysis of environmental impacts, technological changes, and growth. However, these models have not been much used for analyzing income distribution topics, although these present important advantages, such as allowing to analyze the distribution of value added between different economic agents, as well as the disaggregated structure of final demand. Specifically, input-output models provide information about incomes received by different types of workers, different categories of labor compensations, the role of imports, and even the destination of those incomes (subsistence consumption, luxury consumption, investment, etc.). Besides, the consideration of multiregional input-output models is also reasonable if we think in the global context of the productive chains and the increasing fragmentation of value chains resulting from globalization, which undoubtedly affects the global distribution of income.

The historical antecedents of the intellectual inception of input-output tables can be traced back to the first attempt to construct a supply-use table, which is the *Tableau Économique* proposed by the physiocrat François Quesnay (1757, 1766). Here, Quesnay tried to establish different flows of transactions between economic agents, trying to show that agriculture was the only productive sector, the origin of value added being in the products coming from the land. Marx could be considered another intellectual forefather, due to his vision of the economy as a self-reproducing system, in contraposition to the linear conception of neoclassical economists. The concept of general equilibrium posited by Walras (1874) is also fundamental, as input-output tables verify the supply-demand equilibrium in all sectors.

We arrive now to Wassily Leontief (1941), which is considered the *de facto* founder of input-output methodology. Leontief's basic model, symmetric tables, as well as the input-output framework and the structure of supply-use tables, will be commented in more detail in the section of methodology. Multiregional input-output tables will also be commented; these maintain the essential structure of input-output tables but include sectors from additional regions.

Returning to the literature review, the first steps in studying income distribution in an input-output framework can be attributed to Miyazawa's (1976) multipliers, although this work has a very different character to the analyses we are conducting. Other research in this field, very extended nowadays, is that associated to the construction of Social Accounting Matrices (SAMs), first suggested by Meade & Stone (1941), and being fully

implemented in Pyatt & Thorbecke (1976). These tables are a natural extension of the input-output framework when all the income flows between different agents are incorporated, especially those corresponding to the government, companies, households, and the foreign sector. Other important line of research concerning inequality using these models is related to the unequal distribution of environmental impacts (López et al., 2016, 2020). Finally, other researchers have worked in linking the foundations of Sraffa's multisectoral model to Leontief's basic model, with the purpose of approaching income distribution (Steenge & Serrano, 2012). Although our basic multisectoral reference will be that of Leontief's input-output model, Sraffa's vision will allow us to overcome some limitations in our analysis, as it will allow us to situate the distributive conflict between wages and profits in an institutional and technological context, also linked to consumption patterns.

1.4. General methodological framework

In this section, we are describing the main methodological traits of this thesis. Although each chapter will present particularities and extensions, we will deal here with that methodology that is more general and common to all chapters. First, we will present our conception of long-run economic dynamics and their relationship to income distribution, which will help us study the evolutionary dynamics during the period 1929-2010. Then, we will enter into multisectoral models, which will be used for theoretical discussions and empirical analyses focused on the second half of the first period, from 1980 onwards. The strongest links between these two methodologies, which are very distinctive *a priori*, are the concept of reproduction, and the possibilities of time overlapping. The concept of reproduction is compatible with the sectoral input-output vision. Moreover, it is also essential in a dynamic-evolutionary conception. At the same time, many researchers in co-evolution defend the necessity of incorporating sectoral analyses and the study of structural and technological changes, which are well represented in input-output models.

1.4.1. Long-run economic dynamics and innovation.

In this thesis, we adopt the dynamic vision of economies as evolutionary processes, that is, processes that are constantly subject to changes and adaptation, and are governed by the succession of long waves that alternate phases of prosperity and crisis. Here, the

concept of change is key: analogously to what Darwin (1859) postulated, taking the economic system as an organism, the only way of assuring its survival is through a continuous process of change and adaptation to the new conditions imposed by the environment. Thus, each crisis associated to a long wave would be associated to the necessity of a change and rupture with the previous period, bringing about the start of a new wave with different characteristics – this is also linked to improvements in the society's capacity to overcome and extend their goals. In particular, we will focus on the study of scientific, institutional, and technological characteristics in a given wave or period, and in their evolution and the sense of these changes. This particular set of characteristics associated to each wave is known as paradigm. In Chapter II, the concept of techno-economic paradigm and its component will be further explained.

In our evolutionary scheme, we assume that economic long-run dynamics are non-linear and non-deterministic processes. To justify our vision, we take inspiration in Mario Bunge (1979, 1997). According to his theories, we assume the existence of four interrelated and partially autonomous systems (economic, scientific, institutional, and technological), each one of them presenting their own mechanisms. The integration of these systems would form the social system, which would be characterized by particular features, some of them emergent, while others present in the component systems. This being so, we consider income distribution as inherent to the social and economic co-evolutionary system and, hence, it will also present its own characteristics that will go beyond the purely economic or productive spheres – this justifies the fact that income distribution cannot be exclusively studied as a phenomenon strictly related to marginal productivities or purely economic changes[3].

On the other hand, we also assume that the interrelation of various sub-systems would be complex and most probably non-linear. The instrumentation of these complex relations in long waves can accommodate these non-linear dynamics. These long waves would be results of the social system, thus including productive, institutional, and technological aspects, contrasting with shorter cycles (Juglar or Kitchin), which would essentially reflect economic results. As a consequence, long waves cannot be considered to have a non-deterministic character, because these are determined by other social

[3] In this sense, the analysis of income distribution should consider additional things besides wage payments. Specifically, the role of the welfare state on redistribution cannot be left out of the analysis, it not being an economic result, but a joint result of economic, social, and institutional components instead.

components, and because of the complexity of the interrelations. In short, we consider that these waves are emergent multi-faceted phenomena.

This evolutionary perspective can be linked to Schumpeter (1939), in which we will base our descriptive analysis about the characteristics of long waves and their subjacent cycles. Furthermore, we also follow Juglar (1862) and Kondratieff (1935), as we defend a double confirmation of these waves, both statistically and historically (Tylecote, 1992).

Following Schumpeter, we consider that the profile of the waves is mainly formed of alternative phases of prosperity and crisis; however, to these phases must be added what Schumpeter names as the 'secondary wave', which is shaped by the expectations of economic agents, whose optimism or pessimism generate cumulative effects, making the phases of prosperity and crisis last longer. This makes necessary a further division of long waves in four phases, two belonging to the original phase of prosperity – recovery and expansion -, and other two belonging to the phase of crisis – recession and depression.

Furthermore, according to Schumpter, three types of waves can be distinguished in the processes of economic growth, linked to their length: 1) Kondratieff or long wages, of about 50-60 years of average length, which determine economic evolution and are governed by radical innovation; 2) Juglar cycles, of around a decade of average length (assuming that each Kondratieff contains 6 Juglars), which are related to the development of incremental innovation, so these are business cycles in the most traditional sense; and 3) Kitchin cycles, of an average length of 18 months, related to inventory cycles. Finally, regarding explicative causes, Schumpeter, developed an endogenous theory of cycles, known as 'creative destruction', in which he postulated that innovation and technological change are the moving forces of evolution and changes in economic processes – although he also assumed the inclusion of exogenous factors, such as wars.

Although we follow Schumpeter in what was commented above, we should remark that some of our assumptions diverge from his framework. First, we are aware of the limitations of his work (Kuznets, 1940), and so our analysis should be interpreted as a revision at various levels. For example, our explanation of the endogenous causes of the cycle does not admit innovation as a single cause (Rosenberg & Frischtak, 1984). As we

have explained earlier, the scientific and institutional contexts must also be taken into account, jointly with technology. Besides, we cannot support the deterministic scheme of Schumpeter regarding the length of waves, their profile, their recurrence, or the number of subjacent cycles. As we are dealing with emergent non-additive economic processes (Lloyd Morgan, 1923), we cannot admit deterministic patterns. The existence of stochastic elements in the processes we are describing, as well as the importance of dealing with uncertainty in Economics – which should not be reduced to a notion of probability (Ramsey, 1926) -, does not allow a rigid deterministic treatment. Then, the length of long waves can vary from one to another (not being limited to 50-60 years), as well as the subjacent cycles.

In more depth, bearing in mind the concept of long wave as a key for understanding economic fluctuations, we will start from the hypothesis of the existence of two Kondratieff waves in 1929-2010: the first one will last from the start of the Great Depression to the oil crisis of the mid-1970s; the second one would start at the end of the previous one, lasting until the Great Recession, marking the start of a hypothetical third long wave. Thus, we follow Bieshaar & Kleinknecht (1984) when assuming the *a priori* existence of two waves, which have also been confirmed in previous literature (Grübler & Nowotny, 1990; Metz, 1992). Moreover, this hypothesis will be confirmed by applying structural break tests, in order to support the identification of tow different periods (Chow, 1960). Then, using filtering methods (Baxter & King, 1999), we test the existence of Juglar cycles subjacent to the long waves. These fluctuations will be associated to basic improvements in the technological boom of the wave, that is, incremental innovation.

We must also highlight that, although the concept of long wave will be a useful tool for supporting our analyses, our objective is not to contribute to this debate, but rather to present an original analysis for unveiling the structural mechanisms of income distribution.

As was already explained, these two periods have already been treated in the literature, also from a descriptive perspective. According to a technological classification, the first wave would be the ‘automotive and oil cycle’, while the second one would be the ‘information and communication technologies’ cycle (Freeman, 2008). Moreover, these periods have also been classified according to their paradigmatic institutions, respectively, the ‘wave of regulated capitalism’, and the ‘wave of neoliberal capitalism’

(Bertocco, 2017). Once this division in time is established, and the internal fluctuations identified, we will conduct a descriptive analysis in order to classify the different paradigms of the four sub-systems. We will show that each long wave present different characteristics, and so can be defined as economic and historical units by themselves. Specifically, we will see how these different paradigms can be used to explain the changes in income distribution long-run trends, that is to say, from decreases in inequality in the first period to increases in the second one.

To sum up, the methodology explained here is being used essentially in Chapter II. First, we will deal with the economic sub-system from an empirical perspective, checking structural breaks for the long waves and filtering methods for identifying subjacent intermediate-length cycles (between 7 and 11 years). Second, we will carry out a more historical-descriptive analysis to determine the characteristics of the scientific, institutional, and technological sub-systems, which evolve and change from one long wave to another.

Once clarified the methodological aspects that we are using to face research about economic long-run dynamics, we move on to comment aspects about the other big methodological block that is going to form the thesis: the study of income distribution and inequality by using multisectoral input-output models.

1.4.2. Leontief and multiregional input-output models

Our analyses of income distribution are going to be strongly based on the input-output framework and the demand-driven Leontief model (1936, 1941), even admitting the inclusion of 'neo-ricardian'[4] elements. To put it in simple words, input-output tables and double-entry models show, at a sectoral level of detail, purchases and sells of both intermediate inputs and final products. Among other things, this allows the analysis, from a double perspective, of value-added flows throughout the economic structure. Besides, these are also useful because they provide information about wages, consumption patterns, profits, income transactions between regions and/or countries, and taxes. In short, the use of these models allows the integration of both technical and institutional questions into our analyses, which is consistent with our vision.

[4] For 'neo-ricardian', we understand a stream of thought that follows Ricardo (1817) and later contributions on the line of his theories, such as those found in Marx (1867-1894) and Sraffa (1960).

Then, we are going to present briefly which are the basic foundations of input-output methodology. As a previous step to the obtention of an input-output table, we have supply and use tables (SUTs). Broadly speaking, supply tables show the sector of origin in which each good is produced, while use tables show the industry of destination in which each good is consumed. A symmetric input-output table can be constructed by combining and organizing these two types of tables (Eurostat, 2008). See Table 1 below for a simplified example of the generic structure of a symmetric table. As can be seen, symmetric input-output tables include essential information related to income distribution: the decomposition of value added in factor incomes, on the one hand; and the distribution of final demand between different components, on the other hand. The structure of incomes in rows and final demands in columns is a fundamental part of Leontief's vision.

Table 1.1. General and aggregated structure of a symmetric input-output table

<table>
<tr><td colspan="2" rowspan="2"></td><td colspan="3">Sectors (consumption)</td><td colspan="4">Final demand</td></tr>
<tr><td>Agriculture</td><td>Industry</td><td>Services</td><td>Households consumption</td><td>Gross capital formation</td><td>Government consumption</td><td>Gross exports</td></tr>
<tr><td rowspan="3">Sectors (production)</td><td>Agriculture</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Industry</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Services</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">Value added</td><td>Workers</td><td colspan="3">Wages</td><td colspan="4" rowspan="3">GROSS DOMESTIC PRODUCT</td></tr>
<tr><td>Capital owners</td><td colspan="3">Profits
Fixed capital amortization</td></tr>
<tr><td>Government</td><td colspan="3">Taxes</td></tr>
<tr><td>Foreign sector</td><td></td><td colspan="3">Imports</td><td colspan="4"></td></tr>
</table>

Source: own work

In Chapter IV, tables following the structure above will be used for the empirical analysis of income distribution and inequality in Spain, during 1980-2014. For doing so, the Wages row will be disaggregated into compensations by different levels of skills, and the column of Households consumption will be disaggregated by income quintiles, assuming different consumption patterns.

From symmetric tables, input-output models are constructed. These allow the description of production flows between the different sectors of an economy,

establishing relations between domestic and foreign activities, as well as economic transactions between sectors, institutions, and final consumers[5]. A basic demand-driven Leontief model would be constituted by a system of equations expressing final production by sectors. In an economy with *n* sectors:

$$x_1 = z_{11} + \cdots + z_{1j} + \cdots + z_{1n} + f_1$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$x_i = z_{i1} + \cdots + z_{ij} + \cdots + z_{in} + f_i \qquad (4.1)$$

$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$x_n = z_{in} + \cdots + z_{in} + \cdots + z_{nn} + f_n$$

where $\mathbf{x}=(x_i)$ is the gross output vector, $\mathbf{Z} = (z_{ij})$ is the intermediate inputs matrix, $\mathbf{A}=(z_{ij}/x_j)$ is the technical coefficients matrix, which expresses the sectoral requirements of intermediate inputs by unit of product, and $\mathbf{f}=(f_i)$ is the final demand vector, which shows the net final product or what is available for final consumption once intermediate inputs are deducted. In compact notation, this could be expressed as follows:

$$\mathbf{x} = \mathbf{Z} + \mathbf{f} = \mathbf{A}\mathbf{x} + \mathbf{f} \qquad (4.2)$$

Assuming that final demand is exogenous, and solving (4.1) for **x**, we obtain:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f} = \mathbf{L}\mathbf{f} \qquad (4.3)$$

Let **I** be the identity matrix and $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = \left(\propto_{i,j}\right)$ the Leontief inverse, which represents total requirements (direct plus indirect) of good *i* by unit of final demand in sector *j*. This model allows the identification of total impacts caused by exogenous changes in demand. The expression $\mathbf{x} = \mathbf{L}\mathbf{f}$ shows the production that is necessary to satisfy final demand **f**. From (4.3), $\Delta\mathbf{x} = (\mathbf{I}\text{-}\mathbf{A})^{-1}\Delta\mathbf{f}$ can be obtained, which could be used to calculate the changes in production derived from a change in final demand $\Delta\mathbf{f}$. Thus, the input-output model allows the analysis of impacts on production as a result of a determined policy. In addition, impacts can be analyzed on other variables besides production, namely, on labor. The model also allows the calculation of labor requirements, which are given by:

[5] These are much more explicit in SAMs, where additional accounts appear besides sectors and value added. In addition, these can include disaggregated accounts (by types of labor, different households, blocks of countries in the foreign sector, types of taxes, etc.).

$$L = \mathbf{l}'\mathbf{x} \tag{4.4}$$

where *L* is total employment, **l'** is the vector of direct labor coefficients, expressing he quantity of labor that is required by unit of output in each sector. This vector and matrix **A** define the economy's technology. Let us observe that we can also calculate impacts on employment derived from changes in demand:

$$\Delta L = \mathbf{l}'\Delta\mathbf{x} = \mathbf{l}'(\mathbf{I} - \mathbf{A})^{-1}\Delta\mathbf{f} \tag{4.5}$$

Let us also remark that a natural extension of this model would be the construction of a Social Accounting Matrix (SAM) (Stone & Brown, 1962; Pyatt & Round, 1985), which would include monetary flows between sectors and institutions (using accounts related to labor, capital, households consumption, savings and investment, taxes, public consumptions, and net exports). These matrices capture the income flows in an economy, adding information on income distribution that can be incorporated into symmetric input-output tables.

Up to this moment, we have been talking in multisectoral terms for a single economy, which could then be the case of a national table representing intermediate transactions between sectors in a determined country. Nonetheless, without changing the basics of an input-output table, it is possible to move on to a multiregional model (MRIO), where intersectoral relations between different countries are collected, and which will in fact be our base in Chapter V. See Table 1.2 for a simplified example of an MRIO. For its construction, a similar method is followed as to that explained above for the symmetric tables.

Table 1.2. General and aggregated structure of a multiregional input-output table

		Sectors (consumption)					**Final demand**					
		Region 1	**…**	**Region *s***	**…**	**Region *n***	**Region 1**	**…**	**Region *s***	**…**	**Region *n***	**Total uses**
Sectors (production)	**Region 1**	$\mathbf{X}^{1,1}$	…	$\mathbf{X}^{1,s}$	…	$\mathbf{X}^{1,n}$	$\mathbf{Y}^{1,1}$	…	$\mathbf{Y}^{1,s}$	…	$\mathbf{Y}^{1,n}$	$\mathbf{x}^{1}$
	…	…	…	…	…	…	…	…	…	…	…	…
	Region *r*	$\mathbf{X}^{r,1}$		$\mathbf{X}^{r,s}$		$\mathbf{X}^{r,n}$	$\mathbf{Y}^{r,1}$		$\mathbf{Y}^{r,s}$		$\mathbf{Y}^{r,n}$	$\mathbf{x}^{r}$
	…	…	…	…	…	…	…	…	…	…	…	…
	Region *n**	$\mathbf{X}^{n,1}$	…	$\mathbf{X}^{n,s}$	…	$\mathbf{X}^{n,n}$	$\mathbf{Y}^{n,1}$	…	$\mathbf{Y}^{n,s}$	…	$\mathbf{Y}^{n,n}$	$\mathbf{x}^{n}$
	Value added	$\mathbf{v}^{1}$	…	$\mathbf{v}^{s}$	…	$\mathbf{v}^{n}$						
	Total resources	$\mathbf{x}^{1}$	…	$\mathbf{x}^{s}$	…	$\mathbf{x}^{n}$						

Note: When the MRIO represents the world, region *n* is usually a 'Rest of the world' account, with the *n-1* economies not included separately in the table

Source: own work

In Table 1.2 above, sub-matrices $\mathbf{X}^{r,s} = \left(x_{i,j}^{r,s}\right)$ represent intermediate inputs in the global economy, being $x_{i,j}^{r,s}$ sells from sector *i* in region *r* to sector *j* in region *s*; when *s* ≠ *r*, these are exports of inputs. Final demand appears in sub-matrices $\mathbf{Y}^{r,s} = \left(y_{i,d}^{r,s}\right)$, which identify contributions from sector *i* in region *r* to the final demand category *d* in region *s*. In each region, we can distinguish the components of final demand shown in Table 1. However, it is important to note the different character of exports, as here these are final goods destined to consumption, because exports of intermediate inputs from region *r* to region *s* are already collected in matrix $\mathbf{X}^{r,s}$. Besides, $\mathbf{v}^{s} = \left(v_{j}^{s}\right)$ is the value added vector in region *s*, being v_{j}^{s} value added in sector *j* in region *s*. Finally, let us observe that Table 1.2 does not include a row for imports. This is due to imports from región *s* are already included in $\mathbf{X}^{r,s}$. As it also happened in Table 1.1, the value added row can be disaggregated into several categories.

As Table 1.2 represents a closed (global) economy, sums in rows and columns must always coincide:

$$\sum_r \sum_i x_{i,j}^{r,s} + v_j^s = \sum_z \sum_u x_{j,u}^{s,z} + \sum_z \sum_d y_{j,d}^{s,z} \;\; ; \; \forall i,j,r,s,d,u,z \tag{4.6}$$

For the construction of the formal input-output model associated to a multiregional table, we obtain the technical coefficients matrix $\mathbf{A} = (a_{i,j}^{r,s})$, where $a_{i,j}^{r,s}$ represents the direct needs of by unit of output of sector *j* in region *s* (of inputs from sector *i* in region *r*):

$$a_{i,j}^{r,s} = \frac{x_{i,j}^{r,s}}{x_j^s} \tag{4.7}$$

If $\mathbf{x}^s = (x_j^s)$, letting $x_j^s = \sum_r \sum_i x_{i,j}^{r,s} + v_j^s$ be total output of sector *j* in region *s*, we can define a vector $\mathbf{x} = (\mathbf{x}^1, \dots, \mathbf{x}^s, \dots, \mathbf{x}^n)$ of the global economy's total output. As in equation (4.3), we can describe it in matricial form:

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{Y}\mathbf{e} \iff \mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{Y}\mathbf{e} = \mathbf{L}\mathbf{y} \tag{4.8}$$

In (4.7), $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = \left(\propto_{i,j}^{r,s}\right)$ will again be the Leontief inverse, which represents total requirements (direct plus indirect) by unit of final demand of sector *j* in region *s* (coming from sector *i* in región *r*). Besides, $\mathbf{y} = (y_i^r) = \mathbf{Y}\mathbf{e}$ is the aggregated vector of final demand $\left(y_i^r = \sum_s \sum_d Y_{i,d}^{r,s}\right)$. As in the previous model, the multiregional model allows the identification of total impacts derived from exogenous variations in demand, as well as impacts on employment, value added, and other variables; the basic expressions are (4.3) and (4.5) but using the corresponding inverse and demand.

1.4.3. Notes on other multisectoral models

Besides input-output models and social accounting matrices, we can find additional literature on multisectoral models, used mostly for theoretical approaches. These models share the basics with input-output models, due to intersectoral linkages, the interest in technological change, the concept of economic reproduction, and the role played by the economic agents represented. Nonetheless, in contrast with input-output models, which are strongly dependent of a statistical base, and which assume unitary prices, most of these theoretical multisectoral models consider important extensions, such as prices equations, joint production, or income optimization. Moreover, due to their theoretical character, these can also assume uniform rates of profit and/or growth, and even variables such as capital stocks.

The development of these formal models has opened some questions concerning theoretical debates and modelling: which are the equilibrium prices of a model? Does the model determine a maximum rate of growth, given a determined technology defined by **A** and **l**'? How can capital stocks or joint production be included in the analysis?

Here, there is a great number of references, such as Sraffa (1960), Morishima (1973), Pasinetti (1993), and Kurz & Salvadori (1995).

Although other archetypical models could be used, we are going to present briefly a model with single production, which will be the baseline for our theoretical insights in Chapter III. Let us assume that a similar equation to (4.2) is verified, relating total output to intermediate and final consumptions:

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{f} \tag{4.9}$$

Usually, in (4.9), the technical coefficients matrix **A** is constant, and prices are not necessarily equal to unity. Prices can be obtained from the following equation:

$$\mathbf{p}' = \mathbf{p}'\mathbf{A} + \mathbf{v}' \Leftrightarrow \mathbf{p}' = \mathbf{v}'(\mathbf{I} - \mathbf{A})^{-1} \tag{4.10}$$

where $\mathbf{p}'$ is the prices vector, $\mathbf{v}'$ represents the vector of value added coefficients, and $(\mathbf{I} - \mathbf{A})^{-1}$ is again Leontief's inverse.

Following Morishima (1973), it could be assumed that value added is entirely destined to labor compensation with a homogenous wage *w*. In this case, (4.10) would become:

$$\mathbf{p}' = \mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - \mathbf{A})^{-1} \tag{4.11}$$

which reveals a strong relationship between prices and the quantity of labor embodied in each good (direct and indirect labor requirements). This connects Leontief models to models of Marxian and Sraffian inspiration.

We can also assume that there is a uniform rate of profit that compensates advanced capital, which in (4.9) is given by $\mathbf{p}'\mathbf{A}$. Thus, equation (4.11) can be transformed in:

$$\mathbf{p}' = (1 + r)\mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - (1 + r)\mathbf{A})^{-1} \tag{4.12}$$

where *r* would be the uniform rate of profit for all sectors. In many occasions, it is assumed that the rate of profits coincides with the rate of growth. Hence, the model will have two basic equations, one expressing physical quantities and a rate of growth, and its dual expressing prices and a rate of profit:

$$\left.\begin{array}{l} \mathbf{x} = (1 + r)\mathbf{A}\,\mathbf{x} + \mathbf{f} \Leftrightarrow \mathbf{x} = (\mathbf{I} - (1 + r)\mathbf{A})^{-1}\mathbf{f} \\ \mathbf{p}' = (1 + r)\mathbf{p}'\mathbf{A} + \mathrm{w}\mathbf{l}' \Leftrightarrow \mathbf{p}' = \mathrm{w}\mathbf{l}'(\mathbf{I} - (1 + r)\mathbf{A})^{-1} \end{array}\right\} \tag{4.13}$$

In Chapter III, this basic model described by (4.11) will be extended with two objectives: first, to obtain generalized results of some findings from the literature; and second, to

determine which questions are theoretically important for income distribution analyses, so these can considered in the empirical Chapters IV and V.

1.4.4. Other indicators of income distribution and inequality: Gini and Sen indexes

Although input-output models are potent empirical instruments for describing income distribution, mainly because these provide detailed information about value added, final demand, and their respective components, there are some aspects that require additional tools. We refer to the quantification of inequality levels and the scale of distribution. Thus, the input-output analysis will be complemented with some traditional measures of inequality, which will be calculated using the tables as databases, when possible. In this line, usual traditional measures of inequality are such as indexes such as Gini (1921), Theil (1979), Atkinson (1970), or Kakwani (1993). Specifically, we are using Gini indexes as basic measures in Chapters IV and V. These indicators will be complemented with data of property relations, provided by the shares of different percentiles of the distribution scale.

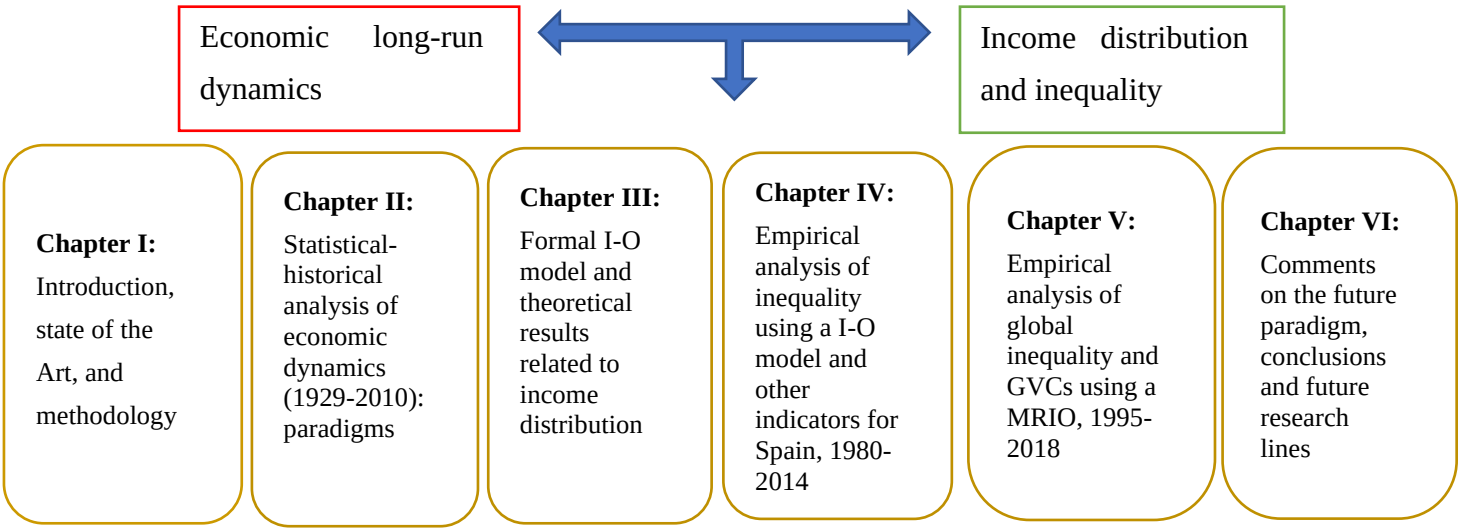
Meanwhile, Gini indicators, either obtained from direct information from the tables or not, can be biased, because these are strictly based on economic data, leaving other fundamental aspects of living standards out of the analysis. Hence, we will complement this with an indicator considering additional dimensions, in the vein of Sen (1976) and later extensions to these indicators (Foster et al., 1984).

1.5. Outline of the thesis

Once the topics, motivation, objectives, and methodology of our thesis have been presented, we will now show the guidelines we are going to follow. The thesis is going to be structured around six chapters. Chapter I is this Introduction, in which we have conducted a deep analysis on the conditions and evolution of income distribution, situating the importance of the topic. The following four chapters are the nucleus of our research, and are divided into two blocks: a theoretical one, formed of Chapters II and III, and an empirical one, constituted by Chapters IV and V, as can be seen in the summary provided by Figure 1.1 below. Chapter II approaches the mechanisms of income distribution in a context of economic long-run dynamics, represented by long waves. Chapter III is based on the theoretical foundations of a multisectoral model in order to try and determine important aspects of income distribution that should be dealt

with in the empirical part. Chapters IV and V will be empirical applications concerning inequality and income distribution in Spain and the world, respectively. Finally, the thesis will conclude with some general concluding remarks, comments on the future paradigm, and future lines of research.

Figure 1.1. Summary of the thesis and its chapters



1.6. References of Chapter VI

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Chapter II: Income distribution, long waves, paradigm shifts, and structural changes, from 1929 to 2010.

The present thesis is formed of two clearly different parts, a theoretical one (Chapters II and III), and another of an empirical character (Chapters IV and V). This second chapter approaches the topic of income distribution in an original theoretical framework. For doing so, we take a look into the evolution of the global economy for the period 1929-2010, and the social, technological, and institutional changes that have determined it. To understand this global framework, structured around the concepts of long waves and paradigms, is a first step to unveil the structural mechanisms of income distribution, in order to prepare the fundamental questions that must be treated in the empirical analyses of the following chapters.

2.1. Introduction

The notion of evolution is unavoidably linked to change. This is no exception when talking of social evolution or, specifically, when studying economic systems in the long run, in a context of continuous development and growth. The evolution of socioeconomic systems, and the changes to which these are subject to, are somehow related to economic crises, which seem to appear recurrently (Nelson & Winter, 1982). Namely, in the last century, three deep structural[1] crises can be identified: the 1929 crash, the 1973 oil crisis, and the 2008 crisis (C. Freeman, 2008). If some relations could be established between these structural breaks and the evolutionary changes that has taken place along this period (1929-2008), the mechanisms of economic growth and fluctuations could be better understood.

Another key element in understanding the socioeconomic processes of evolution and growth is the way that income is distributed among economic agents. Distribution comes after decisions on production, within a given institutional framework, as the last phase of the economic process, and the most evident social result. In this respect, the continuous increase in inequality could be considered one of the main socioeconomic problems that developed countries have been facing during the last few decades (ILO &

[1] As will be seen later, these crises were a complex mixture of institutional, scientific, economic, and technological changes, resulting in new social structures.

OECD, 2015), and one of the main challenges lying ahead – along with climate change. This challenge was already foretold by Sen (1973), who was a pioneer on denouncing inequality as a malady of contemporary societies.

In the words of another Nobel Prize winner, Angus Deaton (2013), inequality might be a direct consequence of progress. However, this does not mean that inequality is perpetually increasing; the historical results yielded by different regimes of distribution might prove otherwise. This being so, Piketty (2014; 2020) identified a clear change in the trends of income distribution during the past century: inequality decreased after the Great Depression – especially, after WWII -, while it started to increase after the oil crisis of the mid-1970s.

In this chapter, we are analyzing contemporary economic systems to reach a better understanding of the income distribution processes. Inspired by Bunge (1979; 1997), we consider the existence of four interrelated and partially autonomous dimensions: the economic, scientific, institutional, and technological systems. Each one of these systems presents its own characteristics or mechanisms. Their integration forms the social system, with its own properties, some of them emergent and not present in the component sub-systems. In this vision, income distribution would be inherent to the social system and, thus, it is affected by the mechanisms of the four sub-systems. This means that income distribution cannot be studied as a mere economic phenomenon, solely explained by marginal productivities – let us think, namely, about the role of the welfare state. Furthermore, the interactions of these mechanisms crystalize in complex emergent evolutions, which will certainly be non-linear and non-deterministic. We suggest that the social system's evolution takes the shape of long-term fluctuations, which have a non-deterministic character, as these are a result of the complex interrelations of all the components. These long-term fluctuations would differ from business cycles, which would mainly be manifestations of the economic sub-system, whose causes could be traced to the sphere of production. In short, studying social systems as the framework in which income is globally distributed, implies to analyze both non-linear long-run dynamics and the evolution in time of their structural characteristics.

First, regarding non-linear long-term dynamics, we assume that these processes are wave shaped. Our first aim is to describe as an evolutionary economic history the period from the 1930s until the last great structural break, the 2008 crisis. We will take Schumpeter's *Business Cycles* (1939) as an initial inspiration. Nonetheless, we are aware of the

limitations of this approach - as were indicated long ago by Kuznets (1940) -, as, for instance, the need to integrate scientific, institutional, and technological aspects, so we will also incorporate some critical remarks. Bearing this in mind, we will assume the existence of two long waves, separated by the oil crisis, so this structural break coincides with the change in distribution trends. First, we will try to identify the subjacent structure of productive fluctuations to these long waves, to explain the economic component of the social system. This identification will be supported both from empirical and historical perspectives (Tylecote, 1992).

Second, taking also inspiration in the concept of 'techno-economic paradigm' (Dosi, 1982), we are focusing on defining the 'wave paradigms'. Each of the two long waves would have their own structural characteristics or mechanisms, which should be useful to explain the different regimes of distribution in 1930-1975, and 1975-2010. We suggest, following Bunge (1979, 1997), that this paradigm consists of four main aspects: the economy, science, institutions, and technology. First, the economic component of the paradigm will be treated separately from the other three non-economic components. Once all the four components have been studied, we will relate these facets to the evolution of inequality in each of these periods.

To carry out this analysis, the chapter is going to follow this structure: in Section 2, data and methodology are presented. Then, we will start dealing with the economic component of the social system. In Section 3, an empirical analysis is first carried out, in order to identify the number of intermediate length fluctuations that form each of the long waves, applying band-pass filters to the data series. Second, the results obtained here will be complemented by a brief descriptive analysis, giving a historical justification to each one of the fluctuations that had been identified. In Section 4, we address the rest of the components that compose the social system, that is, the mechanisms of the scientific, institutional, and technological contexts. We will describe their characteristics during each period, and their changes. Then, we will link the mechanisms of each wave to the different income distribution regimes that can be identified in the two periods, paying special attention to the effects that those have on the distributive policy. Finally, in Section 5, some conclusions are drawn. It should be remarked that Sections 3 and 4 must be seen as two complementary analyses, describing different facets of the same reality.

2.2. Methodology and data

First, we are going to describe the main methodological questions when addressing our analysis of non-linear dynamics. As we have already mentioned, we follow Schumpeter (1939) in some of his assumptions when treating long and medium-term fluctuations (C. Freeman, 1996). Specifically, we take four-phase cycles: recovery, expansion, recession, and depression – in that order, assuming that these start at the lowest point of the downturn phase, that is, just when the recovery phase is about to initiate. We suggest that the period 1931-2010[2] can be divided into two long waves, which are generated by the interactions of the social system's mechanisms: i) 1931-1975, and ii) 1975-2010. The existence of these two long waves has been widely discussed in the literature, especially after the revival of the long wave debate since the 1980s. Following a similar procedure to Bieshaar & Kleinknecht (1984), we base our *a priori* assumptions concerning the existence and time delimitation of these waves on evidence from previous literature (Grübler & Nowotny, 1990; Metz, 1992). Jarne et al. (2007) also support the existence of a technological boom in the second period. A first approach using Chow (1960) tests also indicates that there are signs of structural breaks in the production series of our sample around 1931, 1975, and 2010, which does not contradict our hypotheses (see Table 2.1 below)[3].

Furthermore, concerning the length of our long waves, it can be perceived that, as we are working on a period of around 80 years in total, our two waves are going to be shorter than that defined by Kondratieff (1935), of around 50 to 60 years, although longer than Kuznets cycles (Solomou, 1988), of around 15 to 25 years.

[2] Note that this period differs slightly from what would be delimited by the two crises, 1929-2008. Our cycles start with the recovery phase, and end when the depression phase does. This being so, and according to data, the recovery from the 1929 crisis would start around 1931, while the lowest point of the downturn after the 2008 crisis would be located around 2010.

[3] Additional tests were carried for other key years, such as 1968 and 1983, not being possible to confirm generalized structural breaks in those years.

Table 2.1. Chow test for checking structural breaks in the production series

Country	**Year**	**F-distribution value**	**p-value (α=0.05)**
USA	1931	193.7760	0.0000
	1975	80.7665	0.0000
	2010	3.0035	0.0308
UK	1975	12.4920	0.0000
	2010	3.2871	0.0214
Spain	1975	7.9202	0.0000
	2010	2.7394	0.0444
Japan	1975	11.3983	0.0000
	2010	5.9711	0.0006
Germany	1975	7.5644	0.0001
	2008 (*)	3.0698	0.0286
Italy	1975	24.9456	0.0000
	2010	4.7909	0.0029
France	1975	75.3313	0.0000
	2010	4.5702	0.0039

At a significance level α=0.05, the null hypothesis that there is no structural break is rejected when p-value<α.

(*) *Nota bene*: For Germany in 2010, the null hypothesis cannot be rejected. Nonetheless, the results are favorable for 2008, and so are presented in this table.

Source: own work

In addition, we suggest that both long waves also present an inner structure of intermediate length fluctuations (7 to 11 years), commonly known as Juglar cycles, which are mainly productive manifestations of the economic system. This hypothesis of shorter cycles nestled under long waves has already been treated in the literature (Berry et al., 1993). As for the endogenous explanation of this economic evolution, we find it difficult to justify technology and investment as the sole determinants of fluctuations (Rosenberg & Frischtak, 1984). The socio-institutional framework certainly plays a role in this respect, along with innovation (Nelson, 2008). Finally, we differ from Schumpeter in the sense that our scheme is not deterministic, as we are studying emergent evolutions, which determine the length of each wave, and the number of subjacent cycles.

Concerning datasets, as we assume that intermediate length fluctuations are related to investment, we are using the following quarterly data series for the empirical identification in Subsection 2.3.1: output growth rates (FRED, 2020a), gross investment

growth rates (ibid., 2020b), and industrial production indexes (ibid., 2020c). Our sample includes United States, Germany, France, Italy, Spain, United Kingdom and Japan, as we believe that these can provide a good representation of developed countries. American quarterly time series for the whole period (1931-2010) are extracted from the FRED database. Data for the rest of the countries comes from two sources: for the period 1931-1975, we use disaggregated quarterly data from the Maddison Project 2018 release (Bolt et al., 2018); meanwhile, from 1975 onwards, the quarterly time series come from the OECD database (OECD, 2020a). Finally, in the descriptive analysis in Subsection 2.3.2, we will focus both on production and prices series (OECD, 2020b) - as there is evidence of long wave patterns also existing in prices (van Ewijk, 1982).

2.3. The dynamics of the economic system from 1929 to 2010

Here, we are separately studying the economic component of the 'wave paradigm'. This Section is structured in two parts: first, we apply filters to investment-related series to obtain the number of intermediate-length fluctuations that form the economic sub-system in each long wave. Then, we delimit their periods, linking these time delimitations to specific historical events. This descriptive analysis will be used as a support and a complement to explain the results obtained concerning cycles.

2.3.1 Applying band-pass filters to extract Juglar cycles

Now, we should study the inner structure of these two long waves, to deal with the economic component of the social system's evolution. Our aim is to prove the existence of intermediate length fluctuations that should last around 7 to 11 years – as were originally defined by Juglar (1862)-, and to establish the number of these fluctuations in each long wave.

For the identification of these fluctuations, we are going to apply Baxter-King filters to several time series in order to extract their cyclical components (Baxter & King, 1999). There, the authors justify the adequacy of this methodology for identifying intermediate length cycles, in comparison with other frequently used methods, as Hodrick-Prescott filters (Hodrick & Prescott, 1997), moving averages or first-difference filters. We adapt their methodology, according to the cycles we are seeking.

Let $BK_k(p, q)$ denote the Baxter-King filter used to detect cycles of a minimum length of p quarters and a maximum length of q quarters. Meanwhile, k refers to the lag at

which the filter's weights are truncated at both tails, when applying a finite moving average. Baxter and King use the Burns and Mitchell (1946) time delimitation ($p = 6$ quarters and $q = 32$ quarters) for shorter business cycles of 1.5 to 8 years. Thus, as we are seeking fluctuations with an average length of 7 to 11 years, we adapt this filter by selecting $p = 28$ and $q = 44$. As for the value of k, we decide to truncate at 24 quarters. Baxter and King already proved that their filter yields optimal results for $k \geq 12$, so they use $k = 12$ because it minimizes the loss of data. However, as we apply this filter to Juglar cycles, which are longer than Burns-Mitchell business cycles, and we can afford to lose data at both tails, we consider that we can raise the value to 24 periods to get smoother series. The specific filter is then $BK_{24}(28{,}44)$.

As we have explained above, Juglar cycles are related to productive causes – and, specifically, to investment fluctuations -, so we focus on studying the following series: Gross National Product growth rates, industrial production indexes, and gross investment growth rates. We consider that if a common cyclical pattern could be determined for all the countries in our sample, it could be used to describe an evolutionary economic scheme in the developed world. Results and comments are presented below.

2.3.1.1. The United States

Figure 2.1 below shows the results of applying the Baxter-King band-pass filter to the United States times series. The left column shows the evolution for the first long wave, while the right column refers to the second long wave. First, we look at the first long wave figures. The valleys show that both total production and industrial production series coincide in that this long wave might be formed of five different subjacent cycles. However, the time periods differ slightly, but these will be refined with a closer study of the data in the historical-institutional analysis that follows. As for the investment series, data is only available from the 1950s, but this information does not contradict the other above. As for the figures on the right, it seems clear that the second long wave is composed by four subjacent cycles. Here, the time periods are consistent between the three series.

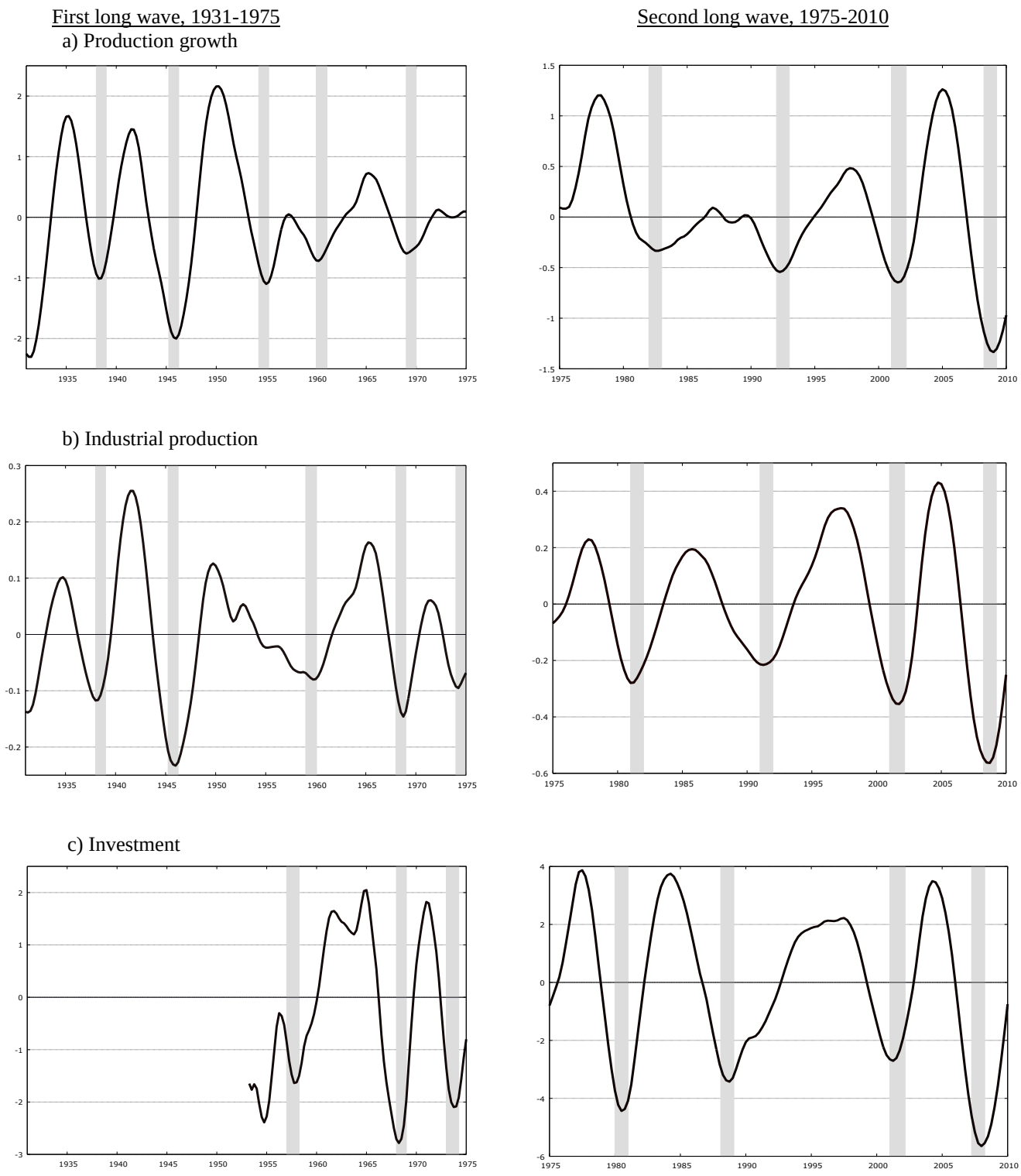
2.3.1.2 Other developed countries

As the isolated case of the United States could be not representative enough on its own, the filter is applied to other developed countries: the United Kingdom, Spain, Japan,

Germany, Italy, and France. It should be checked if the filtered series coincide with those obtained above, to take it as an indication that a general evolutionary scheme might exist. We apply the same filter as above. Figure 2.2 shows the output growth rates results for our first period, while Figures 2.3, 2.4 and 2.5 show the results for each of the series (output growth rates, gross investment growth rates, and industrial production indexes), during the second wave.

As can be seen in the figures presented below, the countries of our sample seem to follow a similar evolutionary pattern. Five subjacent cycles can be identified in our first period, while four subjacent cycles can be detected in the second, similar to that observed in the American case. It can also be underlined another interesting fact: the case of Spain at the beginning of the second wave might appear to not follow the same pattern as the other countries. In fact, this period is clearly anomalous, as 1975 marked the end of Franco's dictatorship, with the following years being a period of institutional adjustment to democracy. Hence, we can insist again in the fact that our scheme of cycles is not deterministic, because the socio-institutional contexts matter and can influence the evolutionary trajectories that are imposed by technology.

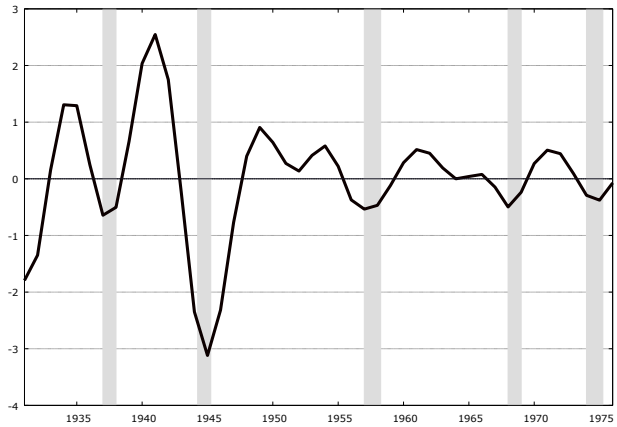
Figure 2.1. Filtered series for the United States.



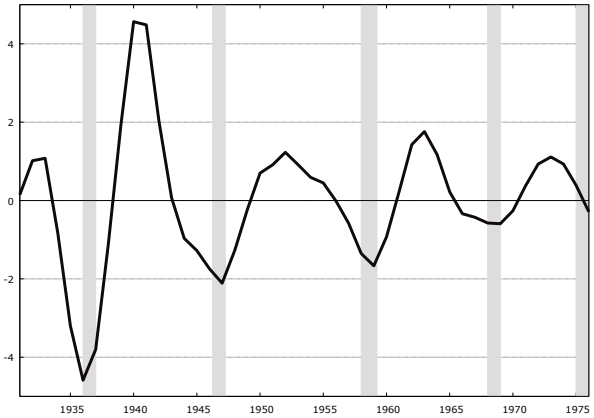
Source: own work based on Federal Reserve Economic Data (2020a, 2020b, 2020c)

Figure 2.2. Filtered output growth rates, first long wave

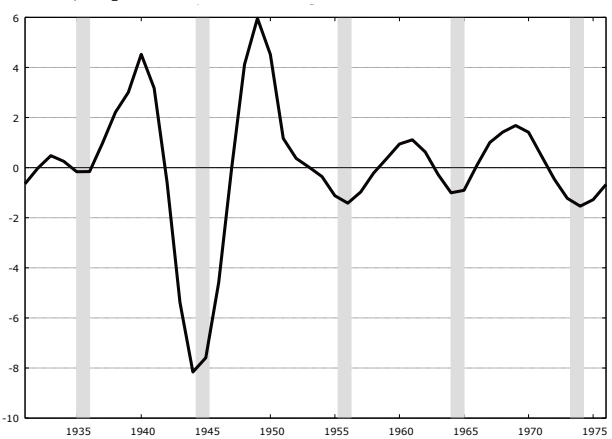
a) United Kingdom



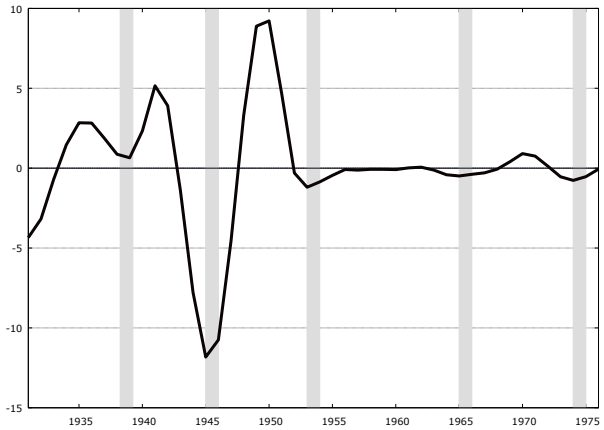
b) Spain



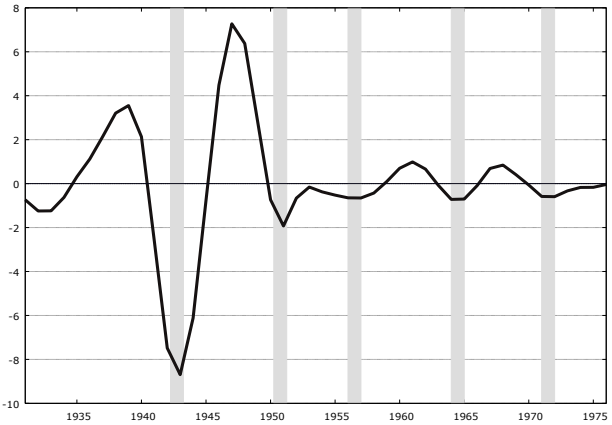
c) Japan



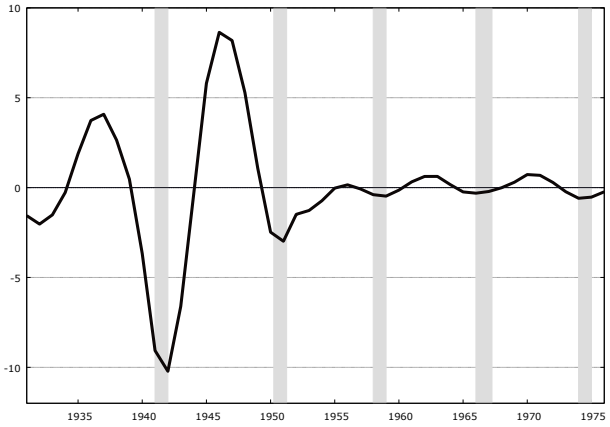
d) Germany



e) Italy



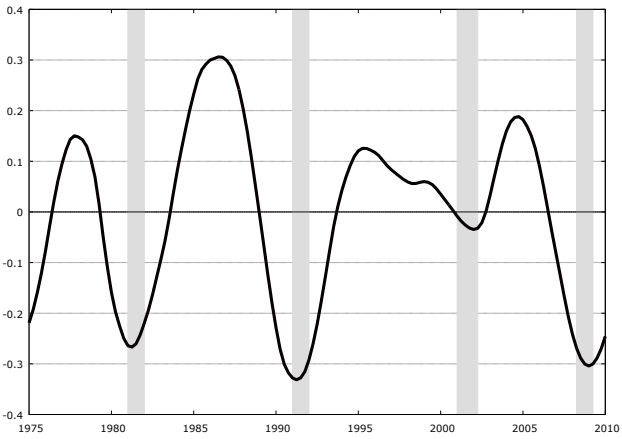
f) France



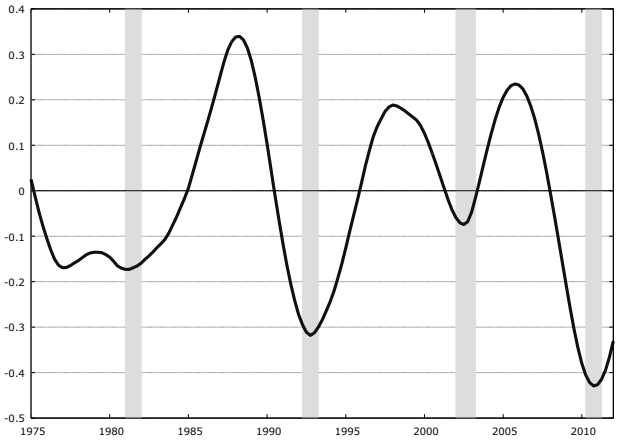
Source: own work based on Maddison Project Database 2018 Release (Bolt et al., 2018)

Figure 2.3. Filtered output growth rates, second long wave

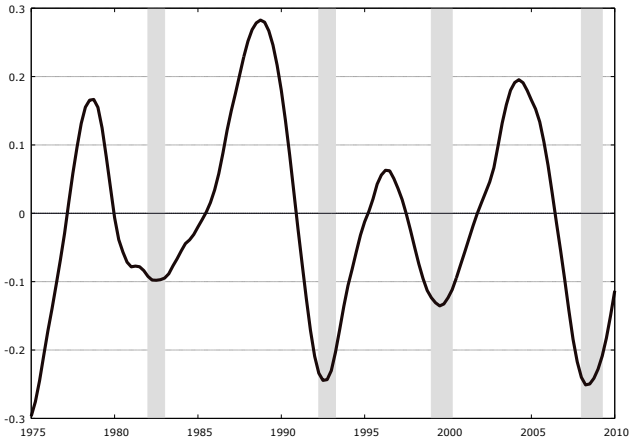
a) United Kingdom



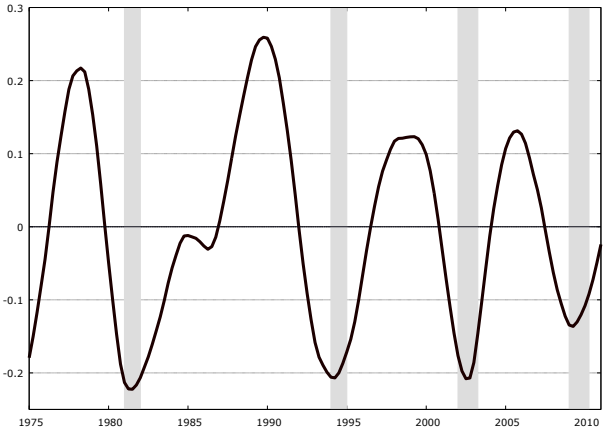
b) Spain



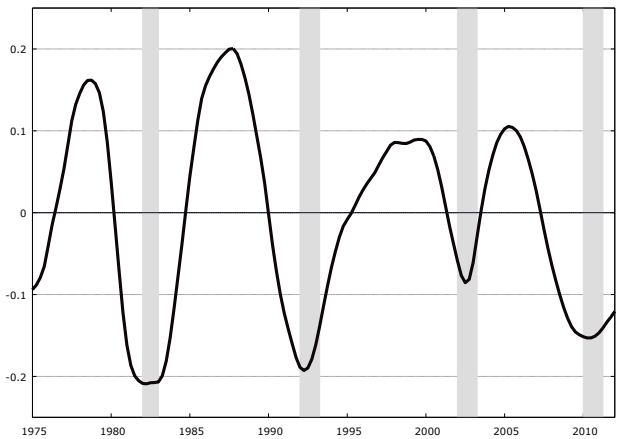
c) Japan



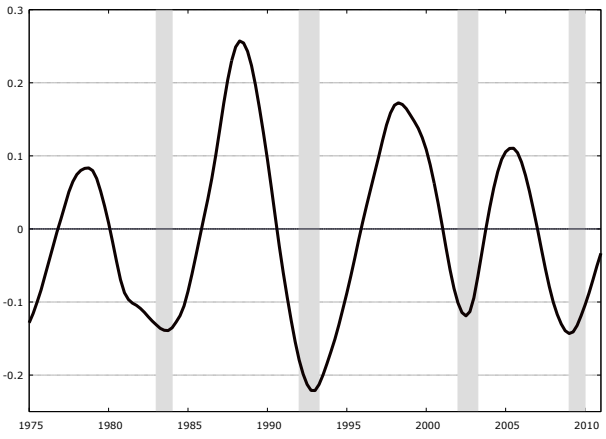
d) Germany



e) Italy



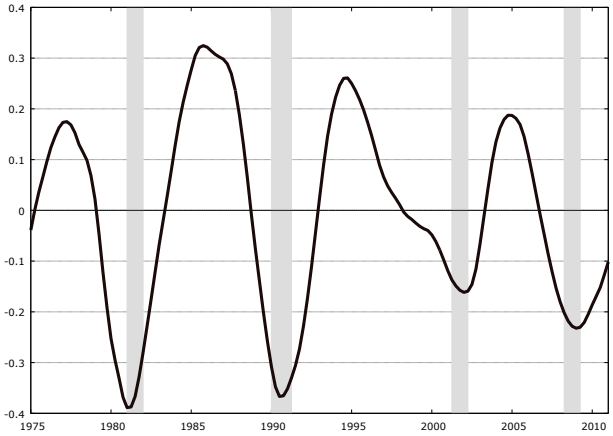
f) France



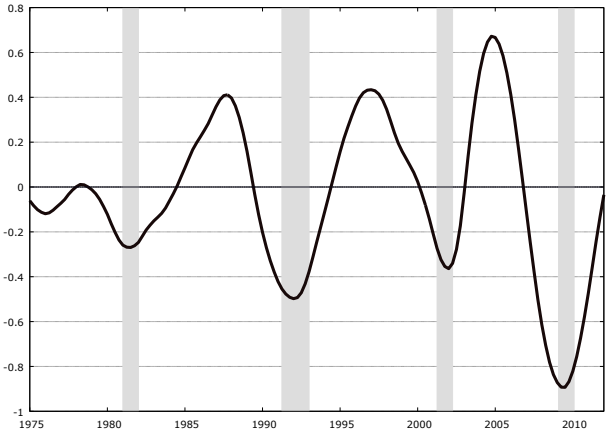
Source: own work based on OECD (2020a) data

Figure 2.4. Filtered industrial production, second long wave

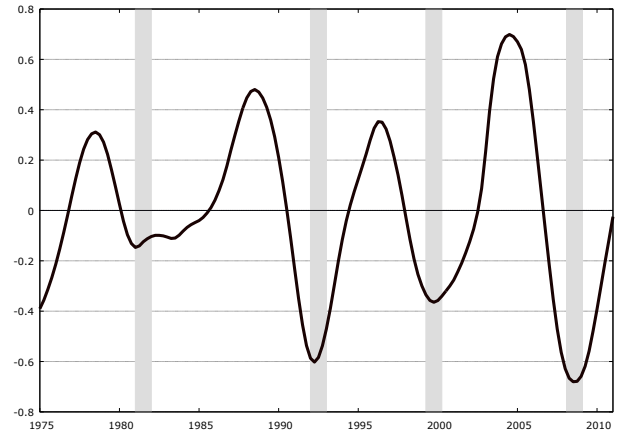
a) United Kingdom



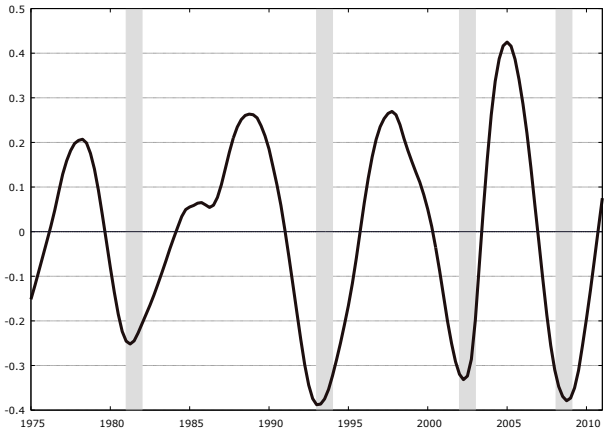
b) Spain



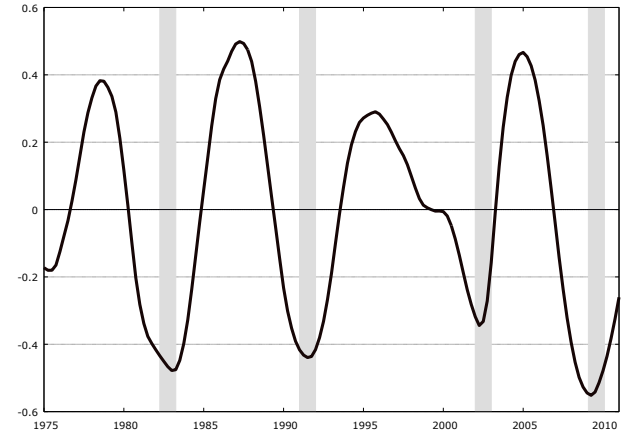
c) Japan



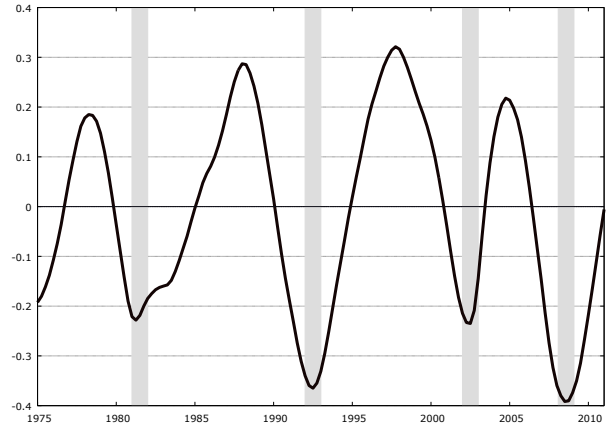
d) Germany



e) Italy



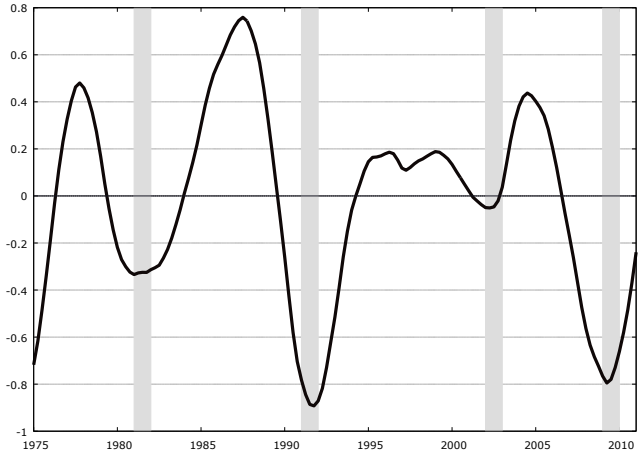
f) France



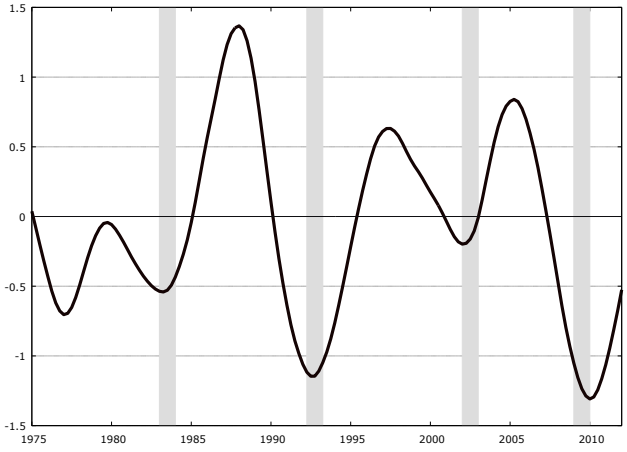
Source: own work based on OECD (2020a) data

Figure 2.5. Filtered investment growth rates, second long wave

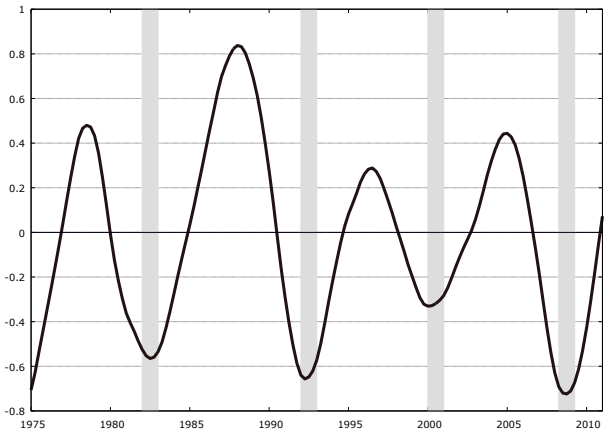
a) United Kingdom



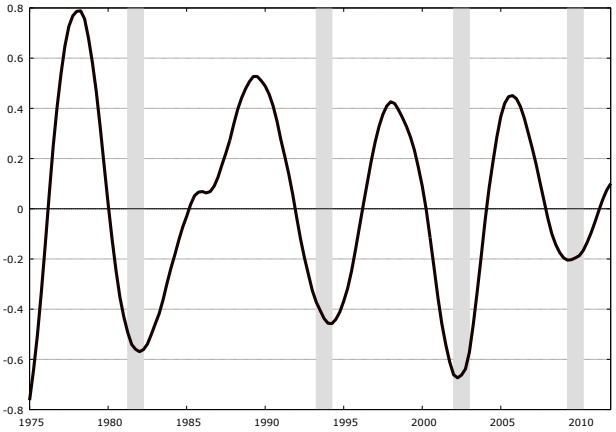
b) Spain



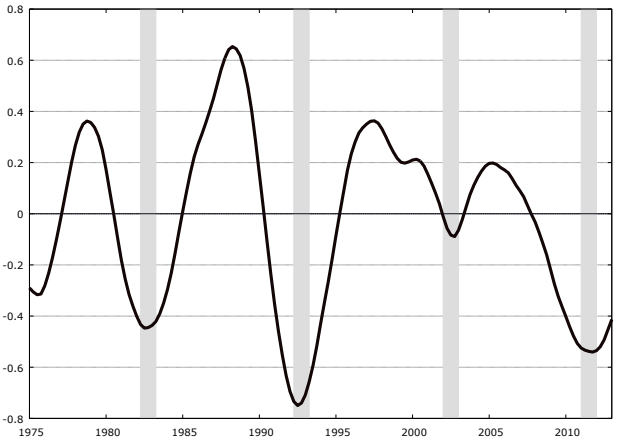
c) Japan



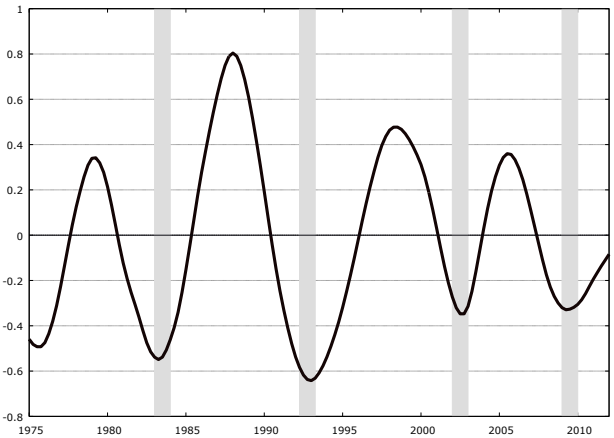
d) Germany



e) Italy



f) France



Source: own work based on OECD (2020a) data

The fact of the post-war evolutions in Germany and France being very much alike also deserves attention. This could be related to the fact that these were two of the countries more affected by war destruction. Our hypothesis is that accounting for the destruction of physical capital, these countries started to accumulate capital at much lower levels than, for example, Spain or the United Kingdom. As a result, the process of accumulation should be more stable, and economic fluctuations would be narrower.

For now, we can hypothesize that we are working with a first long wave, going from the Great Depression to the oil crisis, that is composed by five cycles; and with a second long wave that goes from the oil crisis to the Great Recession, and is formed of four cycles. As a final remark, following our scheme, a third long wave could have started around 2010, with a first intermediate-length cycle ending around 2020. The loss of data on the right tail as a result of taking moving averages when applying the filter prevents us from seeing its complete shape, but it could be inferred that it would be possible to obtain it with additional data.

2.3.2. Long waves and intermediate cycles: a brief descriptive analysis

We now proceed to a brief description of the waves' profiles, using the information available in Figures 1-5. We try to fit historical events into those years, to complement the explanation of the economic system's evolution. We will also pay attention to the data contained in the unfiltered production and prices series (Figures A2.1-A2.14 in Annex). Here, we are focusing on the United States, as it is the economic leader during the period of study, and we can consider that it is going to determine a big part of the economic evolution of developed countries.

2.3.2.1 Intermediate-length cycles, 1931-1975

(1) *1931-1939.* We start our analysis after the American Crash of 1929, a long wave crisis that ended the previous long wave. We can consider that the recovery phase of this first long wave started around 1931 and, thus, so did the first cycle. The hard economic recovery accelerated in 1933, with the expansionary fiscal policies from Roosevelt's New Deal, which is a key element of this cycle. We can consider that this first cycle ended around September 1939, with the German invasion of Poland, the beginning of the WWII, and the social crisis that followed. In contrast with Schumpeter, we cannot treat wars as these were exogenous events.

(2) *1939-1947*. This cycle is associated with the wave's expansion phase, which consolidated through the WWII. The end of the hostilities in May 1945 came with a brief crisis. The war constituted a mechanism for investment allocation, driving resources and innovation towards military expenditure, fostering growth.

(3) *1947-1958*. Post-war growth restarted in 1947, when the Paris Peace Treaties were signed. Europe also started post-war recovery when the Marshall Plan was put in motion. American growth rates were higher than 10% during the first years of the 1950s. Although those rates were negative during the first three quarters of 1954, stable and positive rates appeared in 1955, lasting until the last quarter of 1958, which denotes the end of this third cycle. Again, the ending of the Korean War in 1953 could have hampered investment; it is also noteworthy that growth was reenacted in 1955, when another conflict started, namely, the Vietnam War. A crisis in the automotive industry, a key industry in this wave, also took place. In fact, the American automobile production decreased roughly a 33% between 1957 and 1958 (Haig, 2003). This could be evidence of a change in the consumption patterns that promoted recovery and expansion after WWII, and a step towards slower growth rates, which are characteristic of recession phases.

(4) *1958-1968*. This cycle is located in the long wave's recession phase, where growth is expected to be more stable and lower, while inflation started to accelerate. During this period, there are a few facts around 1968 that can be taken as signals of both the development of the wave's recession phase and an upcoming crisis. On the one hand, the American space race against the USSR, which was a great technological stimulus during this fourth cycle, was reaching its end, with the moon landing in July 1969. On the other hand, a very important social crisis was taking place at that moment in different parts of the world: in America, the social mobilizations in Berkeley, associated with the Vietnam War protests and Counterculture; and in Europe, the French May and the Prague Spring events.

(5) *1968-1975*. This period is characterized by two facts. On the one hand, the appearance of stagflation with high inflation rates, which reveals that strong structural changes were taking place in developed economies. On the other, the harsh oil crisis. Following our scheme, we should have arrived at the structural crisis that ended the first long wave.

To sum up, we have seen that the previously identified cycles for the period 1931-1975 appear to be consistent with the descriptive analysis. Bearing this in mind, we have identified a recovery phase during 1931-1939, an expansion phase from 1939 to 1947, a turning point around 1955, a recession phase during 1958-1968, and a depression phase in 1968-1975 (see Table 2.1).

2.3.2.2 Intermediate-length cycles, 1975-2010

We now proceed to replicate our previous analysis for the second long wave.

(1) *1975-1983*. We start from 1975, when the recovery phase of the new long wave probably started. Although production recovered early, inflation rates were still high at that moment. Related to the need of controlled inflation, some measures were set. Namely, the Federal Reserve's restrictive monetary policy was successful in achieving a decrease in prices: towards 1976, American inflation was lower than 6%, for the first time since 1973. Maybe because of this restrictive policy, the United States growth rates were negative during 1982, towards the end of this first cycle.

(2) *1983-1992*. In this period, the American economy soon started to show stable growth rates of output and prices, while European countries struggled with inflation until 1986, when stable rates of around 2-3% appeared. After some years of growth, negative rates appeared around the last quarter of 1990 in the UK, during the first three quarters of 1991 in the United States, and in the rest of the countries of the sample from the last quarter of 1992 to the last quarter of 1993. The end of this second cycle would correspond, in our opinion, to the turning point of the long wave, the downturn where the long wave's recession phase starts. Several economic and political causes could have contributed to the start of the recession. First, the effects of the restrictive monetary policies that were applied in the United States and Europe to achieve inflation control throughout the 1980s, that were being set as foundations for the Maastricht Treaty and the European Monetary Union. Second, the Gulf War and the invasion of Iraq in 1990, creating a new conflict in OPEC territory. Third, the Savings & Loan (S&L) institutions crisis, that started in America, related to the deregulation of the banking sector that started to take place during the previous decade.

(3) *1992 – 2002*. Here, we enter a phase of stable and low growth of production and prices. As we mentioned earlier, this is a characteristic of the downswing phases, which might make it difficult to anticipate an economic bust. With the coming of the new

century, signs of stagnation and a new crisis reappeared. This crisis, which has received the name of 'bubble.com', clearly shows the influx of technology on the fluctuations of investment, which shape this intermediate-length cycles. We cannot ignore the 9/11 terrorist attacks and the beginning of the Afghanistan War in 2001 as additional explicative causes.

(4) *2002 – 2010*: Towards the middle of 2002, stable economic growth returned until it was interrupted in every part of the developed world, in 2008. Usually, Lehman Brother's bankruptcy in September 2008 has been used as the event to explain the beginning of the Great Recession. Nevertheless, we believe that this cannot be taken as the main explicative cause of the crisis. It is our belief that long wave crises are not intrinsically financial, as those have very important effects over production, employment and society in general – take as example the case of Spain, where unemployment rates reached values higher than 25% during the hardest years of the crisis. In 2010, negative growth disappeared, marking the end of the depression phase and, thus, of this long wave.

To sum up, we have seen the evolutionary scheme of the second long wave. We have identified a recovery phase from 1975 to 1983, an expansion phase from 1983 to 1992, the end of the upswing and the beginning of a recession phase that lasted until 2002 and, finally, a depression phase that ended in 2010 with the Great Recession (see Table 2.1). According to our hypotheses, a new long wave could have started around 2010, and so we might be able to determine a first cycle ending around 2020 that would be part of the recovery phase of a new long wave. The current crisis derived from the COVID-19 pandemics poses a difficult question: is the period 2010-2020 the first cycle of the new long wave, or the final cycle of the second wave? Undoubtedly, this topic would require further research and is an open line for future research.

2.4. Describing the components of the 'wave paradigm' and their changes through time

We hypothesize that each long wave has its own scientific, institutional, and technological characteristics – or mechanisms - that, in conjunction with the economic sub-system with its own mechanism, determine the evolution of the social system. These 'mechanisms' are interrelated and form a paradigm, which could be defined as 'a

privileged level of analysis of the interactions and co-evolutionary dynamics among [these four] sub-domains […]' (C. Freeman, 2008). In fact, this concept could be defined in a similar way as a 'National System of Innovation' (List, 1909), with the inclusion of a socio-institutional context. In this section, we intend to describe the characteristics of each of these sub-domains and we underline the differences that arise from one wave to another. We will then link these characteristics to the evolution of income distribution during these periods.

2.4.1 Scientific context

Following T.S. Kuhn[4] (1962), science – Economics, in our particular case - is structured around 'paradigms' that evolve and change through time in a succession of scientific revolutions and synthesis. '[The] transformations of these paradigms […] are scientific revolutions, and the successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science' (ibid.: 12). Bearing this in mind, we move to the description of the two different scientific contexts that arose when each of the long waves described above started.

2.4.1.1 First long wave, 1931-1975

We consider the publication of Keynes' *General Theory of Employment, Interest and Money* (1936) as a milestone in Economics during this cycle. This book was a reaction against the previous scientific paradigm, that is, the Marginalist Revolution and supply Economics. Confronting Say's law, according to which economic crisis are always a result of insufficient production, Keynes identified the Great Depression as an under-consumption crisis, provoked by a decrease in investment and, consequently, in aggregate demand. Hence, an increase in public expenditure could increase demand and be a solution to the crisis. In addition to this theoretical framework, the success of Roosevelt's New Deal of 1933, a package of expansionary fiscal measures, contributed to the formation of a new academic vision with demand in the center of its analysis. Another example of expansionary fiscal policies during this period is the Marshall Plan, which was American funding for the reconstruction of post-war Europe.

During the late 1930s and the 1940s, a scientific revolution took place in Economics. Keynesian theories were adapted by neoclassical economists, which derived in the

[4] Besides Kuhn, we can take other examples of competitive conceptions of scientific development, as a critique to the cumulative notion and logic positivism: namely, Lakatos (1978) and Feyerabend (1975).

formation of a new paradigm: the 'neoclassical synthesis' (Roncaglia, 2005). We find here, on the one hand, neoclassical microeconomics based on the marginalist concept of utility and an atomistic view of individual rational optimization, where Arrow and Debreu (1954) general equilibrium model played an important role. On the other hand, we find Keynesian macroeconomics, that is to say, disequilibrium models for the explanation of short-term unemployment with the inclusion of price and wage rigidities. To this extent, Hicks' (1937) simplification of Keynes' scheme, the IS-LM simultaneous equilibrium model, constituted a pioneer work.

We cannot end this discussion without talking about the Phillips curve, which is important in the explanation of the exhaustion of the paradigm and its subsequent change. The Phillips curve was an instrument used during the synthesis years for predicting inflation. This model showed an inverse relation between inflation and unemployment variation, with was invalidated with the coming of stagflation during the 1970s crisis. Indeed, stagflation created suspicion around the Keynesian-synthesis theories and as will be explained later, the monetarist revolution led by Friedman revealed to be an attractive academic *corpus* in the hands of neo-liberal politicians.

Here, we have seen the evolution of this first wave's scientific mechanisms: first, we see a revolution, a synthesis, and the formation of a new paradigm; later, a new phase of intern coherence with the paradigm's basic axioms; then, the opposition from heterodox scientists arises, until a new revolution takes place, and a paradigm change is forced. This process constitutes the mechanism of scientific progress, as the succession of new proposals and synthesis contribute to fortify the hard core of scientific knowledge.

2.4.1.2 Second long wave, 1975-2010

Towards the mid-1970s, inflation was the new economic foe. Phelps' (1968) and Friedman's (1968) monetarist critiques to the Phillips curve proved to be more adequate for the existing economic conditions: the Phillips curve would only be valid in the short run because workers suffer from money illusion; but, in the long run, workers adapt their expectations about the price level, and there exists a trend towards a natural rate of unemployment that is compatible with any price level and, hence, with a stable inflation rate – the 'non-accelerating inflation rate of unemployment' (NAIRU) [5].

[5] The monetarist critique of the Phillips curve is a clear example that economic theories can be falsified - in a Popperian sense -, despite its social character. This was important for the vindication of Economics as a science.

The setting of inflation objectives through monetary policy and interest-rate manipulation gained importance during the following decades. In turn, fiscal policy, so important during the previous wave, fell into a second place, as public expenditure effects on aggregate demand were supposed to be anticipated by the rational economic agents, so, in the end, it would only contribute to generate inflation. Rational expectations (Muth, 1961)[6], thus, were revealed to be an important instrument to the monetarist critique of expansionary fiscal policies.

Another theoretical characteristic of this orthodox paradigm is that of capital market efficiency (Malkiel and Fama 1970; Fama 1991). According to this, perfect and complete information prevails in financial markets, so these would be efficient in the sense that assets market values would coincide with their real values in every moment. Then, the existence of speculation and bubbles would be denied. This theory would also be used to justify financial deregulation and liberalization.

Public Choice theories constitute another important feature of this intellectual paradigm (Buchanan & Tullock, 1962). According to this, a paradox would arise when the government intervenes to solve a market failure. As it turns out, these interventions could generate, in turn, government failures. These theories contributed, then, to increase the bad conception of public policies that arose during the downswing phase of the previous wave. The Hobbesian *Leviathan* was reviving, and its most relevant instrument was the Laffer curve. This indicates that, after reaching an optimal point of taxation, there is an inverse relation between the marginal tax rate and tax revenue, as rich people would evade taxes to avoid paying more. Tax cuts for rich people could increase equality, as they would spend more, and money would 'trickle down' and benefit low-income people.

As it usually happens, for economic ideas to become a new scientific paradigm, they need to be translated into policy. In the context of the Cold War, monetarist postulations were attractive for the rising neoliberal governments around the world – mainly in the USA and the UK, but also in Europe (German Federal Republic); in Asia (Japan, the Asiatic tigers, and Russia after the USSR was dismantled); in South America (Chile); and even in some developing countries that had to follow the 'Washington Consensus' principles in order to obtain conditioned aid from the IMF. Soon, the control of inflation

[6] For a critique of rationality in uncertain conditions, see Tversky and Kahneman (1974).

turned to be the main objective of economic policy, and during the 1990s the Taylor rule started to be implemented. Besides this, neoliberal agenda also orientated towards the restoration of class power and the social structure that existed before WWII, which helped to revert the trends in income distribution, with inequality sharply increasing from the 1980s (Harvey, 2005).

2.4.2. Institutional context

From an evolutionary perspective, following Veblen (1899), or other contemporary authors as Nelson (2011), we intend to analyze the institutional characteristics of each wave and cumulative institutional change as a key feature of cycles' structure. According to North (2005), institutions are a reflection of society's ideas and beliefs, so the changes that take place in the scientific context might influence the directions of institutional changes, and vice versa. We focus on three institutional aspects: i) monetary and financial system; ii) the role of government; and iii) labor market.

2.4.2.1 First long wave, 1931-1975

After WWII, post-war reconstruction was a global concern in many aspects, the design of a new international monetary system being one of them. The gold standard had been abandoned by the United States in 1933 due to the restrictions that limited gold reserves imposed over the expansion of money supply and, thus, over real exchanges. International conversations to decide the new monetary order that had to substitute the gold standard ended in 1944 at the Bretton Woods Conference. The new system was based mainly in the universal convertibility of currencies into dollars, and the convertibility of dollars into gold. Hence, this ended being a new version of the gold standard. This contributed to the concentration of financial power in Wall Street, as dollars were the central currency of the system, and their value was backed by gold. In addition, a fixed exchange-rate system was set, with the dollar as reserve currency.

This was also a period of financial regulation. The Glass-Steagall Act of 1933 was approved in order to separate commercial banking from investment banking, to prevent the former to invest in securities and to avoid the unleashing of another speculative bubble. Another important law in this direction was the Bank Holding Act of 1956 that regulated financial holdings' activities and tried to reduce market power concentration. Basically, it tried to avoid that holdings could be integrated by different companies dedicated to commercial activities and investment activities at the same time. The efforts

towards achieving this separation between different banking activities by regulating the financial system constitute a characteristic feature of this wave.

Regarding the public sector, its expansion during this long wave constitutes an important institutional feature (Briggs, 1961). Europe confronted post-war reconstruction around the figure of the welfare state: on the one hand, Germany was the first country to implement a mandatory social insurance system towards the end of the 19th century that inspired modern Social Security; on the other hand, UK's National Health Insurance Act of 1911 introduced the novelty of two contributory schemes for sickness and unemployment insurance coverage. The latter was also the first country to have a universal education system (Butler Act of 1944). The welfare state, then, spread from these two countries through the rest of the Old Continent, and started its development after WWII, based around three principles: 1) Unemployment, sickness and disability insurance; 2) public pension funds for retired workers; 3) benefits in kind related mainly to health and education. In short, the role of governments increased during this period, shaped either as a strong welfare state in Europe, a weaker welfare state biased towards cash transfers over in-kind benefits in the United States, or even as central planning to promote forced industrialization and development in the USSR.

Concerning labor relations, the period that followed the Great Depression was based on the dialogue between trade unions and employers. In America, the Wagner Act of 1935 pursued the enforcement of trade union's bargaining power to balance negotiation. After WWII, the position of trade unions improved even more, as their role in the mobilization of workers during the war was important. This period was also characterized by high growth rates of real wages and labor productivity, and low unemployment (R. Freeman et al., 1980). Labor supply experimented important structural changes: first, women's incorporation to labor market consolidated during WWII and was of great importance, as men were in the battlefront and factories needed to continue their activities; second, labor supply rejuvenated, as the expansion of the welfare state and public pensions incentivized workers to retire earlier - and wages are less expected to improve at the end of professional careers -; third, the qualification of labor supply increased, corresponding to a change in labor demand, which started to focus more in qualified job positions. Finally, wage composition also experienced some changes, as many developed countries started to include fringe benefits like pension plans, paid leaves, health insurances and security social provisions. This period, thus, was characterized by the cooperation of

trade unions and employers, and a general improvement of worker's conditions. Some of these trends will start to change towards 1975, as we will see shortly.

2.4.2.2 Second long wave, 1975-2010

Through the mid-1970s, clear changes took place in the monetary context. At the beginning of this decade, in anticipation of the end of the Vietnam War, President Nixon suspended gold convertibility, freeing the dollar from the 'golden straitjacket'. This put an end to the Bretton Woods system. Exchange rates started to float, and commodity money evolved into fiat money. Furthermore, fiat money consisted mainly of bank money, whose increasing importance was favored by financial innovation – namely, credit cards, ATMs, securities, etc. This change in the definition of money was an opportunity for the development of the financial system. With the rising importance of bank money, a demand for financial deregulation arose, because regulation was constraining its activities[7].

In America, the Garn-St. Germain Act of 1982, which authorized the expansion of S&L activities, was a first step into breaking the separation between commercial and investment banking. As a result of the approval of the Gramm-Leach-Bliley Act of 1999 the Glass-Steagall Act was repealed, which eliminated the main obstacle in the way to liberalization. Finally, the Commodity Futures Modernization Act of 2000 revoked regulation concerning financial derivatives. The rationale behind this wave of deregulation was that ITCs would help to make risk monitoring easier and more efficient, so that regulation would apparently be unnecessary. Another justification for deregulation was the urge for globalization. The liberalization of capital markets caused a huge intensification in international capital movements. Wall Street continued to be the global financial center and dollars still were the international currency. The massive reception of international financial inflows allows the US to finance its huge commercial and fiscal deficits, important features of its growth model.

The rise of neoliberalism through the 1980s caused changes in the role of governments. Although a true retrenchment cannot be perceived, the expansion of the public sector was stopped. We can take as examples some measures that followed this direction. In

[7] '[I]n the four decades following the Great Depression, few changes were made to the regulatory framework. However, in the next three decades, technological advances, as well as shifts in ideology and political power, would all help to transform the system of financial regulation in America' (Sherman, 2009).

the UK, some privatizations took place as was the case of the public council housing. Here, expenditure retrenchment was focused on public pensions, whose indexation changed in order to promote private pension funds. Finally, a regressive poll tax substituting local property taxes was implemented in the late 1980s, seeking to reduce local administration revenues and constrain their expenditure. In the United States, some measures that affected low-income groups were approved, as the cutbacks in the Aid to Families with Dependent Children program and in unemployment insurance. Nonetheless, Reagan's measures to dismantle Medicare and Medicaid did not passed.

Those two countries are paradigmatic cases of liberalism, but to show that these changes were general, we can see the examples of two countries of social democratic tradition (Pierson, 1996). In the German Federal Republic, some fiscal adjustments took place in anticipation of the growth of population that took place after the unification, and some cutbacks were applied to the public pensions system in 1989. It might be possible that this conception of public spending was influenced by the German phobia to inflation ever since the inter-war episode. Our other example is Sweden, where the neoliberal backlash of the 1990s also affected the public pensions system, and some measures concerning public employment were approved. Concluding, a clear decreasing trend since the 1990s can be appreciated in global public spending for the four highlighted countries (OECD, 2020c). In short, the evidence seems to point that the European welfare state was, to some extent, being privatized.

Concerning the labor market, the importance of trade unions decreased. Indeed, American trade unions may have lost importance because of product market liberalization and the increase in competence, as trade unions find it harder to organize a higher number of workers in a higher number of companies (Peoples, 1998). However, American trade unions never were that important to begin with. Nevertheless, in Europe, where trade unions have a greater role, a similar decrease in trade union density has taken place through these years in practically every country, according to OECD data. Trade union coverage, though, is still high in several countries as Belgium, Norway, Denmark, Finland and Sweden.

Another important change in comparison with the previous wave, is the stagnation of real wages and the reversion of distribution trends. Indeed, labor shares have been decreasing in the G20 countries since the 1980s, even though productivity has been increasing (ILO and OECD, 2015). Although the less relevance of trade unions could be

part of the explanation, this fact can be better explained by the new wave of globalization that had been taking place during this period. As a result of higher competence at a global level and the irruption of developing countries, developed countries need to be more competitive. If this cannot be achieved by productivity increases, this must be done by reducing labor costs in order to increase profit margins. In short, the changes in income distribution along the two long waves and the identification of cyclical patterns leave us with an interesting topic for further research.

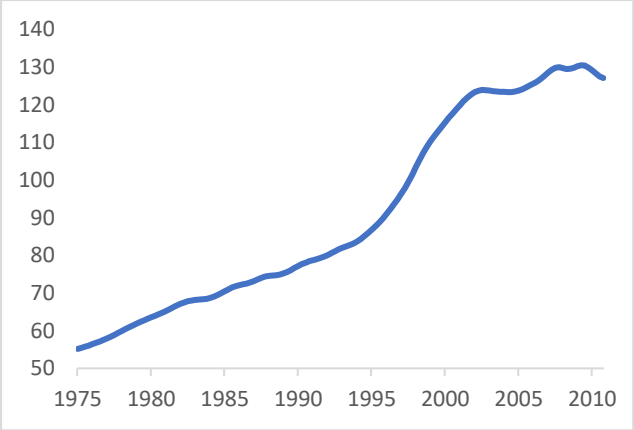
2.4.3. Technological context

An evolutionary conception of technical progress implies the assumption of a hard core of technologies that cluster in time and develop through a life cycle that ends in an exhaustion point; when this point is reached, this set of technologies would be progressively substituted by a new wave of innovations, forming a new technological paradigm (Dosi, 1984). For this to happen, a change in institutions might be needed to accommodate technological change.

Figure 2.6 below provides a representation of this technological evolution for the second wave, which can be considered to have the shape of a logistic curve (Griliches 1957; Sanchez-Choliz et al. 2008). Using USA global industrial capacity index (FRED, 2020d) as an indicator for technological change, we can draw an 'S-shape' or sigmoidal curve, where we can identify a technological leap during the recession phase (towards the late 1990s), followed by signs of exhaustion at the end of the cycle, during the depression phase. This graph can be used to depict the process of innovation inside our evolutionary scheme.

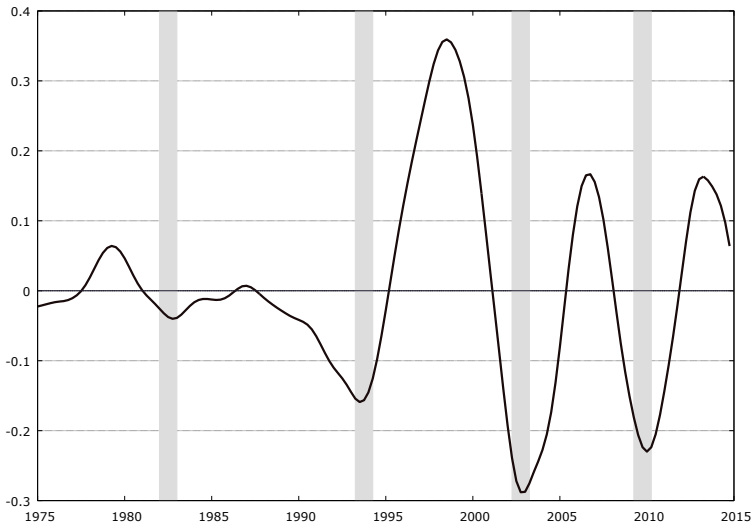
The industrial capacity index could then be taken as a useful tool for cycles research. This assertion can be strengthened by applying to this series the same filters as we did in Section 3. Figure 2.7 below shows the American index filtered for the second long wave. It can be tested that the index behaves as expected, providing further confirmation for the delimitation of four Juglar cycles. Taken jointly with Figure 2.6, it can also be perceived how volatility increases after the technological leap takes place, around the Kondratieff crisis phase, which could be taken as a sign of an upcoming economic bust.

Figure 2.6. USA capacity index, 1975-2010



Source: own work based on Jarne, Sánchez Chóliz, and Fatas-Villafranca (2007), using Federal Reserve Economic Data (FRED, 2020d)

Figure 2.7. Filtered Total capacity index, USA, 1975-2015



Source: own work based on Federal Reserve Economic Data (FRED, 2020d)

2..4.3.1. First Long Wave, 1931-1975

During the first decades of the twentieth century, a key technological change took place in the automobile industry: Fordism. This process innovation put in motion the mass production of cars. These ceased to be luxury goods, as more people began to have access to cheaper models, as a result of production costs savings. Mass production soon had pervasive effects over the economy and spread over other sectors, as the food industry and durable consumption goods – namely, television and domestic appliances. The availability of new products at low costs caused another change in demand patterns:

namely, mass consumption. This was partly allowed by the expansionary fiscal policies that were applied for the promotion of economic recovery from the Great Depression and WWII. These favored low and middle-income groups, which resulted in the consolidation of a consumerist middle class, which was a key process in determining this long wave's growth pattern.

It is also clear that consumption patterns experimented huge changes from the start of our period. As we have commented above, mass consumption patterns were especially important in the durable consumption goods sectors. The purchase of these goods had a component of achieving a certain standard of living. In developed post-war societies, advertising played an important role in promoting this lifestyle – which was ultimately possible due to the spread of television, radio and mass media in general. Nonetheless, mass consumption was not only present in durable consumption. Another important change took place in eating habits, thanks to the development of industrial livestock production, which cheapened the prices of meat. This constituted a great improvement in nourishment and contributed to raise the standards of living from a non-sumptuary perspective.

Another important change that contributed to rising life standards, was the discovery of penicillin by Fleming in 1928, which later would result in the commercialization of antibiotics. These soon experienced a huge social diffusion and were very important in the consolidation of a healthier consumerist class. Medicine can also be considered to start developing a more technological focus from here onwards – as will be seen shortly in the next long wave.

The development of aeronautics was also a key feature of the period as it served several purposes. On the one hand, airplanes enabled a more efficient way of transporting passengers and commodities. On the other hand, the aircraft industry played an important role on military R&D. In this respect, the space race that confronted the US and the USSR in the midst of the Cold War was a key event, which ended with the first landing on the moon in 1969, during the crisis phase of the long wave – and, thus, what can be taken as an exhaustion point of this kind of technologies. Thereafter, the aeronautic industry experienced important changes: the appearance of Airbus in 1970 broke the American monopoly and opened the industry to a higher level of competition; bigger planes were being developed, which would result in the birth of low-cost aviation

in three decades; and, finally, rockets, satellites, and aerospace in general will gain importance.

Concerning energy, oil substituted electricity as the main productive input. Cracking processes – namely, thermal cracking and its substitute, catalytic cracking, implemented in 1937 -, made oil production easier. Also, the development of the automobile and aeronautic industries created a higher demand for oil as fuel for combustion engines, displacing coal. Related to this is the development of the petrochemical industry during the 1930s, and of organic chemistry and synthetic materials, which can be considered key inputs during this period.

2.4.3.2. Second Long Wave, 1975-2010

Here, the technological paradigm was based mainly on information and communications technologies (ICTs). Concerning information, the main innovation were computers. Its intellectual base can be attributed to Turing's (1937), Max Newman's (1948) and von Neumann's (Goldstine & von Neumann, 1948) contributions in their works with algorithms and computers' design. The invention of integrated circuits in the 1950s, IBM's punched cards in the 1960s, and Intel's microprocessor in 1972, were all important milestones. From here onwards, computers entered their maturity phase.

As it happened in the previous wave with automobiles, mass-production of computers was a key event. The first personal computer was launched by Commodore in the late 1970s; then, computers ceased to be used exclusively for scientific purposes. Furthermore, the space race and the technological battle against the USSR was important in the development of an important radical innovation, the Internet. In this context, the US department of defense launched the Advanced Research Projects Agency, which developed the first interconnection web for federal computers, ARPAnet, towards 1967. This was the immediate antecedent of the Internet, whose expansion ended in the creation of the World Wide Web by Tim Berners-Lee in 1991, which allowed the interconnection of personal computers and the exchange of information at a global level.

With respect to telecommunications, the key invention was the mobile phone. In 1973, Motorola developed the first completely portable telephone. From here onwards, mobile phones have been experimenting rapid incremental innovations, from first generation analogic mobiles to fourth generation phones - developed at the end of the period-, which allow the use of data to establish Internet connection everywhere. Furthermore, the

development of computers and telecommunications might indicate another change in consumption patterns, now biased towards more leisure-oriented purposes. Undoubtedly, the analysis of the evolution of consumption patterns constitutes another interesting further line of research, especially in this case, because it implied a change of focus from industrial to service goods.

Concerning energy, the oil crisis made developed countries re-think their energetic mix to reduce their dependence to crude. During this period, the initial development of renewable energy sources was important. Despite this, these sources have not reached their maturity phase, except for maybe wind energy, and they would be more a feature of the next wave. However, the change in the perception of energy that started to take place is important enough to be commented: along this wave, especially towards its end, costs have decreased, and capacity and installations have increased notably in almost every source; oil is still the main energy source, but its weight in the energetic mix have decreased along the wave. Energetic transition, thus, has not been completed, but a global trend has started to show: in 2015, renewable sources were around a fifth of total energy in all the world, and a 17% in the European Union (IRENA, 2018).

As for intermediate inputs, the use of plastics has been paradigmatic. The development of the petrochemical industry during the past wave and of chemical components like polymers took a big part on the proliferation of plastics, and its constitution as a fundamental input during this wave. The substitution of metals by plastics was an important productive feature, as it contributed to decreasing costs and to accelerating production times – and, thus, to the development of new processes of production, as is Just-in-Time.

In medicine, the improvement of internal surgery was a characteristic feature of this period, hearth surgery being a paradigmatic case. In addition, further improvements took place in relation with transplants and diagnosis; endoscopy and magnetic resonance imaging were first experimented during this phase and started to generalize towards the end of the century. To name another innovation on this field, the use of laser technology in surgery can also be underlined, contributing to consolidate the increasing technological character of medicine.

Finally, a comment must be made about what was named as the ‘Green Revolution’. Between the 1960s and the 1980s, new technologies started to be applied on agriculture, which resulted in high growths on productivity in the following years. We refer to the

use of new pesticides, fertilizers, and irrigation processes, and the even the polemic inclusion of genetically modified food. A remarkable fact was the introduction of new high-yielding varieties of rice and wheat in developing countries.

2.4.4. Income distribution trends: mechanisms and emergent results

Once we have identified the institutional traits of each period, we should be able to explain the evolution of income distribution during 1931-2010. See Table 2.2 for some detailed figures on personal primary distributions of income for developed countries. Looking at personal income shares, two trends can be generally distinguished: income shares of top incomes generally decreased during our first period, just to start to increase again in the second. As for primary distribution of income, decreases in labor shares concentrated during our second period, except for France. Using these empirical data as a support, let us recall that, in our framework, income distribution is a central emergent result of the social system, and that the two different evolutions we have identified, may partially explain those changes in long-run income distribution trends.

Let us note that some of the information above, especially that related to the institutional changes in the role of governments, refer to distributive policy, so that pieces of information are complementary to this sub-section, and could also be replicated here. This should be borne in mind, because distribution cannot be exclusively reduced to a conflict between wages and profits; the distributive policy plays an important role in smoothing these conflicts and in reaching more egalitarian results, which might be desirable from a social perspective. We will dedicate some time to the most important emergent result of distribution in the twentieth century: the welfare state.

2.4.4.1. Income distribution during 1931-2010: structural mechanisms

In the first place, can the institutional characteristics of the first period explain the decrease in inequality that took place from the Great Depression to the oil crisis? This period was characterized by a strong public interventionism. The reason was that, on the one hand, the excesses of the financial system revealed that it was necessary to establish more controls and regulation to avoid another crash; and, on the other hand, that the crisis had especially affected the lowest incomes, so a policy of recovering these was mandatory. In addition, the paradigmatic productive process of this period, that is, mass production, could only work if a strong consumerist middle class were established. Thus, the recovery of low and middle-low incomes was crucial for reactivating production.

Hence, expansionary policies were established, as the *New Deal* in the United States, or the more ambitious project of the welfare state in Europe. Furthermore, a commitment between workers and entrepreneurs to achieve a positive labor environment was also the key for overcoming unemployment, in this process of incomes recovery. The important role of trade unions during the war also contributed to enhance the perception of these as crucial institutions to reach this level of commitment.

As has already been mentioned before, WWII played an important role in this period, in the sense that the need for reconstruction favored an environment of social collaboration. Piketty (2014) also defends that the destruction of physical capital, that was highly concentrated in the hands of the richest, was another cause in the decrease in both wealth and income inequality. The Cold War might have also affected these trends. The Communist block rivaled Western countries for designing the economic system that could achieve higher standards of living, and so, high levels of equality were implied. It might have been possible that the threat of the USSR might had pushed the United States and European countries to implement a more egalitarian social program.

In contrast to this first period, inequality started to increase after the oil crisis, especially after the 1980s. This can be explained, at least partly, by the institutional changes that took place around the mid-1970s. The need for regulation seemed to be a thing of the past. The priority was then to achieve stable inflation rates of around a 2%. The focus passed from fiscal policy to monetary policy, because not only was prices control more important, but public expenditures were thought to be useless in a context of rational expectations. The liberalization of the financial sector derived in the financialization of developed economies: the expansion of the levels of expenditure were highly based on credit expansions, which compensated the stagnation of wages during these years (Barba & Pivetti, 2008). The already established mass consumption of durable goods with low prices also enabled to increase consumers' satisfaction with relatively lower levels of income. This could also have partially shadowed the rising inequality during this period.

Table 2.2. Some income distribution indicators for developed countries, 1930-2010

	Top 1% income share			**Top 10% income share**			**Middle 40% income share**			**Bottom 50% income share**			**Labor shares**		
	1930	**1975**	**2010**	**1930**	**1975**	**2010**	**1930**	**1975**	**2010**	**1930**	**1975**	**2010**	**1950**	**1975**	**2010**
France	0.17	0.09	0.11	0.43	0.33	0.33	0.41	0.46	0.45	0.16	0.21	0.21	0.88	0.73	0.63
Germany	0.17	0.09	0.11	0.38	0.29	0.36	0.41	0.46	0.45	0.16	0.21	0.22	0.67	0.67	0.61
Italy	-	0.05	0.08	-	0.28	0.30	-	0.49	0.47	-	0.27	0.22	0.62	0.62	0.54
Japan	0.17	0.09	0.10	0.27	0.33	0.42	-	-	-	-	-	-	0.69	0.69	0.59
Spain	-	0.09	0.11	-	0.33	0.34	-	0.46	0.45	-	0.27	0.22	0.64	0.64	0.61
UK	0.18	0.06	0.12	0.35	0.26	0.34	-	0.48	0.45	-	0.23	0.21	0.60	0.60	0.62
USA	0.18	0.11	0.20	0.45	0.35	0.46	0.41	0.45	0.41	0.14	0.20	0.13	0.64	0.63	0.60

Source: own work using data from World Inequality Database (WID); Feenstra et al., (2015); and UNU-WIDER, World Income Inequality Database (WIID, May 2021 version)

Labor markets also were liberalized as trade unions were gradually losing importance, wages were decreasing, and unemployment increasing, being now endemic characteristics of a globalized world. The consolidation of the participation of women in the labor market might have been related to wage stagnation, with households perceiving higher incomes, even when the average income per household member might have fallen. As will be seen shortly, the rationale of liberalization and stopping the public support to middle and low incomes also had technological traits: the new information technologies only could have worked giving a push to a new wave of globalization, which could certainly have not happened without liberalizing capitals and labor.

2.4.4.2. Distributive policy and the role of the welfare state in extenuating inequality

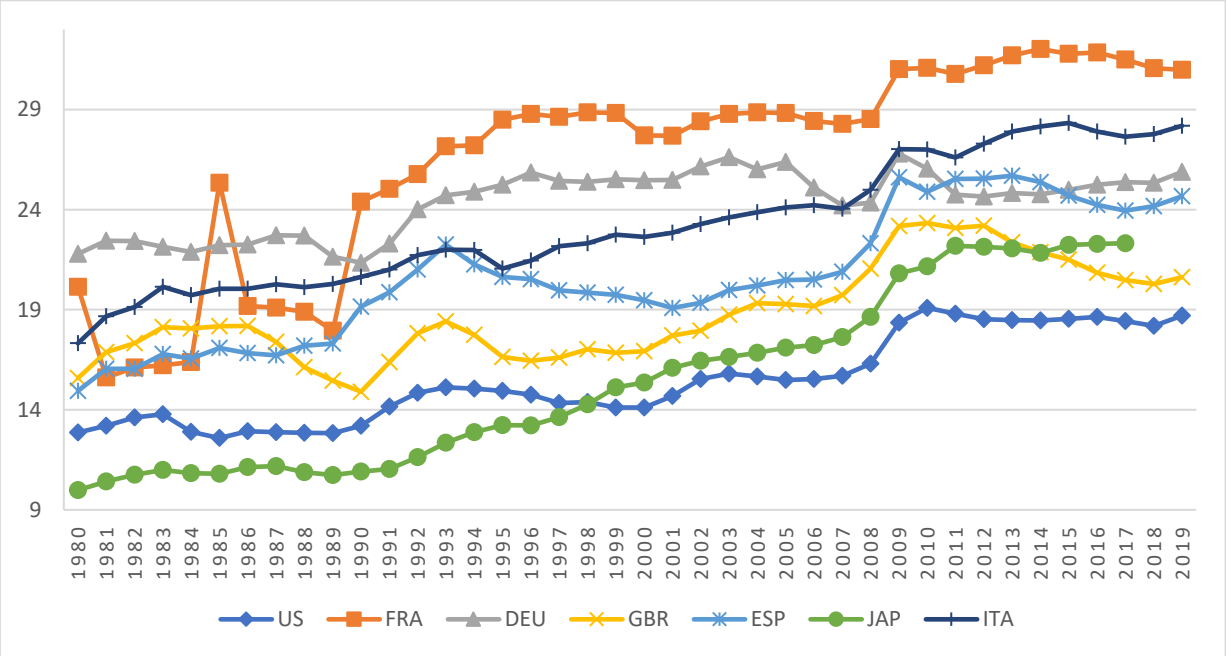
In a very quick note, we believe that the inception of the welfare state in post-war societies is a good proof of the coherence of our scheme: the welfare state would be an emergent institutional result of the changes that were being implemented after the Great Depression. A brief analysis of its recent evolution would show that, despite losing relevance during our second sub-period, it likely contributed to smooth the increase in inequality after the mid-1970s. The importance of this particular emergent result of redistribution will be further explored in the following empirical chapters.

Figure 2.8 shows that, in the countries of our sample, total public social spending increase during the second sub-period, even when public expenditures decreased in total (see Section 4.2.2). In reducing inequalities, in-kind transfers are very important, especially those related to health and education. Figures 2.9 and 2.10 show that public spending in those respect have followed increasing trends. Public health expenditures have been increasing since 1970 in all countries – note the impressive recent increase in the United States, corresponding to the inception of the Obamacare program in 2014 -, whereas public spending on education have stagnated in some countries like Japan or Italy. Finally, Figures 2.11 and 2.12 show the evolution of in-cash public transfers, namely, unemployment and pension benefits. The increasing trend in public pensions is noticeable, whereas unemployment benefits follow a more cyclical evolution, as would be expected.

In short, we believe that the data that we have presented would support our conjectures that, would the welfare state not existed, the increase in inequality during the period

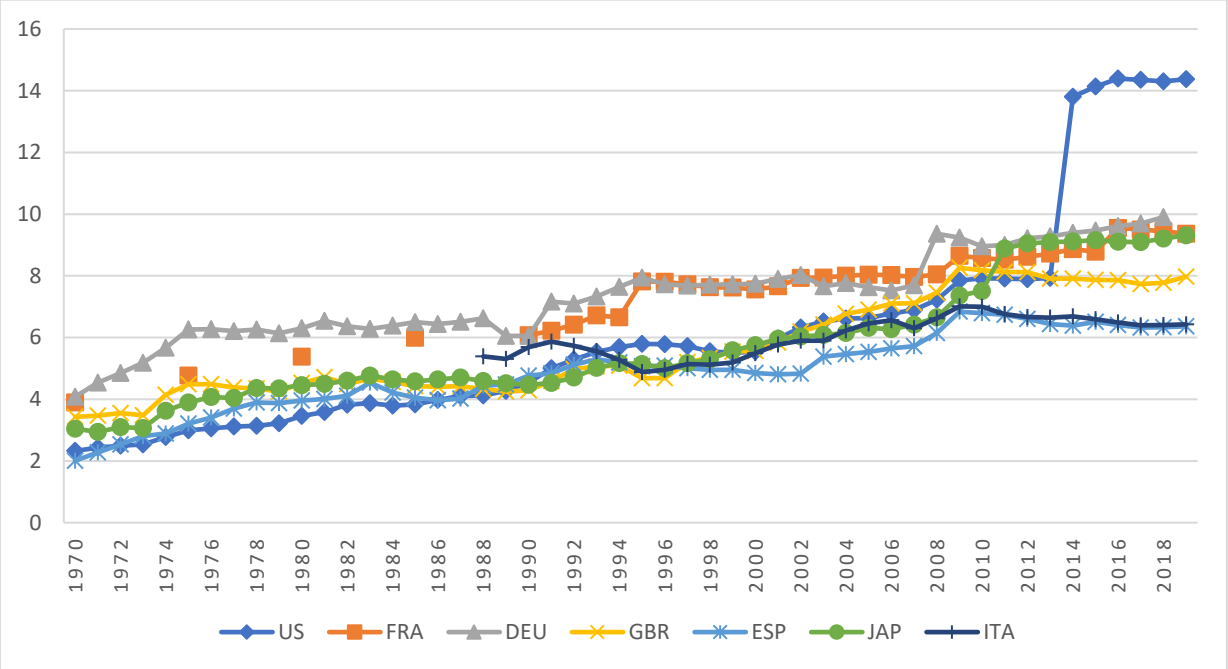
1975-2010 would have been more impressive. The public supply of social benefits is an important mechanism of contemporary distributive policies, even in countries as the United States, where it was not fully implemented. In-kind transfers are perhaps more important, as those offer an equal access to services that would surely be unreachable for low incomes. The welfare state is undoubtedly one of the greatest social accomplishments of the last century's evolution. Its impact on moderating the decrease in labor shares, especially during the second long wave, should be undeniable.

Figure 2.8. Public social spending, % of GDP, 1975-2019



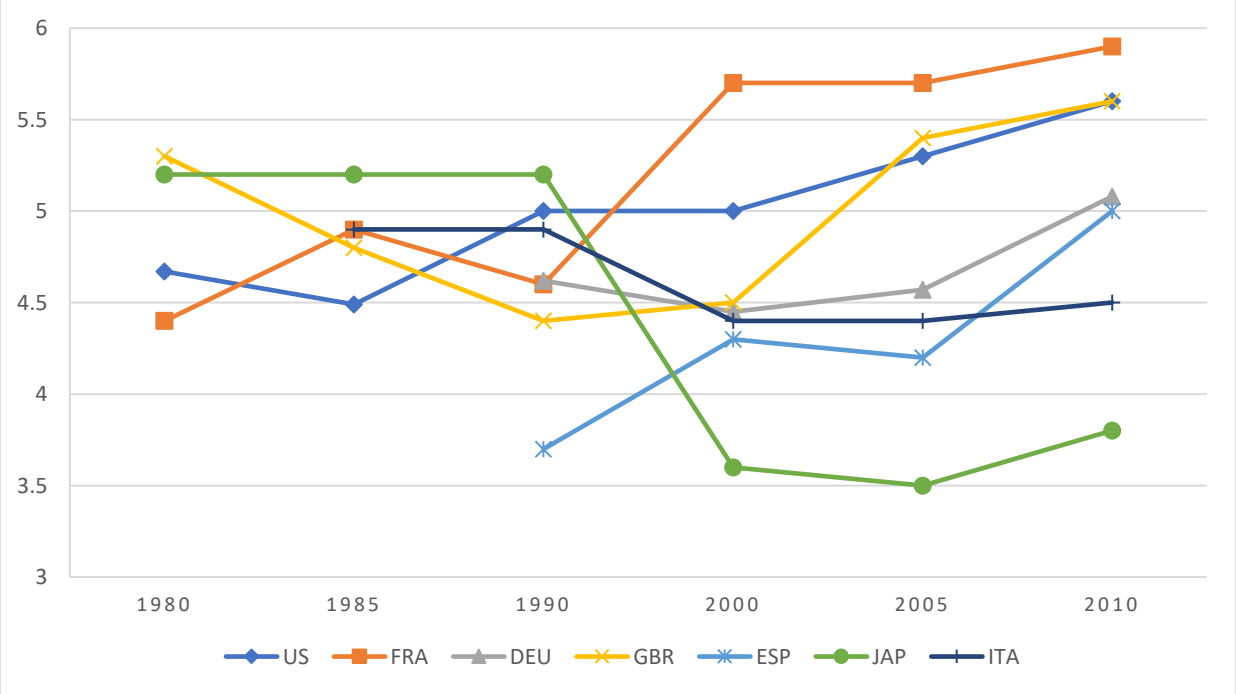
Source: own work based on OECD (2020d) data

Figure 2.9. Public health expenditure, % of GDP, 1970-2019



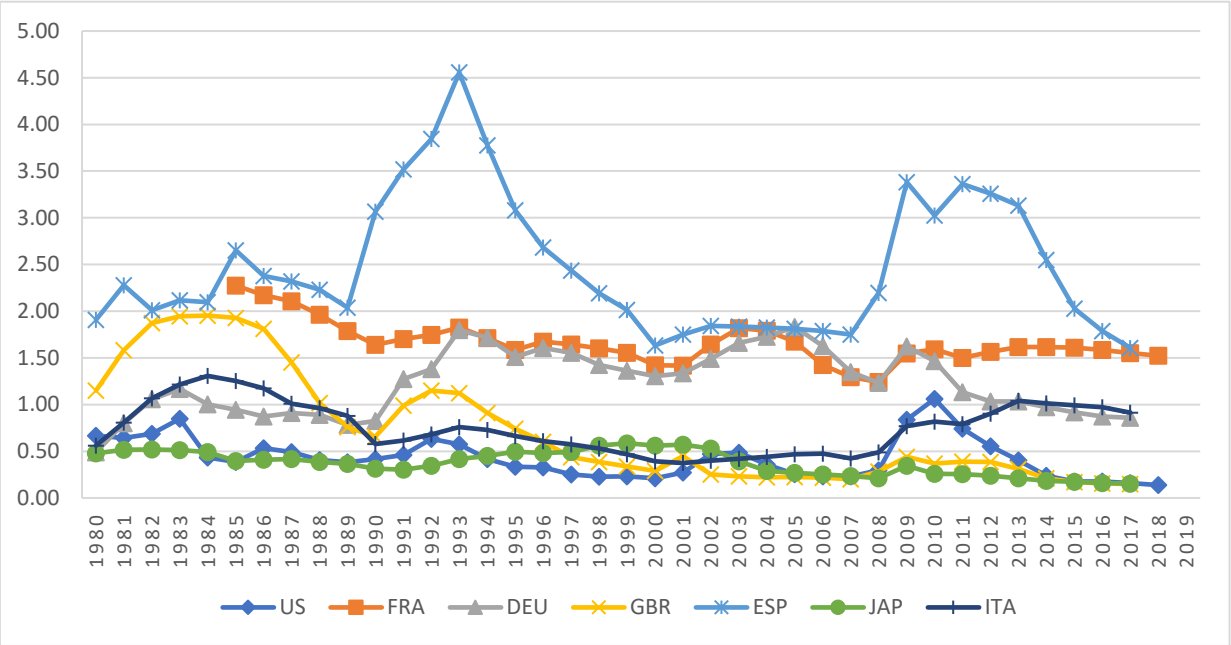
Source: own work based on OECD (2020e) data

Figure 2.10. Public education spending, % of GDP, 1980-2010



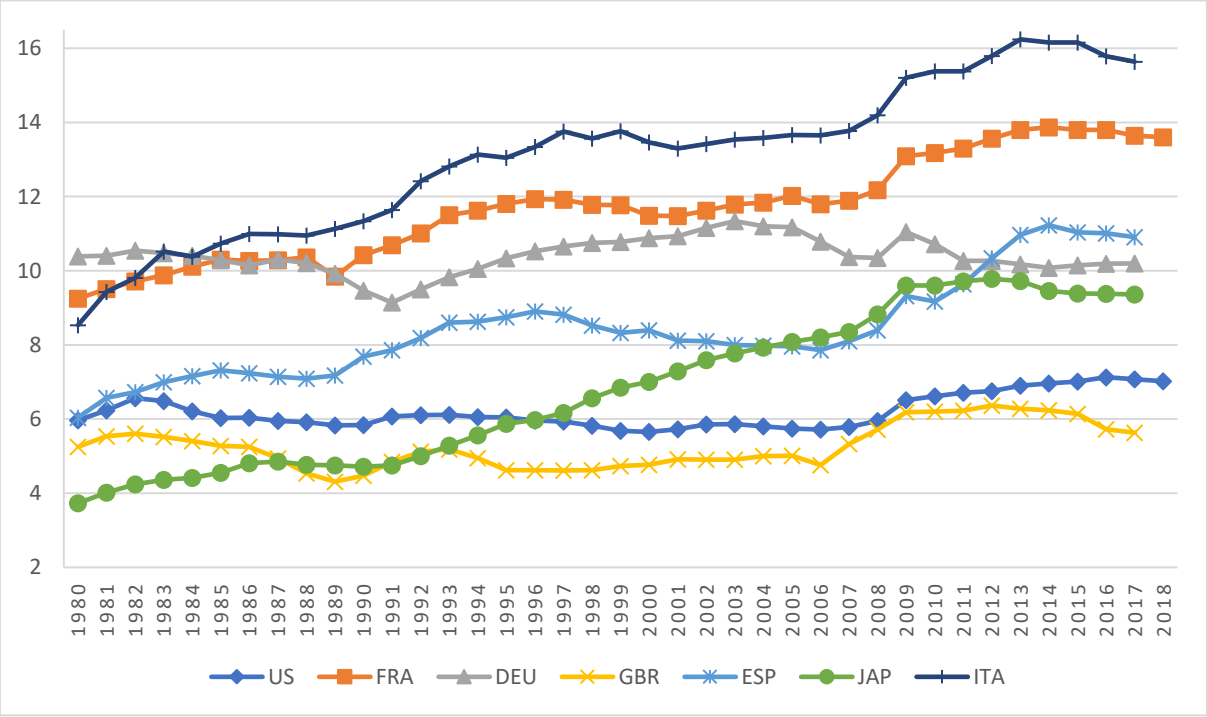
Source: own work based on World Bank (2013) and OECD (2020f) data

Figure 2.11. Public unemployment spending, % of GDP, 1980-2018



Source: own work based on OECD (2020g) data.

Figure 2.12. Public pension spending, % of GDP, 1980-2018



Source: own work based on OECD (2020h) data

2.5. Concluding remarks

In the first place, in this chapter, we have used an evolutionary framework to locate our income distribution research in a long-term dynamic context, heavily inspired in Bunge's theories of systems and mechanisms. The explanation of the recent economic evolution as a succession of two 40 year-long waves seems reasonable, from our three complementary perspectives, as data and historical events go hand in hand. As we are analyzing social and economic facts, though, we cannot expect this evolution to be determinist, as it is composed of multi-faceted and complex emergent processes.

Although we take some inspiration in Schumpeter's (1939) exposition, we can criticize some of his assumptions. First, as our long waves are defined to be shorter than Schumpeter's – of about 50-60 years-, we cannot accept his hypothesis of a Kondratieff consisting of six Juglar cycles, because we are not following a determinist scheme. We find that each of the proposed long wave is composed by a different number of business cycles: five cycles in the first Kondratieff, 1929-1975, and four in the second one, 1975-2010 (see Table A2.1 in the Annex). The number of Juglar cycles that form each of the two long waves that are the object of our study is confirmed by the empirical analysis that was carried out in Section 2.3.1. There, we applied Baxter-King filters to several series that might be related to these fluctuations. The analysis is consistent in cross-country comparison, so we could carry these hypotheses further.

In Section 2.3.2, we develop a historical analysis in order to explain the time delimitation of Juglar cycles, which ought to be consistent with the previous empirical analysis and with the datasets corresponding to the unfiltered series. Furthermore, a time extension of our scheme would suggest that a new long wave should have started around 2010, and a paradigm change might now be taking place as well. The analysis of the techno-economic features that are going to characterize the new paradigm leaves another path to follow in future research.

In Section 2.4, we described 'wave paradigms' and their changes, to be used in the explanation of long-term income distribution trends (see Table A2.2 in the Annex for a summary). Besides the economic system, that has already been dealt with in, we used the other three sub-domains – scientific, institutional, and technological – and their interrelations to determine a pattern for long-term economic evolution. Therefore, for the first wave we established a link between public sector expansion for the promotion of post-war growth, the achievement of an adequate distribution of income and the

consolidation of a mass-consumption middle class, and a technological paradigm based on mass production and the use of oil as energetic base. Meanwhile, for the second wave, we found a relation between the coming a new wave of globalization and liberalization and the development and diffusion of ITCs - as international interconnection and global information exchanges could only take place in such an unrestricted institutional context -, with deregulation, cuts in public expenditure, and an increase in inequality. Finally, as a result of the described mechanisms, we vindicate the importance of the welfare state as a key emergent result of the social system, even as an extenuating circumstance of the inequality increases that have taken place from the mid-1970s.

In short, it could be concluded that our proposed theoretical framework could be useful, not only for explaining changes in income distribution trends in the long run, but also for any analysis that takes place in a wide timespan and deals with structural changes – which are usually a result of structural economic crises, and institutional and technological changes.

2.6. References of Chapter II

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OECD (2020g), Public unemployment spending (indicator). doi: 10.1787/55557fd4-en (Accessed on 27 November 2020)

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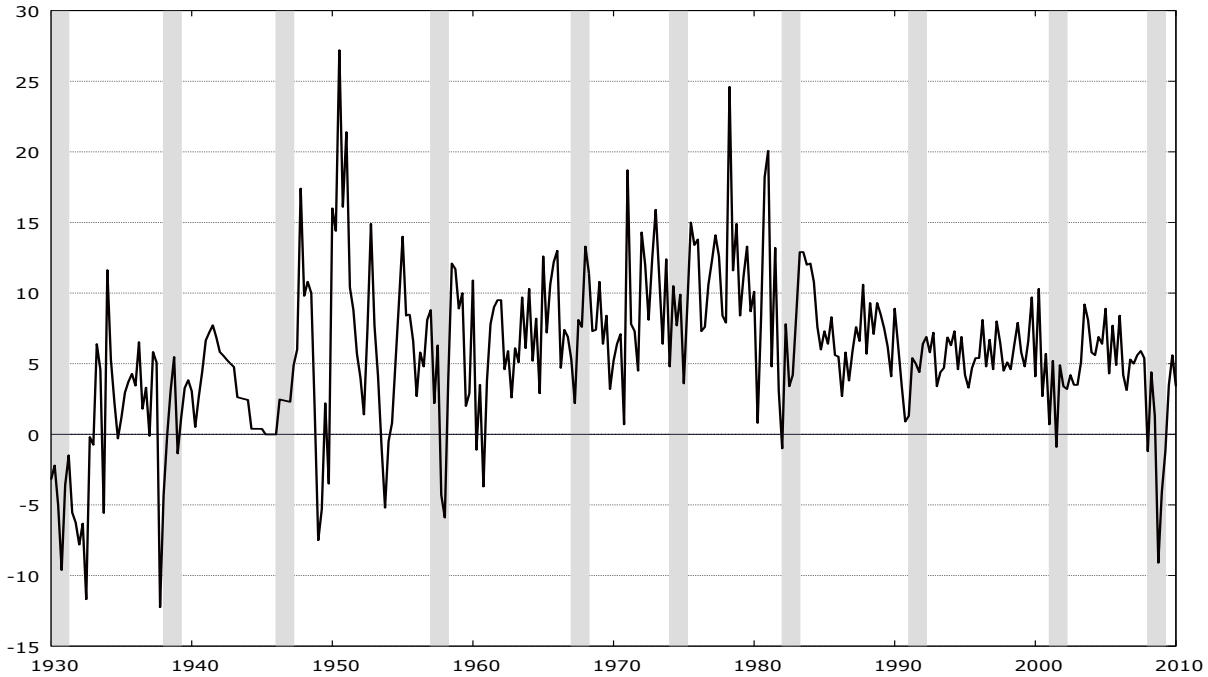
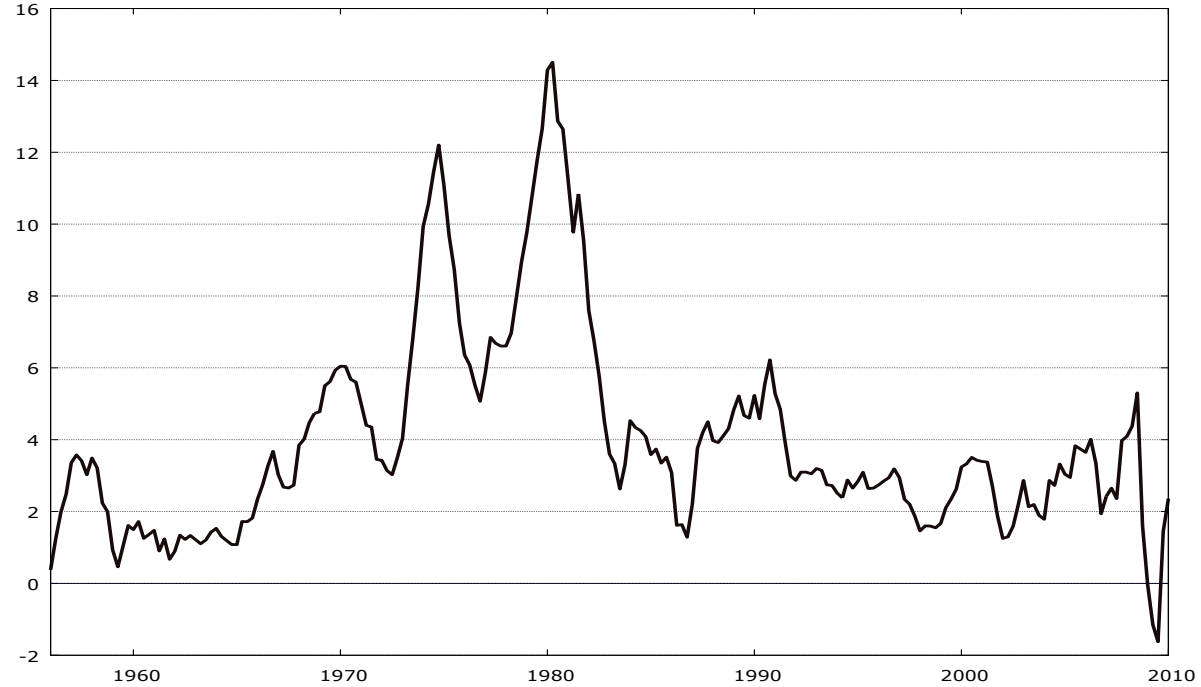
2.7. Annex of Chapter II. Additional Figures and Tables

Figure A2.1. US GNP growth rates, 1930-2010 (used for obtaining Figures 1.a-b)



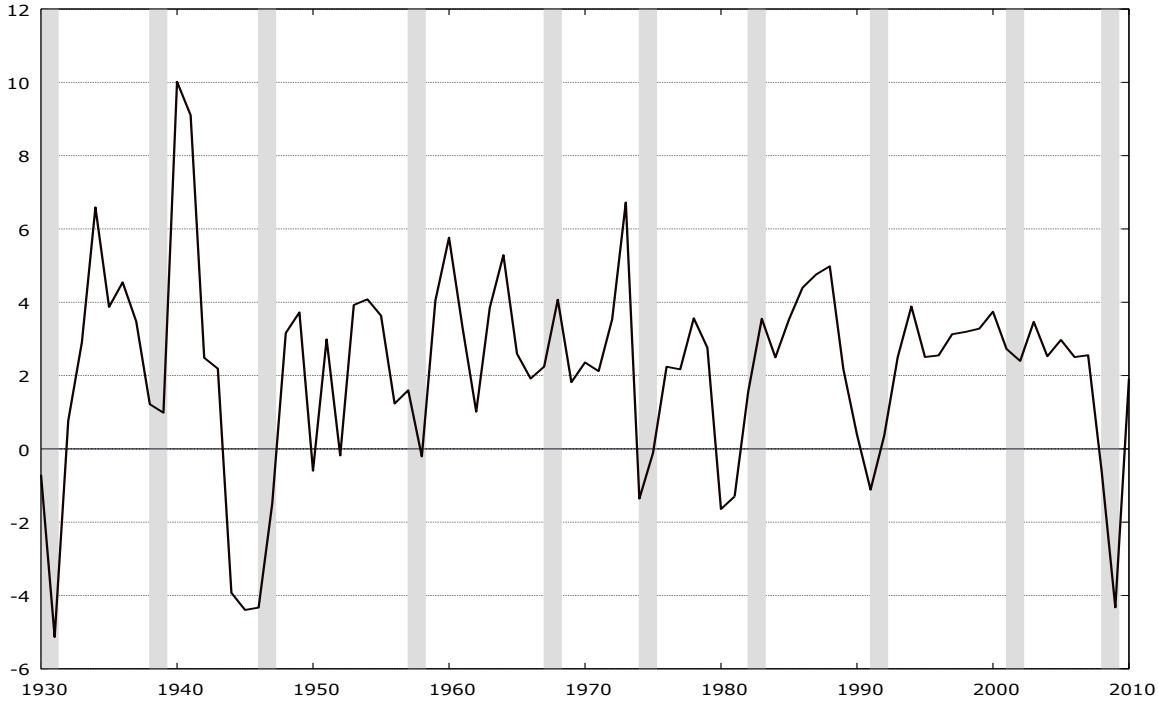
Note: Vertical lines show the cycle's time delimitations suggested in Section 3.
Source: own work based on FRED (2020a) data

Figure A2.2. US inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

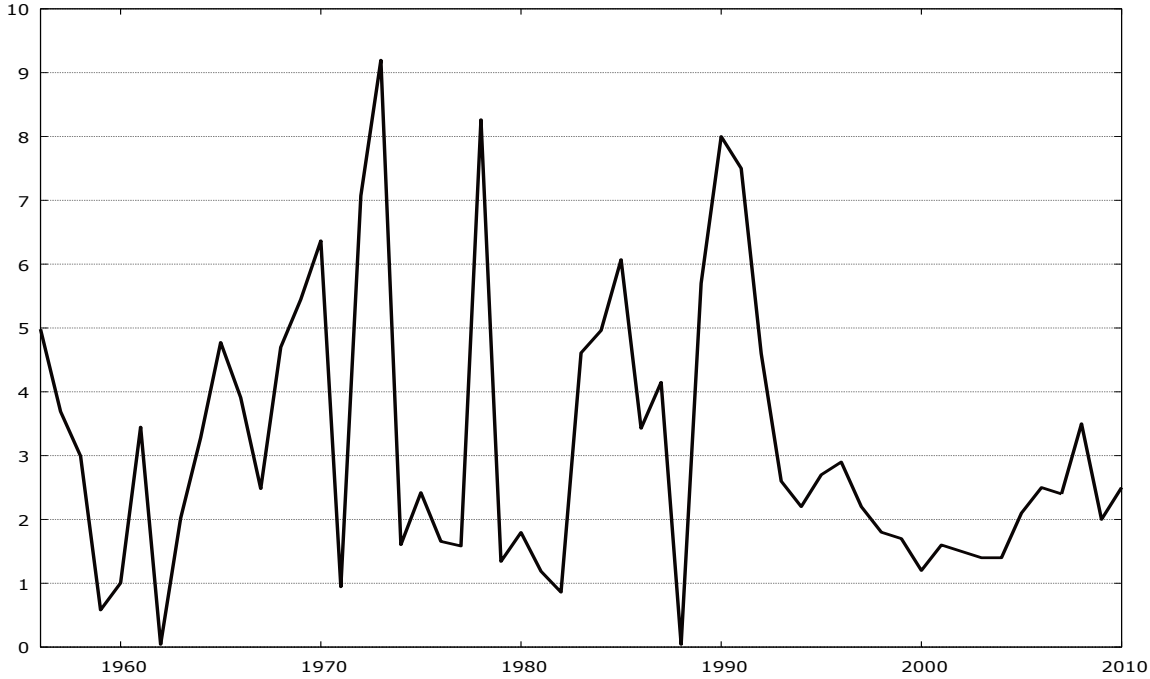
Figure A2.3. UK GDP growth rates, 1930-2010 (used for obtaining Figures 2.a and 3.a)



Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

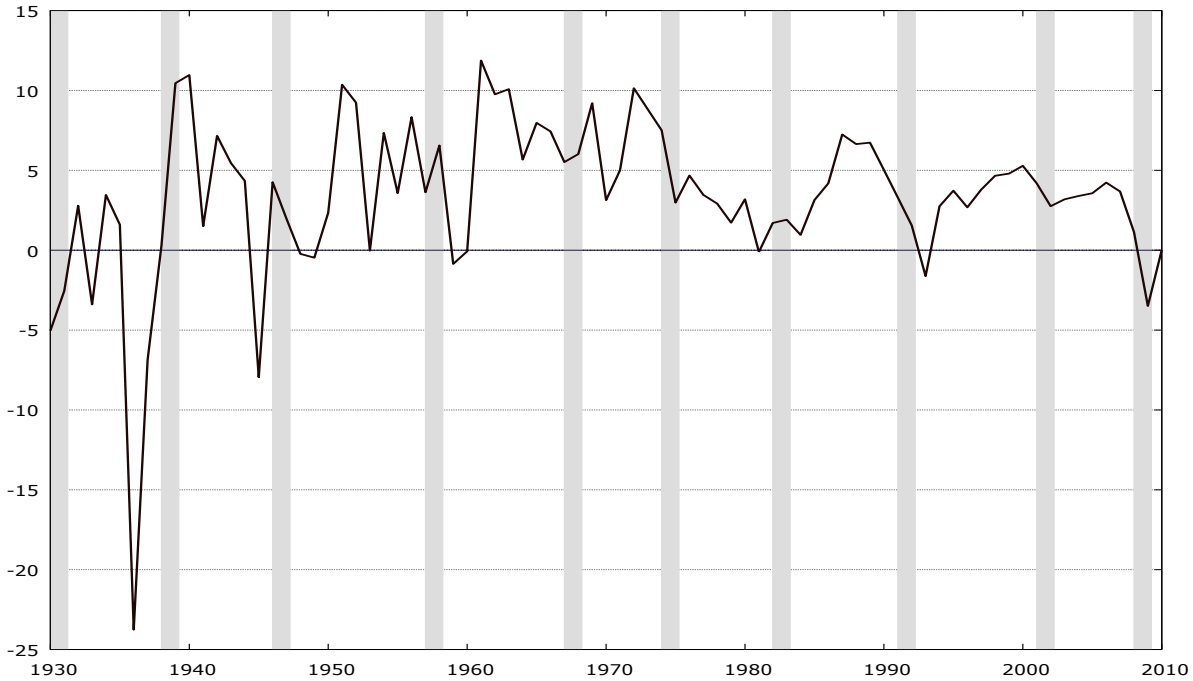
Source: own work based on OECD (2020a) data

Figure A2.4. UK inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

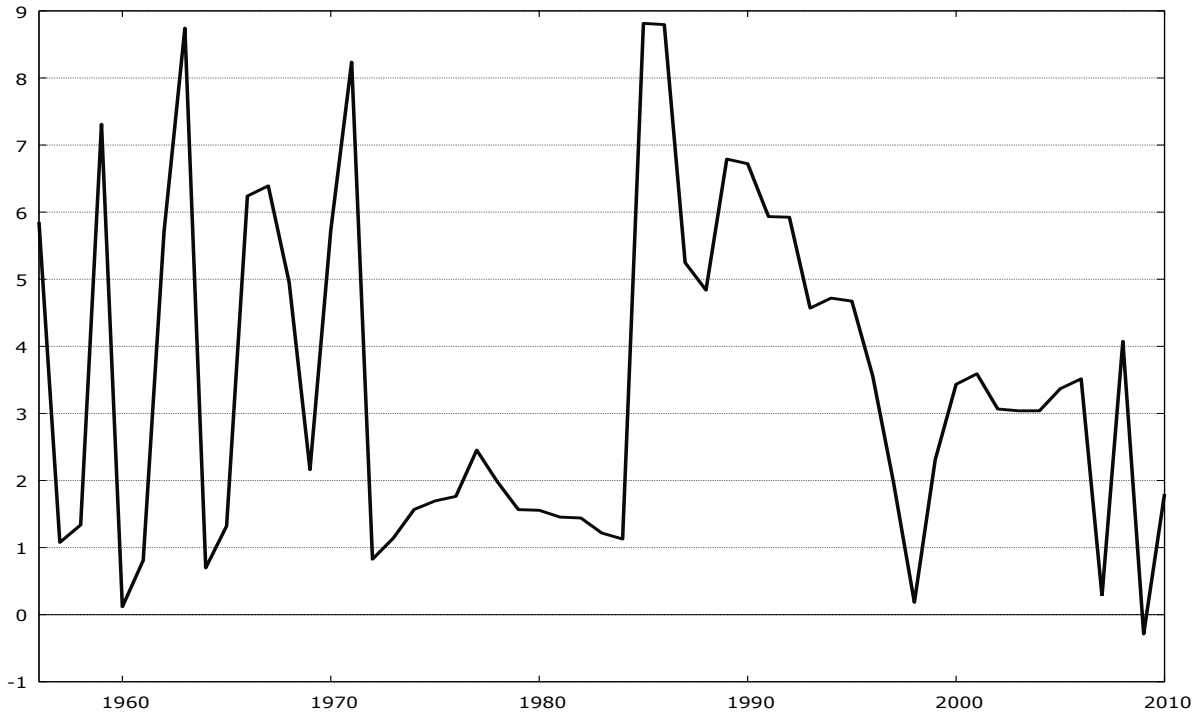
Figure A2.5. Spain GDP growth rates, 1930-2010 (used for obtaining Figures 2.b and 3.b).



Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

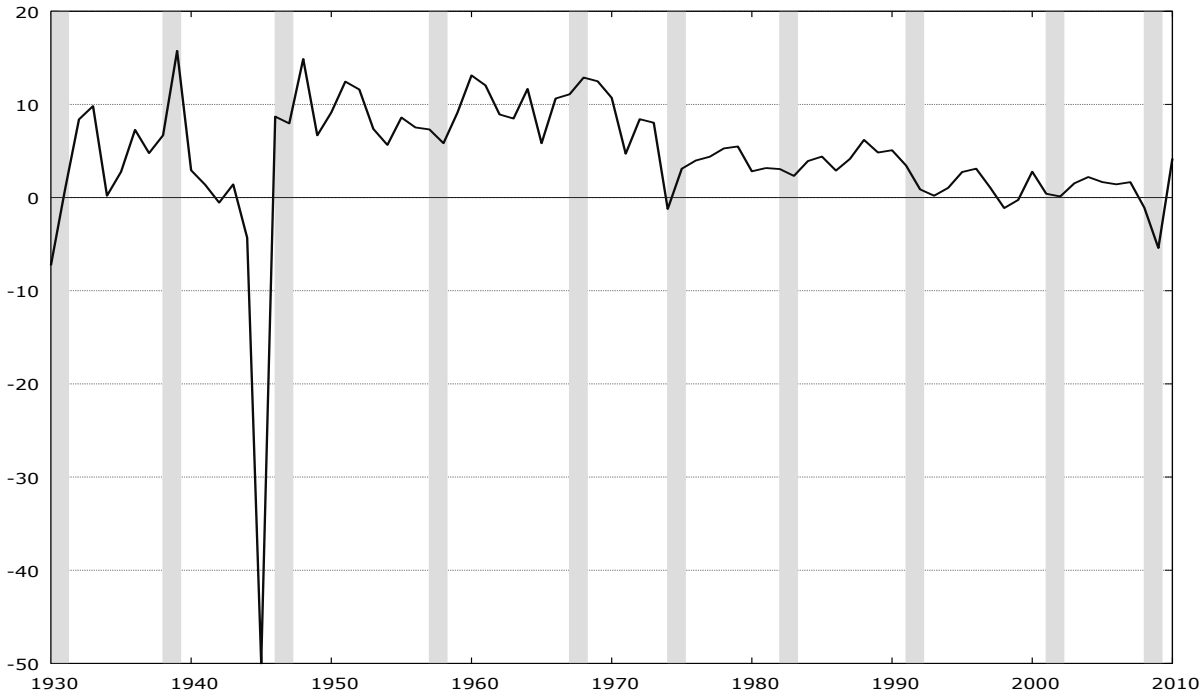
Source: own work based on OECD (2020a) data

Figure A2.6. Spain inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

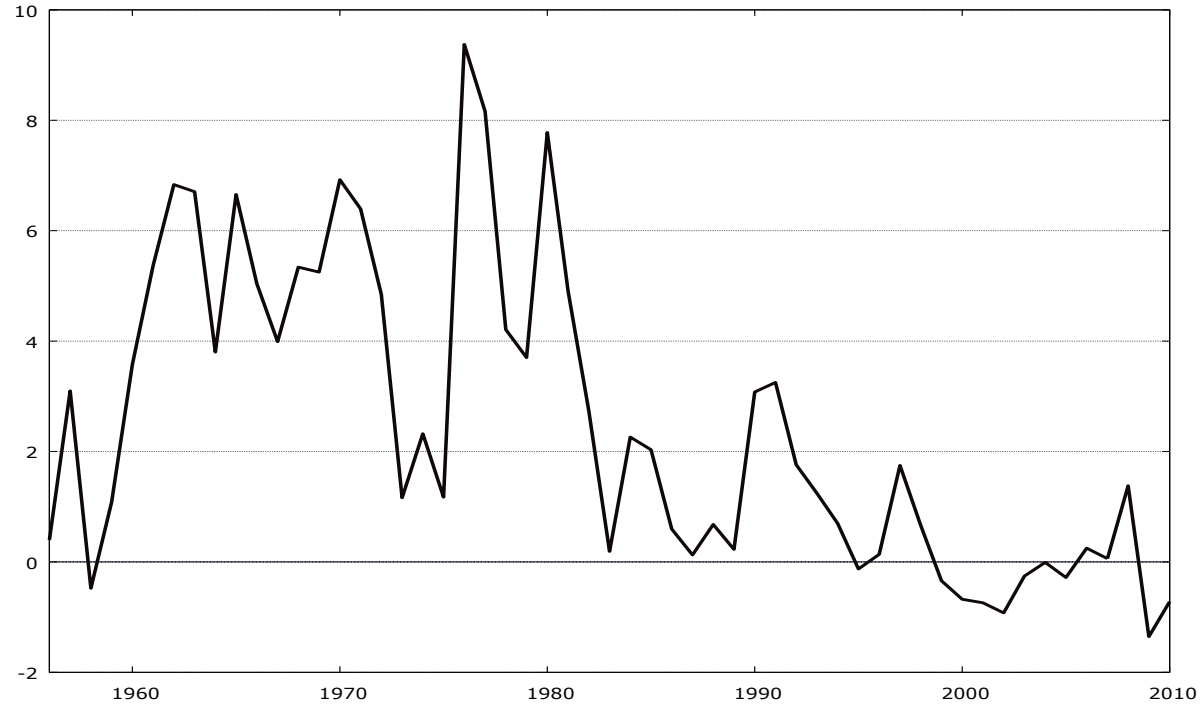
Figure A2.7. Japan GDP growth rates, 1930-2010 (used for obtaining Figures 2.c and 3.c)



Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

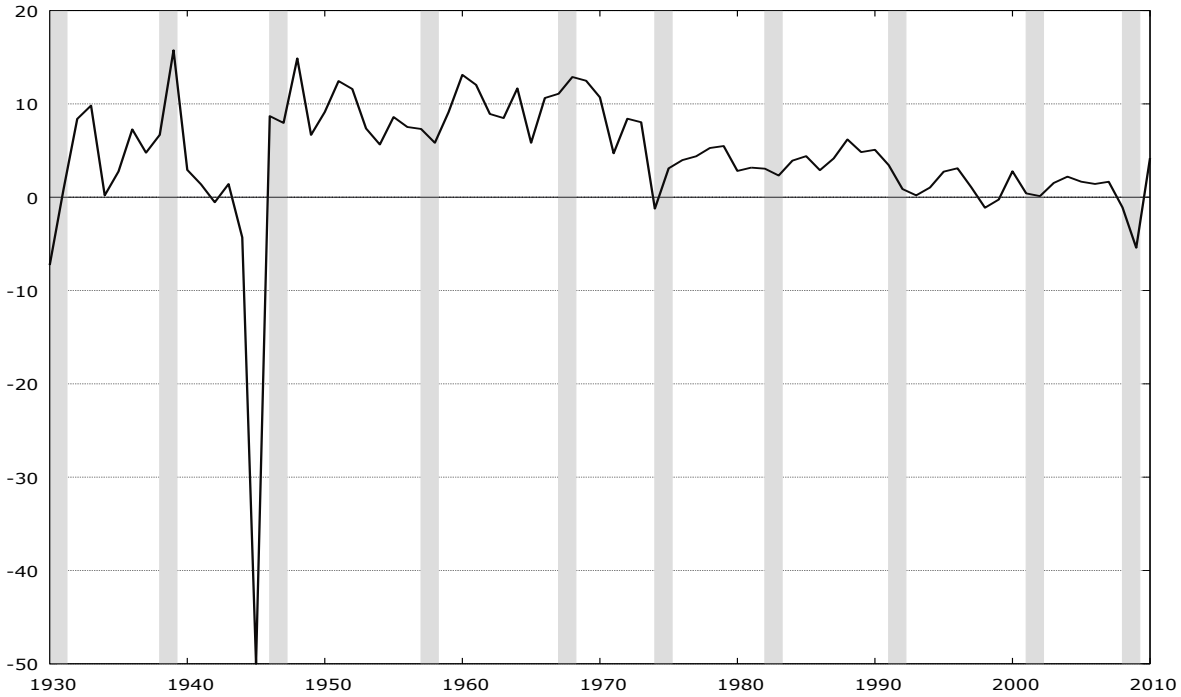
Source: own work based on OECD (2020a) data

Figure A2.8. Japan inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

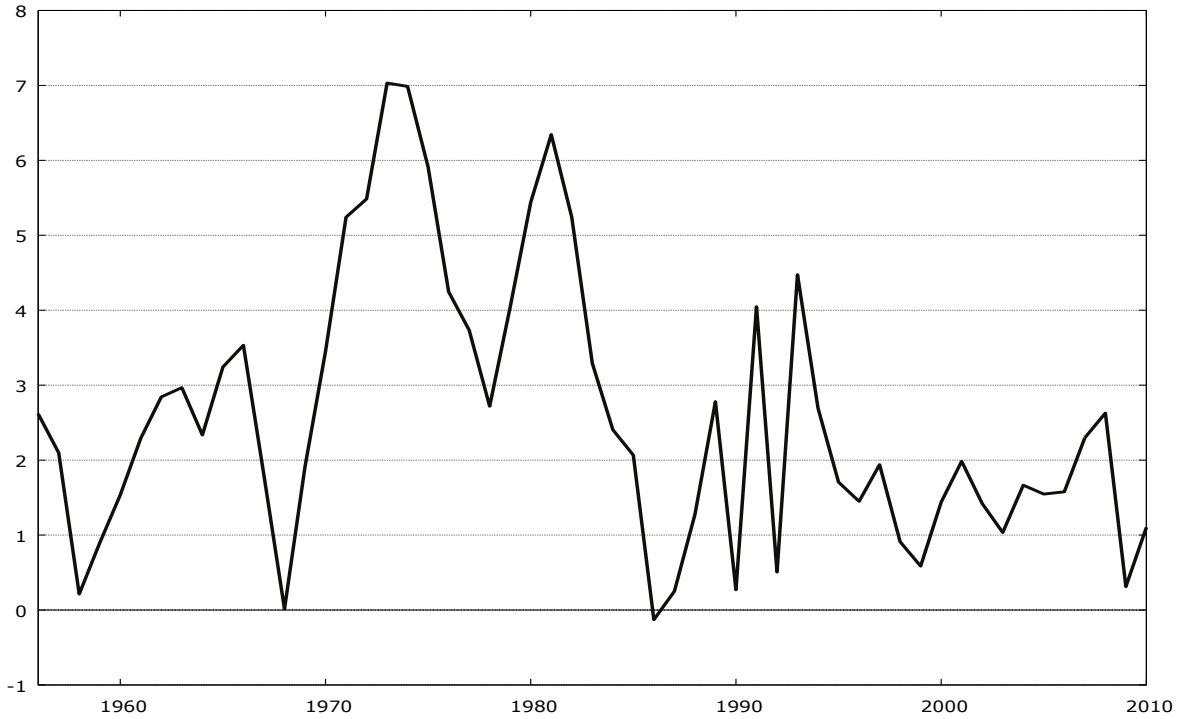
Figure A2.9. Germany GDP growth rates, 1930-2010 (used for obtaining Figures 2.d and 3.d)



Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

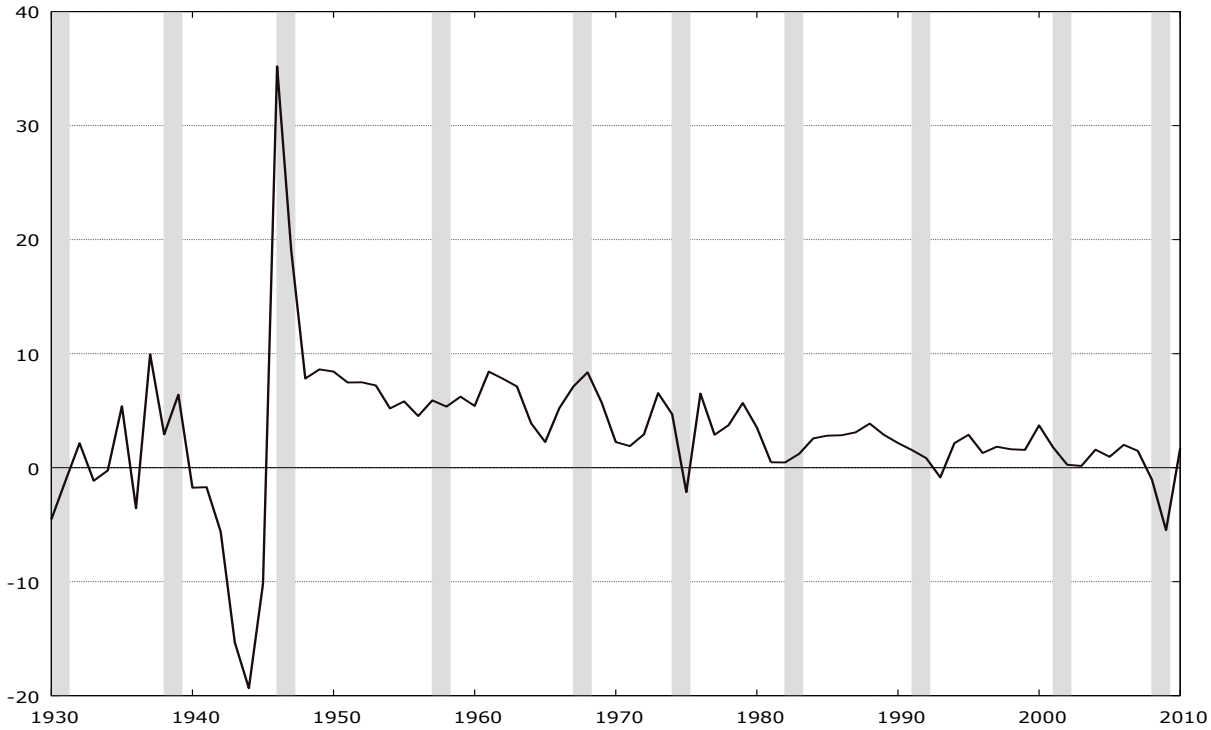
Source: own work based on OECD (2020a) data

Figure A2.10. Germany inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

Figure A2.11. Italy GDP growth rates, 1930-2010 (used for obtaining Figures 2.e and 3.e)



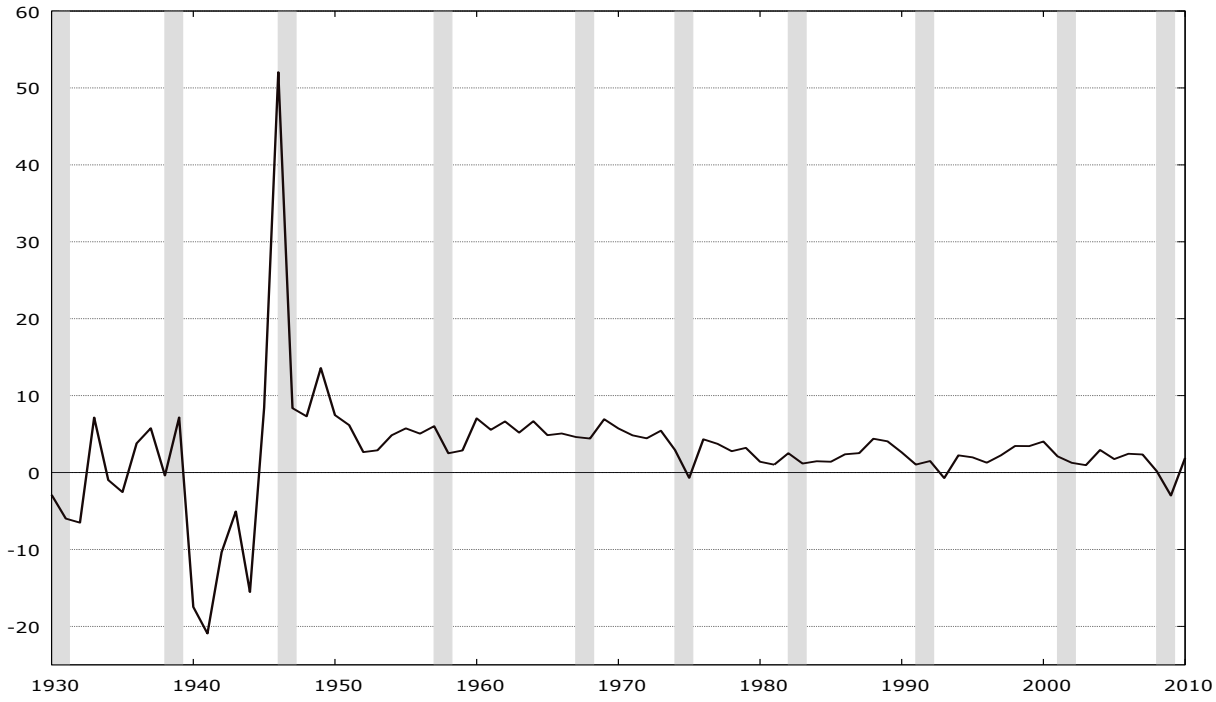
Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

Source: own work based on OECD (2020a) data

Figure A2.12. Italy inflation rates, 1956-2010.

Source: own work based on OECD (2020b) data

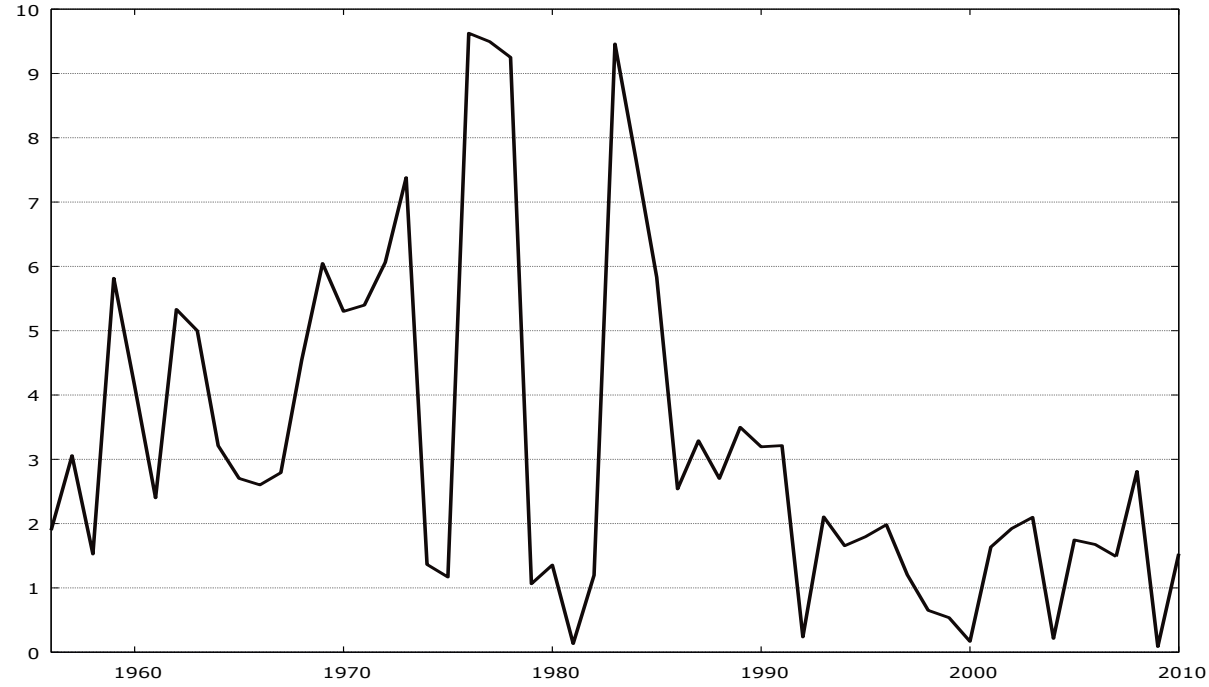
Figure A2.13. France GDP growth rates, 1930-2010 (used for obtaining Figures 2.f and 3.f).



Note: Vertical lines show the cycle's time delimitations suggested in Section 3.

Source: own work based on OECD (2020a) data

Figure A2.14. France inflation rates, 1956-2010



Source: own work based on OECD (2020b) data

Table A2.1. Structure and length of the long waves

Long wave	**Approximate length**	**Juglar cycles**	**Approximate length**	**Long wave phase**
c. 1931 – 1975	44	1931 – 1939	8	Upswing: recovery
		1939 – 1947	8	Upswing: expansion
		1947 – 1958	11	Downturn around 1954
		1958 – 1968	10	Downswing: recession
		1968 - 1975	7	Downswing: depression
c. 1975 - 2010	35	1975 – 1983	8	Upswing: recovery
		1983 – 1992	9	Upswing: expansion
		1992 – 2002	10	Downswing: recession
		2002 - 2010	8	Upswing: depression
c. 2010 – ?		2010 – 2020 (?)	10	Upswing: recovery

Source: own work.

Table A2.2. Paradigms and their characteristics

Long wave	**Paradigm characteristics**				
	Scientific	Institutional			Technologic
		Monetary system	Role of government	Labor market	
Oil cycle (c. 1931 – 1975)	Neoclassical synthesis: Keynesianism mixed with neoclassical marginalism.	Gold standard abandonment. Bretton Woods agreements (1944). Financial regulation: Glass Steagall Act (1933).	New Deal. Welfare State and public sector expansion.	Employment and wage growth. Role of trade unions. Supply changes: women incorporation.	Mass production and consumption: Fordism and middle class. Television and domestic appliances. Aircraft industry. Oil. Penicillin (1928) and antibiotics.
ICTs cycle (c. 1975 – 2010)	New Classical Macroeconomics. Rational expectations.	Bank money. Liberalization. Objective: inflation.	Government retrenchment.	Wage stagnation. Trade union density decrease. High qualification related to ICTs.	Computers. Telecommunications. Green revolution. Surgery. Plastics.

Source: own work

Chapter III: Income distribution, inequality, and consumption in an input-output model.

This chapter, as happened in Chapter II, will mainly have a methodological character. On the one hand, we perform a review of basic references in order to identify the classic problems that are embedded on the theory of distribution. Then, once these problems are identified, we will construct a theoretical model that incorporates heterogeneity in labor and consumption. Specifically, we will focus on the relationship between the primary distribution of income (factor shares of income) and both consumption patterns and technological change.

3.1. Introduction

As it is well-known, the theory of income distribution focuses on the study of the causes that determine the shares of national income held by each factor, as a remuneration of their participation in the process of production. The problem of distribution has traditionally been a major topic in Economics. As was acknowledged by Ricardo in the Preface to his *Principles* (1817), 'to determine the laws which regulate this distribution, is the principal problem in Political Economy'. Although this problem has been recognized since the very inception of the economic science, there has not been much consensus in what concerns the adequate methodological framework with ought to be used when confronting it

As a matter of fact, a strong theoretical debate concerning income distribution took place during the second half of the twentieth century. We refer to what was known as the 'Cambridge controversies' (Harcourt, 1969). On the one hand, the American contenders defended that distribution is determined by the technical relations that are present in the economy – and, in the end, that marginal productivities determine income shares (Ferguson, 1969). On the other hand, the British contenders defended that there also is a distributive framework that takes part in this determination. This distributive framework comprehends a set of institutional and social variables, such as labor regulations, the negotiation power of labor unions and employers, the occupational distribution of labor and skills, the investment and consumption patterns that are present in an economy, or the Welfare State – which certainly plays an important role on extenuating inequalities. This is totally consistent with our evolutionary vision, seen in Chapter II, concerning

changes in the economy and income distribution according to a social paradigm. For the British group, the wage rate and the rate of profit – or, in other words, the labor and capital shares of income, respectively – should be inversely related. The assertion that a determined factor can only increase its share of income by diminishing the other factor's share, means that income distribution reflects a conflict of interests between factor holders. This was already treated by Classical economists as Ricardo (1817) and Marx (1867-1894), and by more contemporary authors as Morishima (1973) or Roemer (1982). The verification of a relation of this kind is not a trivial issue and should be in the center of a distribution and inequality analysis. One of the reasons why we are constructing a multisectoral model up next, is because we are interested in testing some basic conjectures related to the theory of distribution, as is the wages-profits relation in a context of heterogenous labor, or its links to consumption patterns. We also want to deepen the analysis about the possible worker-entrepreneurs collaboration when the technological change takes place.

Looking at recent events and distribution trends, if one would have to choose a side in the Cambridge debate, the Americans or the British, it would appear more reasonable to side with the latter. As it turns out, a recent report from the ILO and the OECD (2015) points out that labor shares have been decreasing in developed countries since the 1970s, despite labor productivity increasing during this period. However, this fact could also contradict one of Kaldor's (1957) stylized facts of economic growth, that income shares are constant in the long run. All these facts reveal the importance of analyzing the deep causes that shape the evolution of income distribution, and the increasing inequality that is present nowadays.

Now, the question is to ascertain what factors are explaining this observed fall in labor shares. According to Dietzenbacher, Lahr, & Los, (2004), changes in the labor compensation share of income can be provoked either by a technological change that increases capital intensity, profit margins or productivity; or by alterations in final demands or the industry mix – in other words, by structural changes in consumption, exports or investment patterns. Hence, it would be reasonable to say that technique does not exclusively determine income distribution, and that the socio-institutional framework of an economy might also play a role in this respect. Taking all these facts into account, we are in the position to justify that our empirical analysis in Chapter IV and V will be based in multisectoral input-output models, as we believe that this framework can

successfully integrate both technical and institutional dimensions, and is partially compatible with the British Cambridge tradition - especially with Sraffa (1960), Pasinetti (1977), or Kurz & Salvadori (1995), which are prime examples of multisectoral income distribution models.

The contents of this chapter will be structured as follows. In Section 3.2, we will present a more detailed relation of the theoretical antecedents of our multisectoral models. In Section 3.3, we will define quantity and prices models including labor heterogeneity, different patterns of consumption and investment, and technological change. In Section 3.4, we will prove that, in our model with heterogeneously trained labor, wages and profits are inversely related, which confirms the classical hypotheses. We close the Section obtaining a formal relation that links changes in the uniform rate of profit to changes in the structures of consumption, investment, or technology. In Section 3.5, we present a specific and simplified model with three sectors, that will be used to perform some simulations and analyze different scenarios, so the characteristics of our model can be better understood, and its analytic potentiality can be displayed. Finally, in Section 3.6, main conclusions will be drawn.

3.2. Theoretical antecedents of input-output and multisectoral models and important concepts for income distribution analyses

Here, we are conducting a brief recollection of the theoretical roots of input-output models, from Classical economics, through Leontief, and finally reaching some more contemporary contributions. Thus, we will introduce most of the income distribution related topics that are going to appear throughout the thesis, such as the inverse wages-profits relationship. For achieving this, we follow Kurz & Salvadori (2000), who did a similar research on the theoretical origins of input-output models.

The first attempt of constructing a table to account for the intersectoral transactions of an economy may be traced back to the French physiocrat François Quesnay (1766). In his *Tableau Économique*, Quesnay presented the flows of commodities and the process of income distribution in a self-reproducing economy with two sectors: agriculture, which was the only sector with the capacity of creating value, and manufactures, the 'sterile' or unproductive sector. Prior to this, due credit must be given to the mercantilist economists William Petty and Richard Cantillon, who influenced Quesnay with their notions of

interdependence and economic reproduction, respectively. Besides, the concept of surplus was also being conceived: as a result of the capacity of agriculture for creating value, a net product is obtained by deducting the inputs required for production from total output. Thus, an income that exceeds the necessary inputs to reproduce the system is generated, and the problem of how to distribute it is born.

It can be seen, then, that the concepts of reproduction, surplus, and sectoral interdependence were already originated before the Classical economists, usually considered the founding fathers of our science. Nonetheless, these were also determinants in the development of the income distribution theory, with essential contributions in the names of, for example, Adam Smith, David Ricardo, or Robert Torrens. The connection between mercantilists and physiocrats, and Classical economists is completed with Karl Marx (1867). Strongly inspired by Ricardo's theory of value, Marx developed a 'historical materialistic' theory of distribution, meaning that distribution is dependent of the socially dominant structures of production, which comprehend both techniques and institutions. He focused on the antagonistic relationship between wages and profits, and the class struggle derived from it. He also carried further the concept of economic reproduction, represented in the 'Money-Commodity-Money' scheme. Although Marx's theories reached some important cul-de-sacs (the falling tendency of the rate of profit, the values into prices transformation problem), his contributions and his influence in this field are undeniable. It should be underlined that several of Marx's formal imperfections were improved and refined much later by Morishima (1973), who carried a great effort towards the mathematical modelling of Marx's theories.

Turning to the 21st century, we should highlight two economists that, although not contributing directly to the genesis of input-output models, advanced concepts of highly importance for this process. First, we have V.K. Dmitriev (1974 [1904]), who anticipated the notions of reduction to dated quantities of labor and non-basic industries (those industries whose goods do not enter into the processes of production of every other existing industries), which were later developed by Sraffa. He also worked in the formalization of the wages-profit inverse relationship, but it should be remarked that Dmitriev's reasoning fell into the trap of circularity that would be much discussed decades later in the Cambridge debates on capital: for obtaining the value of the rate of profit, the return on capital must be known, but it is clear to infer that this also depends on the rate of profit.

The other important figure of the early 21st century is Georg von Charasoff (1910). He was a pioneer on proposing a treatment of capital on a primitive pre-Leontief model with sectoral interdependence. He developed the following construction, which reminds of Leontief's expanded inverse:

$$y, My, M^2y, \dots, M^ky, \dots \tag{3.1}$$

where **y** is a vector of net output, and **M** is an augmented input coefficients matrix that also includes intermediate and wage-good inputs per unit of output, as well as capital costs. Each element of the previous expression is a step backwards in the production process. Carrying this series to a sufficiently high degree, it yields the 'original capital' that is used in the initial phase of production.

Going a few decades further, we finally reach the contributions of Wassily Leontief (1936, 1941), the founding father of what it is today known as input-output tables, whose structure and foundations were already presented in the methodological section of Chapter I. Although Leontief's model is the cornerstone of multisectoral models, there are a few other peculiar types of models that should be mentioned. These models are of special interest for our purposes, as they focus on income distribution, and are centered on the concepts of economic reproduction, interdependence, and surplus. First, we have von Neumann (1945), who developed a general equilibrium growth model with these characteristics: a multisectoral model with rate of growth/profit that generates a surplus, and a system of prices that affect the distribution of income. Goodwin (1967) also developed a growth model, with no such multisectoral character, but very focused on distribution in relation to cycles.

Finally, we arrive the last block of economists that we must mention here as influences for our input-output distribution analysis. This block is headlined by Sraffa (1960). His multisectoral model is closely related to the input-output framework and collects several topics that have been in the center of the theory of distribution debates, namely, basics and non-basics, joint production, and the wage-profits inverse relationship. He also contributed to Ricardo's value theory, by defining the 'standard commodity', an invariable measure of value that is accompanied by constant prices and, thus, do not affect income distribution. The most basic representation of Sraffa's model for an economy with *k* sectors can be written as follows:

$$(A_a p_a + B_a p_b + \cdots + K_a p_k)(1 + r) + L_a w = A p_a$$

$$(A_b p_a + B_b p_b + \cdots + K_b p_k)(1 + r) + L_b w = B p_b \qquad (3.2)$$

… …

$$(A_k p_a + B_k p_b + \cdots + K_k p_k)(1 + r) + L_k w = K p_k$$

where each one of the previous equations represents an industry producing its own commodity. The elements of the first parentheses refer to the means of productions multiplied by prices p_i, *r* is the uniform rate of profit, *w* is the wage rate, and L_i is direct labor used in each sector. Various similarities to the input-output framework can be drawn, as will be seen shortly.

The last mention goes to a group of economists that, following Sraffa's contributions, developed more contemporary multisectoral models. On the one hand, we have Pasinetti (1973, 1981, 1993) whose most famous contribution is probably the concept of 'vertically integrated sectors', an important notion of sectoral interdependence that might have inspired the whole concept of 'global value chains'. On the other hand, we have Kurz & Salvadori (1995), who developed a theory of production based on multisectoral economics, gathering contributions from Leontief, von Neumann, and Sraffa, among others. We end this section here, not without mentioning that there is a plethora of contributions in input-output economics nowadays (Miller & Blair, 2009), and that even Sraffian current of thought is still alive (Ciccone et al., 2011a, 2011b). Nonetheless, extending this literature review until today would perhaps be out of scope for our humble purpose of just exposing the origins of multisectoral input-ouptut models.

3.3. An input-output model with an augmented coefficient matrix

For the sake of simplicity, our model describes a closed economy. In addition, we do not consider specific capital goods, although this economy dedicates a part of total production to growth purposes. As it is usual in the literature, this hypothesis implies that the economy's rate of growth will coincide with the rate of profit in the prices model. Finally, we are going to assume that there are *m* (*m=3* in our simulated scenarios) different types of productive workers that have a distinctive training and different wages, being $\mathbf{t}_i' = \left(l_{i,j}\right)$, the 1x*n* direct labor coefficients vector by type *i*, $T_i = \sum_j l_{i,j} x_j$, labor of type *i*.

We take Steenge & Serrano (2012) as a guide for constructing an income distribution input-output model, where the vision of labor and capital as competing parties constitutes a basic hypothesis.

The economy's output is represented by the following equation:

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{f}_{T_1} + .. + \mathbf{f}_{T_m} + \mathbf{f}_K = \left[(1+r)\mathbf{A} + \mathbf{f}_{T_1} \big/ T_1 \, \mathbf{t}_1' + ... + \mathbf{f}_{T_m} \big/ T_m \, \mathbf{t}_m' \right] \mathbf{x}$$
$$= \left[(1+r)\mathbf{A} + \mathbf{B}_1 + ... + \mathbf{B}_m \right] \mathbf{x} = \left((1+r)\mathbf{A} + \mathbf{B} \right) \mathbf{x} \; = \mathbf{M}\,\mathbf{x}, \qquad (3.3)$$
$$\text{with } \mathbf{f}_{T_1} = \mathbf{f}_{T_i} \big/ T_i \, \mathbf{t}_i' \mathbf{x} \geq \mathbf{0} \text{ and } \mathbf{f}_K = r\mathbf{A}x \geq \mathbf{0}$$

where $\mathbf{x}$ is the *n*x1 final output vector; $\mathbf{A}$ is the *n*x*n* technical coefficients matrix[1]; $\mathbf{f}_{T_i} \big/ T_i$ is final demand per type *i* worker; $\mathbf{f}_K$ represents the part of final demand that is destined to economic growth, being proportional to intermediate inputs demands $\mathbf{Ax}$; and *r* is the exogenous rate of growth. Note that $\mathbf{M} = (1+r)\mathbf{A} + \mathbf{B}$ is the augmented coefficients matrix, including technical, growth, and wage input coefficients, and $\mathbf{x}$ is the left-hand eigenvector of $\mathbf{M}$, with an eigenvalue equal to 1. As a summary, we can obtain production, given an exogenous rate of growth and a productive structure.

Furthermore, the economic model used requires an additional equation to describe the prices of production, which will be used to value the physical goods consumed by each worker, as well as the goods contained in the value added. If we assume that the rate of profit is uniform and that wages are not paid in advance, the equation for these prices is:

$$\mathbf{p}' = \mathbf{p}'\mathbf{A} + w_i \, \mathbf{t}_1' + ... + w_m \, \mathbf{t}_m' + \mathbf{s}_k' = \mathbf{p}' \left[(1+r)\mathbf{A} + \mathbf{f}_{T_1} \big/ T_1 \, \mathbf{t}_1' + ... + \mathbf{f}_{T_m} \big/ T_m \, \mathbf{t}_m' \right]$$
$$= \mathbf{p}' \left((1+r)\mathbf{A} + \mathbf{B}_1 + ... + \mathbf{B}_m \right) = \mathbf{p}' \left((1+r)\mathbf{A} + \mathbf{B}_L \right) = \mathbf{p}'\mathbf{M} \qquad (3.4)$$

Where $\mathbf{p}'$ is the 1x*n* vector of prices, *r* is the rate of profit; $w_i = \mathbf{p}' \mathbf{f}_{T_i} \big/ T_i$ is the wage or income earned by type *i* workers, who use their earnings to pay their consumption $\mathbf{f}_{T_i}$; and $\mathbf{s}_k' = r\,\mathbf{p}'\mathbf{A}$ is the 1x*n* investment coefficients vector. Then, given an exogenous rate of growth, we can obtain prices.

[1] It is assumed that Matrix $\mathbf{A}$ is square, non-negative, and indecomposable.

It can be noted that equations (3.3) and (3.4) must verify the basic equality between generated and spent income:

$$\mathbf{p}'\mathbf{f} = \mathbf{p}'\mathbf{f}_{T_1} + .. + \mathbf{p}'\mathbf{f}_{T_m} + \mathbf{p}'\mathbf{f}_K = r\,\mathbf{p}'\mathbf{A}\mathbf{x} + w_1\,\mathbf{t}_1'\mathbf{x} + ... + w_m\,\mathbf{t}_m'\mathbf{x} \tag{3.5}$$

3.4. Links between the rate of profit, wages, and the structural and institutional framework

Although the inverse wages-profits relationship has already been proved in several theoretical works, here, we are confirming that including heterogeneity in labor (and, thus, in its compensations), and in consumption patterns, does not alter this result. Besides, we will find a formal expression for the relationship between the rate of profits and the rest of the variables of the model, or in other words, the structural (technological) and institutional framework.

3.4.1. Checking that wages and profits are inversely related

To test this relationship, we are again following the method in Steenge & Serrano (2012).

We are going to introduce the function $\omega(r)$ in (3.4), as can be seen below:

$$\begin{aligned}\mathbf{p}' &= \mathbf{p}'\left[(1+r)\mathbf{A} + \omega(r)\left[\mathbf{f}_{T_1}/T_1\,\mathbf{t}_1' + ... + \mathbf{f}_{T_m}/T_m\,\mathbf{t}_m'\right]\right] \\ &= \mathbf{p}'\left((1+r)\mathbf{A} + \omega(r)\mathbf{B}_L\right) = \mathbf{p}'\mathbf{M}_{r,\omega}\end{aligned} \tag{3.6}$$

If $\omega(r) = 1$, equations (3.4) and (3.6) are the same. Moreover, if we assume that $\omega(r)\mathbf{B}_L$ represents the wage component of prices, $\omega(r)$ can capture the relationship between wages and profits, which we expect to be decreasing. As can be seen directly from equation (3.6), price vector $\mathbf{p}'$ is the left-hand Perron-Frobenius eigenvector of

$$\mathbf{M}_{r,\omega} = (1+r)\mathbf{A} + \omega(r)\mathbf{B}_L \tag{3.7}$$

with its eigenvalue $\lambda(\mathbf{M}_{r,\omega})$ being equal to 1.

Being r_0 and ω_0 the initial values that verify $\lambda(\mathbf{M}_{r_0,\omega_0}) = 1$. If $r_0 < r_1$, as $\mathbf{A}$ is indecomposable and non-negative, it is well-known that:

$$1 = \lambda(\mathbf{M}_{r_0,\omega(r_0)}) < \lambda(\mathbf{M}_{r_1,\omega(r_0)})$$

Then, if $\mathbf{B}_L$ do not change, it should be verified that $\omega(r_0) < \omega(r_1)$, in order to check that $\lambda(\mathbf{M}_{r_1,\omega(r_1)}) = 1$. This proves that the relationship between wages and profits is decreasing when all the surplus is entirely destined either to investment or to wages, even when labor heterogeneity is introduced into the model.

Let us also note that a similar demonstration would prove that any increase in other expenditures different from investment or wages, would also provoke a decrease in wages. Furthermore, changes in consumption patterns could provoke either increases or decreases in the rate of profits, and even keep it unchanged. These relationships are going to be deeply studied in the following subsection.

3.4.2. Global dependence of the rate of profit r

In order to study in more depth, the relation between the rate of profit *r* and the structural and institutional framework, we are first obtaining a functional relation, Proposition 1, between the changes in *r* and the elements in matrix $\mathbf{M}$, which describes the economy. We start from equations (3.3) and (3.4), and we can represent ***x*** and ***p*** as follows:

$$\mathbf{x} = \left[(1+r)\mathbf{A} + \mathbf{B}_1' + ... + \mathbf{B}_m'\right]\mathbf{x} = \mathbf{M}\,\mathbf{x}, \text{ with } \mathbf{x} \geq \mathbf{0}$$

$$\mathbf{p}' = \mathbf{p}'\left[(1+r)\mathbf{A} + \mathbf{B}_1' + ... + \mathbf{B}_m'\right] = \mathbf{p}'\mathbf{M}, \text{ with } \mathbf{p}' \geq \mathbf{0}$$

$$\mathbf{B}_i' = {}^{\mathbf{f}_{T_i}}\!/_{T_i}\,\mathbf{t}_i'$$

where $\mathbf{M}$ includes now technical, growth, wage, and consumption coefficients.

The functional expression for the changes in *r* is given by the following proposition:

Proposition 1. If[2]:

$$\begin{cases} \mathbf{x} = \left[(1+r)\mathbf{A} + \mathbf{B}_1' + ... + \mathbf{B}_m'\right]\mathbf{x} = \mathbf{M}\,\mathbf{x}, \text{ with } \mathbf{x} > \mathbf{0} \\ \mathbf{p}' = \mathbf{p}'\left[(1+r)\mathbf{A} + \mathbf{B}_1' + ... + \mathbf{B}_m'\right] = \mathbf{p}'\mathbf{M}, \text{ with } \mathbf{p}' > \mathbf{0} \\ \mathbf{p}'\mathbf{x} = H \end{cases} \tag{3.8}$$

it can be verified that:

[2] H can take any constant value. Here, $H = 1$, assuming that the value of total production is equal to unity. Nonetheless, other values can of H can be more useful for the interpretation of results.

$$\partial r = -\frac{\sum_{i,j}(1+r)\,p_i\,\partial a_{ij}\,x_j + \sum_{s=1}^{m}\sum_{i,j}(1+r)\,p_i\,\partial b_{s,ij}\,x_j}{\mathbf{p}'\mathbf{A}\mathbf{x}} \tag{3.9}$$

Proof: Following Neudecker (1967),

$$\lambda\mathbf{p}' = \mathbf{p}'\mathbf{M} \rightarrow \lambda\mathbf{p}'\mathbf{x} = \mathbf{p}'\mathbf{M}\mathbf{x} \rightarrow \lambda H = \mathbf{p}'\mathbf{M}\mathbf{x} \rightarrow \partial\lambda H = \partial\mathbf{p}'\mathbf{M}\mathbf{x} + \mathbf{p}'\partial\mathbf{M}\mathbf{x} + \mathbf{p}'\mathbf{M}\partial\mathbf{x}$$
$$\rightarrow 0 = \lambda(\partial\mathbf{p}'\mathbf{x} + \mathbf{p}'\partial\mathbf{x}) + \mathbf{p}'\partial\mathbf{M}\mathbf{x} \rightarrow 0 = \mathbf{p}'\partial\mathbf{M}\mathbf{x}$$
$$\rightarrow 0 = \partial r\,\mathbf{p}'\mathbf{A}\mathbf{x} + \sum_{i,j}(1+r)\,p_i\,\partial a_{ij}\,x_j + \sum_{s=1}^{m}\sum_{i,j}(1+r)\,p_i\,\partial b_{s,ij}\,x_j$$

and, as by definition $\lambda(\mathbf{M}) = 1$, (3.9) is verified.[3]

Proposition 1 can be summarized into the following facts:

1) The rate of profit is affected by changes in worker's consumption patterns, investment, and other types of consumption that form final demand. Moreover, we might wonder if some demand patterns reduce the potential productive capacity and, thus, the growth possibilities of an economy.
2) It should be underlined that, from a formal point of view, it is indifferent whether the changes take place via technological change (changes in a_{ij} or $b_{k,ij}$) or via consumption. This reveals that reductions in consumption can play a similar role as costs reductions derived from technological change, which is undoubtedly relevant from the income distribution perspective.
3) A change of the same magnitude affecting two different goods will, generally, have different effects over the rate of profit, because these are weighted by p_i and

[3] To fully comprehend the meaning of Proposition 1 above, it should be reminded that, in equation (3.8), $\mathbf{p}'$ and $\mathbf{x}$ are respectively the shadow prices and the balanced growth output, that is to say, the solutions to von Neumann (1945) model defined by matrix $\mathbf{M}$ (Kurz & Salvadori, 1995: 403). This model would be defined as follows:

$$\begin{cases} \mathbf{x}' \geq \alpha\,\mathbf{x}'\mathbf{M}' \\ \mathbf{p} \leq \beta\,\mathbf{M}'\mathbf{p} \\ \mathbf{x}'(\mathbf{I} - \alpha\,\mathbf{M}')\mathbf{p} = 0 \\ \mathbf{x}'(\mathbf{I} - \beta\,\mathbf{M}')\mathbf{p} = 0 \\ \mathbf{x} \geq \mathbf{0}, \mathbf{p} \geq \mathbf{0} \end{cases} \tag{3.10}$$

Equation (3.10) reflects, on the one hand, that p_i measure the productivity of an additional unit of physical resource *i*, through changes in the optimal rate of profit (or growth) α. Therefore, p_i are structural (and institutional) measures of value. Namely, a good would have a higher social value the higher its p_i is. On the other hand, x_j are the optimal levels of production for a cost given. They are measures of the technological and institutional importance of a determined sector. The higher x_j is, the more relevant the sector is; however, it should be noted that x_j are heavily affected and, thus, biased by the way sectors are aggregated in I-O tables.

x_j. Consequently, when we are studying a reduction due to technological change, we should check if the expression $\sum_{i,j} p_i \left((1+r)\,\partial a_{ij} + \sum_{s=1}^{m} \partial b_{s,ij} \right) x_j$ is negative, instead of looking into the sign of $\sum_{i,j} \left((1+r)\,\partial a_{ij} + \sum_{s=1}^{m} \partial b_{s,ij} \right) x_j$. Undoubtedly, both will be negative if all ∂a_{ij} and $\partial b_{s,ij}$ are negative.

4) Finally, equation (3.9) can be a useful device for detecting the goods and productive processes that are more important on distributional changes.

Although these results confirm the traditional hypotheses of wages and profits being inversely related, some questions remain open and should be addressed. On the one hand, as different consumptions affect the rate of profit in different ways, it seems reasonable to analyze which goods have a large impact in it. On the other hand, we should address to what extent this antagonistic character is total or partial; in other words, if there are any consumption patterns that favor collaboration between workers and entrepreneurs. This can be important when facing technological change, and the surplus to be distributed also includes the new incomes generated by the technological improvement. In the following sections, we will partially approach these questions.

3.5. A specific 3x3 model

Equation (3.9) above showed how the rate of profits can be affected by wage payments, consumption patterns, investments, and technological changes. Now, we are going to check, by using a simple model, all these relations and the direction of their effects.

3.5.1. The model

For achieving these purposes, we reduce the general case that has been described in Section 3.3 to a specific 3x3 model, in order to simulate diverse scenarios. In this case, we are considering an economy with three sectors and three types of productive workers. We will perform some simulations to check the functionality of the model and to enter into some of the income distribution topics in which we are interested, albeit in a very preliminary approach.

Our baseline input-output model is shown in Table 3.1. below:

Figure 3.1. Baseline input-output table

	Sector 1	**Sector 2**	**Sector 3**	**Final demand**	**Output x**
Sector 1	10	12	5	15	42
Sector 2	12	20	10	25	67
Sector 3	5	10	5	10	15
Value Added	15	25	10		
Output x	42	67	30		

Source: Own elaboration

Starting from this basic scheme and following equations (3.3) and (3.4), we break down value added into investment, $r\mathbf{Ax}$, and wage payments to three types of workers, $w_i T_i = \mathbf{p}'\mathbf{f}_{T_i}$. At the same time, the final demand will be broken down into the consumption corresponding to each type of worker, verifying $w_i = \mathbf{p}'\mathbf{f}_{T_i} \big/ T_i$.

In this model, the technical coefficients matrix and the direct labor coefficients vector are, respectively:

$$\mathbf{A} = \begin{pmatrix} 0.2381 & 0.1791 & 0.1667 \\ 0.2857 & 0.2985 & 0.3333 \\ 0.1190 & 0.1493 & 0.1667 \end{pmatrix} \; ; \; \mathbf{l}' = \begin{pmatrix} 0.2381 & 0.0746 & 0.5000 \end{pmatrix}$$

and as we also assume that L = 30, with 10 workers in sector 1, 5 workers in sector 2 and 15 workers in sector 3, employed in the following proportions:

$$(s_{ij}) = \begin{pmatrix} 0.6000 & 0.3333 & 0.1000 \\ 0.3000 & 0.3333 & 0.3000 \\ 0.1000 & 0.3333 & 0.6000 \end{pmatrix}, \text{ then the labor inputs are: } \begin{pmatrix} 6.0000 & 1.6666 & 1.5000 \\ 3.0000 & 1.6666 & 4.5000 \\ 1.0000 & 1.6666 & 9.0000 \end{pmatrix}$$

so, the labor productivities are (4.2, 13.4, 2.0), with the highest productivity in sector 2, followed by sectors 1 and 3.

Now, for disaggregating consumption, we assume a wage structure for each sector in the following proportions: 1: 3: 5, from the lowest level of qualifications to the highest one. Then, we take the following 'subjective' consumption patterns for each type of worker:

$$(c_{ij}) = \begin{pmatrix} 0.6000 & 0.3333 & 0.2000 \\ 0.3000 & 0.3333 & 0.4000 \\ 0.1000 & 0.3333 & 0.4000 \end{pmatrix}$$

Finally, we can calculate true consumption by type of consumer and sector in all scenario, using a balancing (updating) method (Junius & Oosterhaven, 2003; Lenzen et al., 2007). Note that the proportions of the 'effective' consumption pattern can in fact differ from those of the 'subjective' one, because the balancing method assures in all of our scenarios the equilibrium conditions: supplies equal demands for all products.

If $r = 0$, final demand (which changes with *r*) for each type of worker *j* are given by:

$$(\mathbf{f}_j) = \begin{pmatrix} 4.1876 & 5.7811 & 5.0313 \\ 2.9182 & 8.0573 & 14.0245 \\ 0.4219 & 3.4949 & 6.0832 \end{pmatrix}$$

Finally, once we know final demands by worker type and sector, we can calculate the coefficients matrix of worker's final demand, $\mathbf{B} = \mathbf{f}_{T_1} / T_1 \, \mathbf{t}_1' + \mathbf{f}_{T_2} / T_2 \, \mathbf{t}_2' + \mathbf{f}_{T_3} / T_3 \, \mathbf{t}_3'$, which is, for $r = 0$:

$$\mathbf{B} = \begin{pmatrix} 0.1206 & 0.0378 & 0.2468 \\ 0.1369 & 0.0597 & 05084 \\ 0.0462 & 0.0236 & 0.2159 \end{pmatrix}$$

3.5.2. The relationship between r and w in our specific model

Now, we are running some simulations for our model with different rates of profit, whose feasible values (non-negative wages) range from 0 to 0.55, in order to confirm the decreasing relationship between wages and profits, which we have previously proved from a formal point of view. If the rate of profits rises, so does the rate of growth, and thus value added available for paying wages decreases. This reduction, jointly with the condition of equilibrium between supply and demand for each good, provoke changes in each type of worker's compositions of final demand. Then, their effective consumptions change, even when they are keeping their preferences unchanged.

The results obtained are shown in Table 3.1 below. Column (1) shows the uniform rate of profit. Column (2) shows the weight of profits over total value added, while column (3) shows labor shares over total value added - or what we could call the wage rate *w*.

Average wage, as shown in column (4), is calculated by dividing the total wage bill by the total number of workers. Column (5) shows the weight of type 3 workers' wages over total wages. Finally, column (6) shows the value of parameter ω, which is equal to 1 in these simulations. We carry out our simulations until the rate of profit reaches its technical maximum value, $R = 1.5609$, which is obtained from equation (3.4) when $\mathbf{B}_L = \mathbf{0}$.

Table 3.1. Relationship between *w* and *r* in the specific model

r (1)	**Profits/VA** (2)	*w* = **Wages/VA** (3)	$\bar{w}$ (4)	$w_3 T_3 \Big/ \sum_i w_i T$ (5)	ω (6)
0.00	0.00	100.00	1.67	50.28	1.0000
0.05	8.90	91.10	1.52	50.24	1.0000
0.10	17.80	82.20	1.37	50.20	1.0000
0.15	26.70	73.30	1.22	50.14	1.0000
0.20	35.60	64.40	1.07	50.07	1.0000
0.25	44.50	55.50	0.93	49.97	1.0000
0.30	53.40	46.60	0.78	49.85	1.0000
0.35	62.30	37.70	0.63	49.65	1.0000
0.40	71.20	28.80	0.48	49.34	1.0000
0.45	80.1	19.90	0.33	48.76	1.0000
0.50	89.0	11.00	0.18	47.22	1.0000
0.55	97.90	2.10	0.04	32.67	1.0000

Looking at Table 3.1, we first perceive a decreasing relation between wages and profit rates, as was expected. Columns (3), (4) and (5) show decreasing values while the rate of profit increases, confirming our conjectures in this respect, and the formal results obtained in the previous section. Column (3) shows the clear contradiction between the rate of profit *r* and the labor share *w*. When profits are null, labor share reaches a 100%; while when the rate of profit is 0.55, a value close to the maximum *R*, the labor share is close to 0%. Column (4) shows that the decreasing relationship is true even if we consider average earnings. Finally, column (5) reveals that even the group of more qualified workers[4] suffer wage losses when the rate of profit increases – furthermore, workers of this type suffer the relative smallest losses when the rate of profit rises, and then the losses

[4] It is an assumption of the model that high-skilled workers are those with higher wages. This could be considered a general situation, but other different wage structures could be imposed.

of medium and low-skilled wages should relatively fall more. However, as it is probable that this decreasing relationship holds in very specific conditions and that structural changes in the model could weaken it, a further analysis in this direction might be necessary.

3.5.3. Consumption patterns and the primary income distribution

In this context, another question of importance is the workers' consumption patterns y and their influence as distributive mechanisms of income distribution. Undoubtedly, changes in income distribution alter the agents' capacities of consumption. Thus, it could be assumed that consumption patterns may be a representation of a secondary distribution of income. Now, we are focusing on to what extent the structure of consumption can alter the primary distribution of income, that is, labor and capital shares. We are doing so in a model that does not have any explicit mechanisms of redistribution.

Then, we try different scenarios to test the effects of changes in worker's consumption patterns on primary distribution. We run four different scenarios (three plus the base one) on consumption patterns. The baseline scenario is the previously described. In the first scenario, type 3 workers prefer good 1, while the other workers keep the same proportions as in the baseline case. In the second one, workers 3 prefer the good 2; and in the third one, the preference is for good 3. These scenarios are interesting because we test there the behavior of the type of workers that have higher earnings (type 3), and sectors 2 and 3 present the highest and lowest labor productivities, respectively. All scenarios are run for growth rates from 0 to 0.45. It should be remarked that in all simulations, sectoral productivity does not change, as it happens with total output, and the number of workers of each type and sector. Moreover, note that we are obtaining labor shares valued by prices **p** defined in (3.4).

For a better understanding of the results, we need to explain the concept 'labor shares valued at **p**', which are defined as: $\left(\sum_{1}^{n}\mathbf{p}'\mathbf{f}_{T_i}\right)\Big/\mathbf{p}'\mathbf{v}$, with **v** being the value added vector, and $\mathbf{p}'\mathbf{f}_{T_i} = w_i T_i$ the total wage payment to workers *i*. This is the labor share when consumption and purchasing power are considered. Although prices in the baseline scenario are not unitary, as in an input-output table, this is not relevant, as we could always modify and make equal to unity the quantity of the good we are establishing as numeraire. In this case, prices in the tables are equal to those in (3.4). Bearing this in

mind, changes in prices in the other scenarios are collecting changes in values, so this can justify the use of 'labor shares valued at **p**'.

Table 3.2 below shows the results for the different simulations. In the second column, the results from baseline scenario are shown. In the third, fourth, and fifth columns, we see the **p**-valued labor shares for Scenarios 1, 2, and 3. These four scenarios have different prices changing the worker purchasing power. Finally, the last column shows the percentage change between Scenarios 2 and 3. Remember that goods 3 and 2 have the lowest and highest labor productivities, respectively.

Table 3.2. Labor shares with different consumption patterns

Profit rate *r*	Baseline scenario	Scenario 1: workers 3 prefer good 1	Scenario 2: workers 3 prefer good 2	Scenario 3: workers 3 prefer good 3	Difference between Scenarios 3 and 2
	Labor shares	Labor shares	Labor shares	Labor shares	% change
0.00	100.00	100.00	100.00	100.00	0.00
0.05	90.91	90.80	90.85	92.70	2.03
0.10	81.86	81.69	81.77	84.87	3.80
0.15	72.84	72.65	72.75	76.57	5.25
0.20	63.86	63.69	63.78	67.84	6.37
0.25	54.91	54.77	54.85	58.76	7.12
0.30	45.99	45.91	45.96	49.41	7.50
0.35	37.11	37.09	37.10	39.89	7.51
0.40	28.26	28.29	28.27	30.30	7.19
0.45	19.45	19.51	19.45	20.73	6.61

Source: Own elaboration

Scenario 3 presents, for all values of *r*, the highest labor shares. If we compare Scenarios 3 and 2, as shown in the last column, the percentage changes in labor shares are significant; preferences for good 3 yield labor shares that are more than 5% higher for $r > 0.15$, compared to Scenario 2, which is very surprising when changes of 1% are economically significant. We have a similar result comparing Scenarios 3 and 1. Hence, it seems clear that the destination of expenditures is key in the process of distribution and the relevant role played by productivity in these differences. As a possible example, we can think about the change in eating habits that took place during the first half of the twentieth century when industrial production of poultry was introduced, with its subsequent cheapening. In fact, these changes in the value of certain bundles of commodities could be a key for explaining the development of new consumption patterns that result in the establishment of new class structures in society.

It is an expected result, a lower productivity implies higher prices for the good 3, as we can see in Table 3.3. Therefore, when workers 3 prefer to consume good 3, they consume more expensive goods, and its valued labor share should be higher.

Table 3.3. Prices for different uniform rates of profit

Profit rate *r*	Good 1	Good 2	Good 1	Sum
0.0	0.28	0.23	0.50	1.00
0.05	0.28	0.24	0.48	1.00
0.10	0.29	0.24	0.47	1.00
0.15	0.29	0.25	0.46	1.00
0.20	0.30	0.26	0.44	1.00
0.25	0.30	0.27	0.43	1.00
0.30	0.31	0.28	0.42	1.00
0.35	0.31	0.29	0.40	1.00
0.40	0.32	0.29	0.39	1.00
0.45	0.32	0.30	0.38	1.00

Source: Own elaboration

Undoubtedly, the changes of valued labor shares also depend on other variables, for example, the growth rate *r*, the worker consumption preferences, and the equilibrium conditions. Effective consumptions explain the similar results of Scenarios 1 and 2. However, productivity has always a significant influence; for checking this, we have run all simulations assuming a productivity equal to 4 for all sectors, then the differences between Scenarios 2 and 3 fall around 50% for the two highest values of *r*.

Another conclusion extracted from previous results is that we can confirm a certain theoretical weakness in Sraffa's (1960) wages-profits relationship[5]: $w = 1 - r/R$; where *w* is the wage rate, *r* is the rate of profits, and *R* is the maximum rate of growth. This is one of the most used theoretical results when defending the existence of an inverse relation between wages and profits. But, at the same time, it can be interpreted that, given a determined technology characterized by *R*, *r* determines *w*, without leaving room in the explanation for the consumption pattern implicit in the rate of profit. However, we have

[5] Income distribution between capital and labor is analyzed, in Sraffa (1960), through the following well-known equation: $w = 1 - r/R$, where *w* represents wages, once the net national income and the total labor force are normalized to unity, $R\mathbf{p}'\mathbf{Ax} = 1$ and $\mathbf{l}'\mathbf{x} = L = 1$. The equation is obtained for an output that maintains the proportions of the standard commodity, which coincides with that of the right-hand eigenvector of matrix $\mathbf{A}$. Equation can be easily proved as seen below:

$$\left.\begin{array}{c}\mathbf{x} = \mathbf{Ax} + R\mathbf{Ax} \\ \mathbf{x} = \mathbf{Ax} + r\mathbf{Ax} + w(R\mathbf{Ax})\end{array}\right\} \Rightarrow R\mathbf{Ax} = r\mathbf{Ax} + w(R\mathbf{Ax}) \Rightarrow R = r + wR \Leftrightarrow w = 1 - \frac{r}{R}$$

seen that the influence of consumption pattern cannot be negligible and, thus, the previous relation should be carefully addressed, being aware of the special theoretical conditions in which it was obtained.

3.5.4. Technological change and income distribution

It seems clear that any analysis of distribution cannot be complete without considering technological change. Technical change is related with distribution in the sense that, as the maximum growth capacity of an economy and its net output increase, the rules that determine the way that this increment is distributed can be subject to changes. The rents that are derived from technological change can be distributed in a way that both capital and labor shares of income increase at the same time – thus, breaking the inverse wages-profit relation and opening a gate for cooperation. As it is well known, Marx's famous 'law of the falling tendency of the rate of profit' has been largely refuted, mainly due to the influence of technological change (Okishio, 1961; Vegara, 1977).

In our case, these technical changes are reflected in the augmented input coefficients matrix **M** – equation (3.9) clearly shows the formal relationship between changes in this matrix and the rate of proftis. Therefore, in this subsection we are running some different scenarios of technological change that reflect in labor productivity. In Scenario 1, we study the effect of a reduction in the direct labor coefficient of sector 1 of a quantity $l_1' = \frac{l_1}{(1+3r)}$. In Scenario 2, we apply the same modification in sector 2. Meanwhile, Scenario 3 will focus in the effects of such a change in sector 3. Finally, in Scenario 4, we apply a technological change that increases labor productivity in all sectors simultaneously, but in this case each sector will experience a reduction of a quantity $l_i' = \frac{l_i}{(1+r)}$ We will then proceed to compare the resulting distributions of income in each scenario. Table 3.4 below shows a summary of the results (see Table 3.1 to compare with the initial case), assuming no changes in initial prices.

Table 3.4. Relationship between *w* and *r* in the presence of technological change

r	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
	Wages/VA	$\bar{w}$	$\frac{w_3 T_3}{\sum_i w_i T}$	**Wages/VA**	$\bar{w}$	$\frac{w_3 T_3}{\sum_i w_i T}$	**Wages/VA**	$\bar{w}$	$\frac{w_3 T_3}{\sum_i w_i T}$	**Wages/VA**	$\bar{w}$	$\frac{w_3 T_3}{\sum_i w_i T}$
0.00	100.00	1.67	50.28	100.00	1.67	50.28	100.00	1.67	50.28	100.00	1.67	50.28
0.05	91.10	1.59	49.16	91.13	1.63	50.61	91.07	1.56	50.95	91.10	1.59	50.24
0.10	82.18	1.49	48.12	82.33	1.58	50.90	82.08	1.45	51.56	82.20	1.51	50.20
0.15	73.26	1.39	47.16	73.58	1.50	51.15	73.03	1.33	52.11	73.30	1.40	50.14
0.20	64.34	1.27	46.27	64.86	1.41	51.37	63.93	1.19	52.58	64.40	1.29	50.07
0.25	55.41	1.13	45.42	56.18	1.29	51.55	54.78	1.05	52.95	55.50	1.16	49.97
0.30	46.47	0.98	44.62	47.53	1.15	51.69	45.59	0.90	53.21	46.60	1.01	49.85
0.35	37.53	0.82	43.83	38.90	0.99	51.81	36.36	0.73	53.28	37.70	0.85	49.65
0.40	28.59	0.65	43.03	30.30	0.81	51.87	27.10	0.56	53.01	28.80	0.67	49.34
0.45	19.64	0.46	42.13	21.71	0.61	51.84	17.80	0.38	51.89	19.90	0.48	48.76
0.50	10.69	0.26	40.77	13.14	0.38	51.57	8.46	0.18	47.22	11.00	0.28	47.22

We focus first in labor shares. It can be seen that labor shares are slightly higher when a technological change of this kind takes place in sector 2 (Scenario 2), which is the most productive sector. In short, it seems that increasing productivity in sectors with high labor requirements per unit of output might be more attractive from the point of view of the entrepreneur, as it allows capital shares to increase. This could be an interesting mechanism to promote productivity increases in low-productivity sectors. Scenario 4 shows the different effect on labor shares depending on productivities: when a simultaneous and equal technological change takes place, it does not modify the income shares held by each factor. This also leaves room for further theoretical and empirical research, which is necessary for establishing the influence and weight of changes in productivities, in a process of technological change.

Let us note that this is also compatible with what was seen in the previous subsection, where higher shares were associated to the fact that workers were consuming goods with lower productivities. Hence, if the entrepreneur increases productivity in goods destined to consumption, especially in those which are less productive, this would increase his rate of profit in detriment of labor shares.

In respect with average wages, it can be noted that sectoral technological changes are always positive, as these increase average earning in all cases. This could shed some light

over the well-known debate of whether technological change is positive or negative for workers, at least from the point of view of payment, if not of employment. If we focus now on the relative earnings of high-skilled employees, these only decrease in Scenario 1, which is reasonable, as sector 1 employs type 3 workers in a small proportion. Again, Scenario 4 does not show any changes in this column.

As a final comment, it should be underlined that we have not analyzed important aspects of how technological changes could affect the relationship between wages and profits. We have assumed that all value added not destined to investments, ($r\mathbf{Ax}$), corresponded to labor compensation. However, the real criteria regarding the distribution of the surplus can be diverse. As we saw in Chapter I, these crucially depend on the institutional and structural framework, thus including consumption. It is then possible that technological change could modify this relation, or even weaken it, as we have seen that a simultaneous increase in capital shares and average wages can take place in our model, and so the situation of workers and entrepreneurs can improve at the same time. Thus, further research should involve a deeper analysis in order to clarify how the distributive variables relate in a context of innovation.

3.6. Concluding remarks

The aim of this chapter was to model and deepen into the topic of income distribution taking into account the social, institutional, and technical structures which we believe to be an essential part of real economies. For these aims, we have focused on primary distribution of income, between workers and other agents, and how it relates to consumption and technological change.

Taking Steenge and Serrano (2012) model as a guideline, we have constructed a multisectoral model with quantities and prices equations, adding some extensions, such as the introduction of heterogeneous labor and wages, and different consumption patterns. Fort he simulations, the specific model contains three sectors, three types of workers, and three different consumption patterns associated to each labor type

In this extended model, the ‘classic’ conflict between wages and profits still holds, by the obtention of a novel formal proof. Moreover, we have developed a formal proposition for expressing the relationship between the uniform rate of profit and each one of the parameters of the model (intermediate inputs, labor, and subsistence consumption). The

proposition allows to show the inverse wages-profits relationship in an ample set of conditions. Particularly, the inverse relation has been confirmed in the specific 3x3 model we have defined.

We were also interested in the impact that the different components of demand could have over distribution and, specifically, on the wage-profits relationship. The obtained proposition incorporates consumption with different patterns and can be generalized to also include the rest of the components of final demand. Thus, this proposition could also serve a purpose for opening new research lines, as it could be used for reaching a better understanding of entrepreneurs' behavior and the role of consumption patterns or different types of demand on income distribution.

We have designed scenarios including changes in consumption patterns, in order to check what consumption structures favor a more egalitarian distribution. Basing our analysis in the changes in prices that are associated to the different structures of workers' consumption, we have shown that, for a given rate of profit/growth, labor shares can sensitively vary. In our specific model, we have obtained, for similar initial situations, differences in r of more than a 5%, for high values of the rate of profit. In short, consumption structures can play an important role in the primary distribution of income. Although productivity might not be the only factor affecting distribution via consumption, it has non-negligible effects: facing changes in consumption patterns, labor shares tend to be higher when these changes consist of a higher consumption of low-productivity goods.

Finally, we have analyzed the sectoral effects of a labor-saving technological change, finding that both workers and entrepreneurs can be better off at the same time, which might be an indication that innovation could weaken the classic conflict between wages and profits. On the one hand, we have seen, in our specific model, that a technological change of this kind yields a more favorable distribution to workers when the innovation is applied in sectors that are more productive; whereas labor shares over total value added are lower when the innovation is applied in sectors with high labor requirements per unit of output. On the other hand, a case of balanced technological change, that is to say, that takes place simultaneously in all sectors and in the same conditions, does not yield changes in the distribution of income between workers and entrepreneurs. Then, a more exhaustive analysis in relation to the effects of technological change on the primary distribution is required.

3.7. References of Chapter III

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Chapter IV: Income distribution, inequality, and social stratification: a Structural Decomposition Analysis for Spain, 1980-2014.

After the theoretical inquiries performed in the previous chapters, we now move on to the empirical part of the dissertation. In Chapter II we have determined the two different regimes of income distribution that have taken place during the last century, noticing that there might a structural break around 1975, bringing about generalized increases in inequality in several developed countries. Meanwhile, in Chapter III, we have found some theoretical factors that modify the distribution of income. Among these, the drivers of this said increasing inequality might be found. Thus, an empirical study of income distribution in this line should take into account the primary distribution between labor and capital, heterogeneous labor, and consumption patterns, all this inserted in a given technological-institutional framework. In short, the stratification of labor and consumption as possible sources of inequality are going to be object of our analysis here.

Furthermore, we will link the concept of inequality to that of social stratification. Any given distribution of income that is not egalitarian will yield different levels of income for specific parts of the population. If these different incomes persist and are related to any characteristics of said population (namely, their labor skills, their age, or their gender), this will crystalize in social stratification. To study to what extent the Spanish society is stratified, and how this affects the evolution of inequality, we will apply a Structural Decomposition Analysis for different categorizations of labor and consumption. In short, in Chapter IV, we are focusing on Spain as a representative case of what might happened in developed countries during our second wave or sub-period, in terms of their internal levels of inequality. It presents the advantages of being a country in which the 2008 crisis hit especially hard in the social area, due to its structural and institutional characteristics. As a logical continuation, in Chapter V, we will open these analyses of income distribution to a global perspective, taking into account inequalities between countries, as well as considering again intra-country levels of inequality.

4.1. Introduction

Since the end of World War II, developed countries have experienced a clear exponential economic growth, until the beginning of the Great Recession in 2007-2008. However, it

is not clear whether this economic growth has gone hand in hand with decreases in social inequalities within countries or, on the contrary, has fostered disparities. Indeed, there is a huge debate in economic literature concerning this topic.

In this context, several studies claim that the recent evolution of inequality has been U-shaped, with inequality increasing from the 1970s (Alderson & Nielsen, 2002; Bluestone & Harrison, 1988). Besides, other authors consider that these increases in inequality have been especially intense from the 1990s onwards (Attanasio & Pistaferri, 2016; Corak, 2013; Piketty, 2020; Tridico, 2018). In short, there seems to be a consensus regarding the increases in internal inequalities in developed countries during the last four decades, but this is not so true in the case of the possible explanations that might be behind this phenomenon.

Concerning explicative causes, some papers focus on factors related to the flexibility of the labor market (Blundell et al., 2018, ILO & OECD, 2015). Apparently, since the 1990s, labor mobility increased, favoring inequality among different categories or stratification of labor. In that sense, the relative increase in high-skilled workers, many of them associated with automation and development of high-skilled services, played a role in creating higher disparities between high and low-skilled compensations (Acemoglu & Restrepo, 2018; Castellano et al., 2016; Yang & Gao, 2018). Besides, low-skilled workers are usually the most affected during a crisis period, such as the ongoing pandemic (Deaton, 2021). All of this has favored social stratification and income disparities. It is also important to differentiate inequality in consumption from inequality in income, although both are strongly correlated. It is clear that income inequality directly or indirectly affects both the levels and the patterns of consumption (Aguiar & Bils, 2015), and can generate further stratifications in this sphere. Moreover, empirical evidence supports the notion that consumption might be a better measure of well-being than income (Meyer & Sullivan, 2003, 2012). However, the evolutions of income and consumption inequalities can differ as, namely, in the USA, they evolved in opposite directions after 2006 (Meyer & Sullivan, 2013, 2017). Additionally, other factors that might explain these inequalities are public expenditures, financialization or globalization (Atkinson, 2003, Munir & Bukhari, 2020).

As for the consequences of this recent increasing inequality, it seems to have led to a higher stratification of societies. That is, the differences in income among different groups of population is increasing along time. Namely, in this line Frick & Goebel

(2008) conclude that interregional inequalities in Germany are due to a higher territorial stratification, with lower social classes appearing in a higher concentration in the east. Castellano et al. (2016) analyze inequality and stratification in labor incomes in Portugal and Italy, using a decomposition of Gini indexes. Besides, Goldthorpe (2010) also discusses the role of social strati in explaining income inequality, concluding that it is a key topic and that it is urgent to include it in the analysis of inequality.

Spain has been one of the European countries[1] with the strongest increases in inequality in the last two decades (Gradín, 2002), reason by which it seems to be a good case to go further in the analysis of inequality. In this context, the main aim of this chapter is to to analyse the stratification of the Spanish economy as a way to explain its increasing inequality. Our analysis is carried on at macro-level and covers the years 1980-2014, a period with an average growth rate above 2%. This period also covers the years of the consolidation of democracy in Spain, as well as its incorporation into the EU in 1986. We will focus our analysis both on labor incomes and consumption levels, decomposing wages and employment by skills and gender, and consumption patterns by income quintiles. We will use Sen and Gini indexes as inequality measures.

To achieve our aim, we use an input-output framework. In particular, we will apply a Structural Decomposition Analysis (SDA) to annual changes in value added, which, to the best of our knowledge, has not been used so far to analyze inequality[2]. The SDA shows the contribution or effects of technology, labor, capital, and final demand to changes in value added and, thus, to income distribution. Both the absolute and relative values of these effects are significant, since the sum of all of them is equal to value added changes. Let us note that the consumption effects are not independent of the other effects. This will allow us to obtain the contribution of each stratus (by skills, gender, and consumption patterns) to economic growth, from where we can extract possible explanations to the evolution of inequality in Spain during our period of study. Besides, in each labor stratus, labor costs will be decomposed in wages and employment to analyse which factor drives inequality in terms of labor. Moreover, our analysis is done for the whole economy and by sectoral blocks, because their evolutions are sometimes very different from the global one (Lambert & Aronson, 1993).

[1] In Germany, for example, it has also increased (Biewen & Seckler, 2019).
[2] Input-output model has been previously used in inequality studies, such as in Parteka & Wolszczak-Derlacz (2015), but not the SDA, up to our knowledge.

This chapter is structured as follows. In Section 2, we will present a literature review in relation to economic growth, inequality and its factors, and stratification. We will continue in Section 3, explaining the methodology used. That is, the construction of the time series input-output tables for Spain from 1980 to 2014, and the disaggregation of the SDA. In Section 4, we will introduce a brief analysis of inequality in the Spanish economy using input-output data, supported by Gini and Sen indexes. Results for estimations of a price equation will also be presented, which will allow us to deepen in the distribution of income. We will present the results from the SDA in Section 5, confirming some of the trends previously commented. We will finish drawing some conclusions in Section 6.

4.2. Literature review

As it was commented in the Introduction, it is clear that, from the 1990s until the beginning of the economic crisis of 2008, most developed countries have experienced a great economic growth (Chiarini et al., 2020, Jiménez et al., 2017, Todaro & Smith, 2020). However, there is not a consensus about the connection between economic growth and inequality. Part of the economic literature shows a positive correlation between both variables (Chen & Ravallion, 2013, Ferreira & Ravallion, 2009, Škare & Druzeta, 2016). Other part of the literature links decreases in inequality with sustainable economic growth (Berg & Ostry, 2017). However, many papers have empirically analyzed the evolution of inequality in the last decades, observing a clear increasing trend for several countries (Piketty & Saez, 2014, Wahiba & El Weriemmi, 2014), as well as detecting structural breaks since the 2008 crisis.

The question that now arises is: why has inequality recently increased despite the economic growth experienced? Economic literature has tried to answer these questions, but without a clear agreement. From the perspective of primary distribution of income, ILO & OECD (2015) claim that inequality has increased from the 80s in most developed countries due to the increasing capital shares of income. In the same line, Alvaredo et al. (2013) show that increasing capital shares of income can be a possible factor of the income increase of the top 1%. In terms of labor, wages differences have been extensively studied. Card & DiNardo (2002) analyzed the effect of technological changes on employment and the unequal distribution of wages. Cunha & Heckman (2007) focus on the heterogeneity of employment and its relation with income

inequality, observing a positive correlation. Da Silveira & Lima (2021) show wage inequalities as a key factor even to be considered as a driver of productivity changes. In this chapter, we will also find a positive correlation between inequality and labor productivity.

All these inequalities lead to a stratification of the economies. Stratification or the division of the economy in social classes has been mainly studied from the perspectives of sociology, health, or education (Kim et al., 2016; Kusow & Eno, 2015; McLeod, 2013; Yi et al., 2021). We can also find some economic literature that studies stratification decomposing Gini indexes with overlapping techniques (Monti & Santoro, 2011). In general, it seems the lower the overlapping (the higher the stratification), the higher the inequality (Yitzhaki & Lerman, 1991). Thus, Castellano et al. (2016) show that gender and labor skills can generate different kinds of stratification in labor. This will be one line of analysis in this chapter.

Consumption patterns are also considered a good representation of stratification (Ciarli et al., 2010), and thus will also be analyzed here. For instance, Meyer & Sullivan (2013, 2017) show that inequality in consumption in the USA until 2006 is explained by the increasing gap between high and low quintiles. However, from 2006 onwards, it changes and inequality is mainly explained by the evolution of the top 50% incomes. That is, the medium class disappears, while the top 1% gets richer (Ravallion, 2016).

Spain is a good representation of what had happed in other countries (Anghel et al., 2018). Indeed, as Gradín (2002) claims, Spain has always had a great polarization. Broadly speaking, most papers of the literature focus on regional inequalities (Díez-Minguela et al., 2018; Martínez-Galarraga et al., 2015; Tirado et al., 2016). Thus, this chapter contributes to getting more insights about inequality and stratification at a national level, considering distinctions in labor and consumption. The SDA, apart from Sen and Gini indixes, is the key instrument of our analysis. Indeed, we consider a long period, 1980-2014, which will allow us to differentiate the evolution of income by its five significant periods and conect with the recent debate. That is, Almeida et al. (2021) and Clark et al., (2021), among others, find a fall in inequality during the COVID-19 pandemic for four European countries.

4.3. Data and methodology

As previously stated, our general framework of analysis is based on input-output tables extended with disaggregated labor inputs and consumption patterns. In this section, first, we will briefly explain the construction of the series of input-output tables from 1980 to 2014, as well as the process of the disaggregation of labor and households' consumption. Second, the SDA will be explained.

4.3.1. Constructing annual Spanish input-output table series for 1980-2014

The original data used to construct the tables were extracted from EORA database (Lenzen et al., 2013), as it fully covers the period analyzed. Initially, we have the information in supply and use tables (SUTs), that must be transformed into symmetric input-output tables (SIOTs). Supply tables show the commodities that each sector produces, as well as imports, and, in this case, follow the structure of a (119x76) commodity-by-industry matrix. Use tables show which sector or industry is consuming each commodity to be included in the production process, value added, and the components of final demand, presented here as a (119x76) commodity-by-industry matrix. Following Eurostat (2008) and Rueda-Cantuche et al. (2009), an industry-by-industry symmetric input-output table (where technological relations between industries are shown) is estimated using Model D, which assumes a *fixed product sales structure*. We choose Model D, which converts SUTs into an industry-by-industry SIOT, because the data used later for the disaggregation are also published by industries. Furthermore, as we focus on the sectoral structure of the economy, this approach seems to be coherent. We also perform a sectoral aggregation, reducing the original 76 industries to 8 sectors, according to the available data used to disaggregate labor and consumption. This sectoral aggregation is assigned following a technological classification, under the criteria established by the OECD (2017)[3].

Once we have these standard tables constructed, following the objective of this chapter, we proceed to disaggregate Labor costs and Households' consumption. To disaggregate Labor costs, some auxiliary data, which are not directly contained in the tables, are extracted from EUKLEMS database (van Ark & Jäger, 2017). These data are specifically

[3] PS: Primary sector, ES: Energy sector, HT&MHT: High and Medium-high Technology Industry, MLT: Medium-low Technology Industry, LT: Low technology Industry, C: Construction, HTS: High Technology Services, RS: Rest of services.

related to labor compensation, shares of total labor compensation, and of total hours worked by category of labor and number of workers. This allows us to disaggregate labor compensations by different categorizations. We obtain labor costs for three categories of labor in the case of skills: High-skilled, medium-skilled, and low-skilled workers; and for two groups in the case of gender: Male and female.

Concerning consumption patterns data, we used the Eurostat Household Budget Surveys, the Spanish 1980-2005 annual Household Budget Surveys, and the continuous 2006-2014 Surveys (INE, 2021). First, we retrieve from these surveys the different consumption patterns (the sectoral proportions of total consumption) associated to income quintiles. Then, we proportionally allocate total households' consumption to the weight of each category's compensation. Finally, a table-balancing GRAS algorithm (Junius & Oosterhaven, 2003; Lenzen et al., 2007) is applied and the resulting table yields the desired estimation, namely, households' consumption disaggregated by income quintiles.

See Table 4.1 below for a simplified structure of the resulting SIOTs.

Table 4.1. Structure of the disaggregated symmetric input-output tables

		Sectors			Final demand							
		Sector 1	….	Sector 8	1st quintile households' consumption	2nd quintile households' consumption	3rd quintile households' consumption	4th quintile households' consumption	5th quintile households' consumption	Gross capital formation	Government consumption	Gross exports
Sectors	Sector 1											
	…….											
	Sector 8											
Value added	Type 1 workers compensation											
	……											
	Type *k* workers compensation											
	Fixed capital amortizations											
	Net capital stocks profits											
Foreign sector	Imports											

Note: In the case of skills, $k = 3$ (High-skilled, Medium-skilled, and Low-skilled); and, in the case of gender, $k = 2$ (Male and Female)

4.3.2. Structural Decomposition Analysis

Here, we apply the structural decomposition to value added. Considering the well-known input-output equation system,

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{y} \Leftrightarrow \mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} \tag{4.1}$$

the value-added vector can be obtained as

$$\mathbf{v} = \hat{\mathbf{c}}\,\mathbf{x} = \left(\mathbf{w}'\hat{\mathbf{a}} + \mathbf{k}'\right)(\mathbf{I} - \mathbf{A})^{-1}\hat{\mathbf{y}}\,\mathbf{e} \tag{4.2}$$

where **v** is *n*x1 value-added vector, **c** the *n*x1 vector of value-added coefficients, **w** is the *n*x1 wage vector, **a** is the *n*x1 vector of labor input coefficients, **k** is the *n*x1 vector of capital payment coefficients, and **e** is a *nx1* vector of ones.

Value added changes can be divided into three parts: one associated with variations in the **c** coefficients (the primary factors effect), another reflecting the effect associated with changes in the technical coefficient matrix **A** (technical effect), and a third (demand effect) that captures changes in **y**.

As noted by in Dietzenbacher & Los (2000), and in Pei et al. (2012), there is a dependence problem between $\Delta\mathbf{c}$ and $\Delta\mathbf{(I-A)}^{-1}$. To solve it, we follow the same formulation as in Sánchez-Chóliz et al. (2021). That is, we substitute **A** by $\mathbf{\Omega(I-\hat{c})}$, where $\mathbf{\Omega}$ represents the technological structure of matrix **A** independently of **c**. Thus, expression (4.2) can be rewritten as

$$\mathbf{v} = \hat{\mathbf{c}}\mathbf{x} = \hat{\mathbf{c}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} = \left(\hat{\mathbf{w}}\hat{\mathbf{a}} + \hat{\mathbf{k}}\right)\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - (\hat{\mathbf{w}}\hat{\mathbf{a}} + \hat{\mathbf{k}})\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} \tag{4.3}$$

From here, we can decompose value added in five effects as shown in expression (4.4).

$$\begin{aligned} d\mathbf{v} = {} & d\hat{\mathbf{w}}\hat{\mathbf{a}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} + \hat{\mathbf{w}}d\hat{\mathbf{a}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} + d\hat{\mathbf{k}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} + \\ & \hat{\mathbf{c}}\,d\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} + \hat{\mathbf{c}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}d\hat{\mathbf{y}}\mathbf{e} = \\ & d\hat{\mathbf{w}}\,\hat{\mathbf{a}}\mathbf{x} + \hat{\mathbf{w}}\,d\hat{\mathbf{a}}\,\mathbf{x} + d\hat{\mathbf{k}}\,\mathbf{x} + \hat{\mathbf{c}}\,d\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}\hat{\mathbf{y}}\mathbf{e} + \hat{\mathbf{c}}\left[\mathbf{I} - \mathbf{\Omega}\left(\mathbf{I} - \hat{\mathbf{c}}\right)\right]^{-1}d\hat{\mathbf{y}}\,\mathbf{e} \end{aligned} \tag{4.4}$$

The first one is the wage effect and represents the contribution of changes in wages to variations in value added. The second one is the labor effect. It reflects the contribution of changes in employment coefficients to variations in value added. As the calculi are done with the coefficient of labor respect to output, negative values can show increases in productivity. The sum of both yields the labor cost effect. When this effect is negative

can be interpreted as savings in labor costs due to, for instance, innovations. In that sense, we can achieve the same interpretation from the third (capital) effect: a negative value can also be interpreted as a capital-saving innovation. The fourth one is the technological effect which shows the contribution of changes in technology inputs (that is, in the coefficients of matrix **A**) to changes in value added. The last effect is the final demand effect.

Taking the information in our annual tables, we decompose both labor and wage effects, into three categories in the case of skills, and two in the case of gender. In other words, when we decompose by skills, we will have low-skill, medium-skill, and high-skill wage and labor effects. The sum of the three labor cost effects yields the total labor cost effect. The same applies in the case of gender, where we distinguish between male and female. As we also have information of consumption by quintiles, we divide the final demand effect into six; five related to consumption quintiles, being Q1 the poorest and Q5 the richest, and the last one being a "rest" that includes factors such as government consumption, capital stock or exports. All this allows us to know the contribution of each quintile group to value added growth and their links with social stratification.

As we are working with discrete data, following Dietzenbacher & Los (1998), we calculate the average of the two polar solutions as a commitment, to obtain our final results.

4.3.3. Prices model and uniform rates of profit

The traditional demand-driven Leontief model does not explicitly consider profit rates because neither capital stocks nor the sectoral destination of capital goods are considered. However, these rates are important elements of income distribution, as it was made clear by Sraffa (1960), Pasinetti (1977) and other researchers that have focused on multisectoral models. Furthermore, these models usually consider variations in prices because these are important for income distribution analyses. Let us also remember the results obtained in Section 3.5.3 for a specific model. To see in our models the links between prices and distribution, we have obtained a system of prices for each one of our tables, as well as estimations of the rates of profits assuming a uniform profit rate.

In the multisectoral models literature, as in Morishima (1973), we find price equations as the following:

$$\mathbf{p}_t' = (1 + r_t)\,\mathbf{p}_t'\,\mathbf{A}_t + w_t\,\mathbf{l}' \Leftrightarrow\ \mathbf{p}_t' = w_t\,\mathbf{l}'(\mathbf{I} - (1 + r_t)\mathbf{A}_t)^{-1} \qquad (4.5)$$

where r_t would be the uniform rate of profits and w_t is a uniform wage rate. Nonetheless, this equation is excessively schematic, as it does not include significant aspects as labor and wage heterogeneity, capital stocks, amortizations, investments, and capital stock retributions.

To incorporate labor costs and labor heterogeneity here, if $\mathbf{s}_i' = \left(s_{i,j}\right)$ are the retributions to type *i* labor in sector *j* ($i = 1,\ldots,m$), and $\mathbf{c}_i$ are the unitary consumption patterns of type *i* workers, we may assume that the contribution of labor costs to the prices vector $\mathbf{p}_t$ will be: $\mathbf{p}_t^{'}\left(\sum_{i=1}^{m}\mathbf{c}_i\,\mathbf{s}_i'\right)$.

To include capital amortization costs, we will use the amortization coefficients vector $\mathbf{m}_t$, obtained from the tables, and the sectoral capital stock coefficients matrix $\mathbf{K}_t = \left(k_{i,j}\right)$; with $k_{i,j}$ being the capital stock of good *i* that is necessary for producing a unit of good *j*. The latter is obtained from EUKLEMS data, which offers information about Nominal Capital Stocks by 10 types of assets, which are further aggregated to our sectoral classification, in order to obtain capital stock matrices for each year.

After obtaining $\mathbf{K}_t$[4], the contribution of amortizations costs to prices is given by $\mathbf{p}_t^{'}\mathbf{K}_t\,\hat{\mathbf{m}}_t$. On the other hand, $\mathbf{K}_t$ allows us to know the retributions to capital stocks, once we assume that the rate of profit is uniform and equal to r_t, and those will be $r_t\,\mathbf{p}_t^{'}\mathbf{K}_t$.

Finally, to include the annual cost of domestic investment flows, we use the net capital formation vector (gross capital formation vector $\mathbf{f}_{k,t}$ minus sectoral amortizations given by $\mathbf{K}_t\,\mathbf{m}_t^{'}$). This demand represents the domestic investment flows that will be annually incorporated into the capital stock. To distribute this demand vector over our 8 sectors, we will define matrix $\mathbf{T}_t$, obtained using a similar procedure to that in Södersten & Lenzen (2020) for the inclusion of capital flow matrices not distinguishing between

[4] We can now check if our estimations can be taken as valid. Summing in columns, we obtain sectoral capital stocks, and the sum of these elements would obviously yield the total capital stock. In real economies, the value of this total stocks usually oscillates between 1.5 and 4 times total value added (Kuznets, 1961). According to our yearly estimations, our total ratios are between 2.69 and 3.46, which would be acceptable values.

capital goods and other types of goods. In analogy to how we constructed the capital stock matrices, we use the EUKLEMS Capital Input Data (van Ark & Jäger, 2017), which contains sectoral Nominal Gross Fixed Capital Formation for 10 different assets, and we construct a matrix $\mathbf{T}_t$ according to the asset-sector correspondence. The contribution of this component to the prices vector is $\mathbf{p}_t^{'}\hat{\mathbf{f}}_{k,t}\mathbf{T}_t$.

In short, the prices equation we suggest is the following:

$$\begin{aligned}&\mathbf{p}_t^{'}=\mathbf{p}_t^{'}\mathbf{A}_t+\mathbf{p}_t^{'}\left(\sum_{i=1}^{m}\mathbf{c}_i\,\mathbf{s}_i^{'}\right)+\mathbf{p}_t^{'}\mathbf{K}_t\,\hat{\mathbf{m}}_t+r_t\,\mathbf{p}_t^{'}\mathbf{K}_t+\mathbf{p}_t^{'}\hat{\mathbf{f}}_{k,t}\,\mathbf{T}_t\\&\Leftrightarrow\mathbf{p}_t^{'}=\mathbf{p}_t^{'}\left(\mathbf{A}_t+\left(\sum_{i=1}^{m}\mathbf{c}_i\,\mathbf{s}_i^{'}\right)+\mathbf{K}_t\,\hat{\mathbf{m}}_t+r_t\,\mathbf{K}+\hat{\mathbf{f}}_{k,t}\,\mathbf{T}_t\right)=\mathbf{p}_t^{'}\,\mathbf{M}\end{aligned}\tag{4.6}$$

Equation (4.6) will then be used to obtain r_t, when the Frobenius root is equal to unity (note that the prices vector is the left-hand Perron-Frobenius eigenvector of **M**).

4.3.4. Specific measures of inequality: Gini and Sen indexes

From the tables disaggregated by skills (three types of workers) and gender (two types of workers) on the one hand, and consumption quintiles on the other hand (so there are two tables for each year), Gini and Sen indexes can be applied. For our estimations, we use a standard formulation of Gini index, following a similar procedure to that in Alonso-Villar and del Río (2010):

$$G=\left|1-\sum_{k=0}^{k=n-1}\left(X_{k+1}-X_k\right)\left(Y_{k+1}+Y_k\right)\right|\tag{4.7}$$

where Y_k represents the accumulated proportion of labor compensation/consumption up to labor category/income quintile *k*, while X_k stands for the accumulated proportion of population up to labor category/income quintile *k* (while *n* takes the value of 2 for gender, 3 for skills, and 5 for consumption. Thus, three types of Ginis are calculated: two using labor compensations for our two labor categorizations, and another one for households' consumption.

In the case of the Sen index we construct a global inequality index inspired in the original contribution of Sen (1976) and later extensions (Foster et al., 1984) adapted to the input-output datasets that we are using. Our inequality index, for which we follow the formulation in Sen (1976), can be described by:

$$S = H * (I + (1 - I) * G) \quad (4.8)$$

where H represents the proportion of workers receiving income under a certain threshold, to account for workers receiving low wages. We set this threshold in value added per capita, and we multiply it by 2 to discount the effect of the Spanish active population representing less than a 50% of the total. Meanwhile, I is a measure of the gap between labor compensation per worker and value added per capita. Finally, G is a global Gini index obtained from our tables (for the sake of simplicity, we use the Gini by levels of skills, as seen in Section 4). A higher value of this index reveals a situation of higher inequality.

4.4. Inequality in Spain: A descriptive analysis

In this section we are going to analyze the evolution of inequality in Spain by sectors and at a national level. To do that, we apply Sen (Hoover et al., 2004; Shorrocks, 1995) and Gini indexes (Alonso-Villar & del Río, 2010), using multisectoral data from our tables[5].

4.4.1. Global evolution of labor and wages in the Spanish economy

Making use of the constructed tables, we are first focusing on the labor structure of Spain, looking at the evolution of employment (including both employees and self-employed). This is shown in Figure 4.1 below. Generally, employment has been increasing until 2008, when it started decreasing, except for the case of high-skilled workers. The highest losses in employment along the period, 2008-2014, are concentrated in low-skilled workers, who were reduced by 40% from 1980 to 2014. Medium-skilled occupations were also reduced along the last decade of our period, while high-skilled employment has continuously grown. Meanwhile, it must be highlighted that, in terms of employment, there has been convergence by gender, as the number of female workers has also grown at impressive rates.

Figure 4.2 shows the evolution of nominal labor compensations (in millions of dollars) for the different categories. First, it can be seen that total labor compensation decreased from 1980 to 1986, which coincides with the political transition to democracy and the

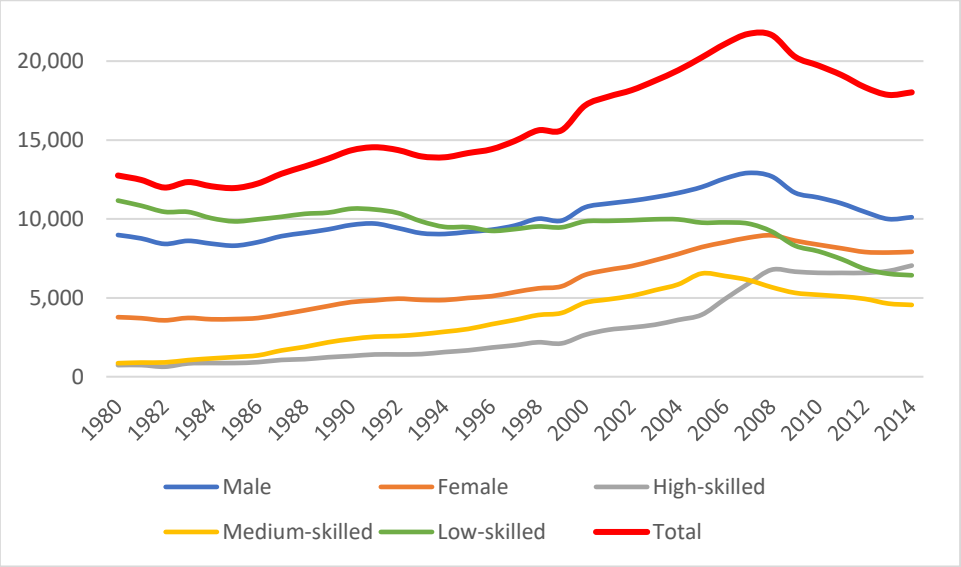
[5] See Appendix 1 in the Annex for clarifications on the formulas used for calculating Gini and Sen indexes.

pre-EU period. Then, these increased from 1986 to 1992, remaining stable until around the turn of the century. After that, the series experience a sharp increase that lasted until the 2008 crisis, when wages started to decrease and did not recover until after 2010.

Now, if we look at the evolutions by gender, it must be highlighted that the convergence that was seen in terms of employment is not so evident in terms of compensations, although the gap was lower in 2014 than in 1980. As will be seen later in the Gini indexes, this means that, despite the strong incorporation of women to the labor market and the improvements towards equality in certain sectors, from the perspective of global compensations, gender equality has not improved as would be desirable.

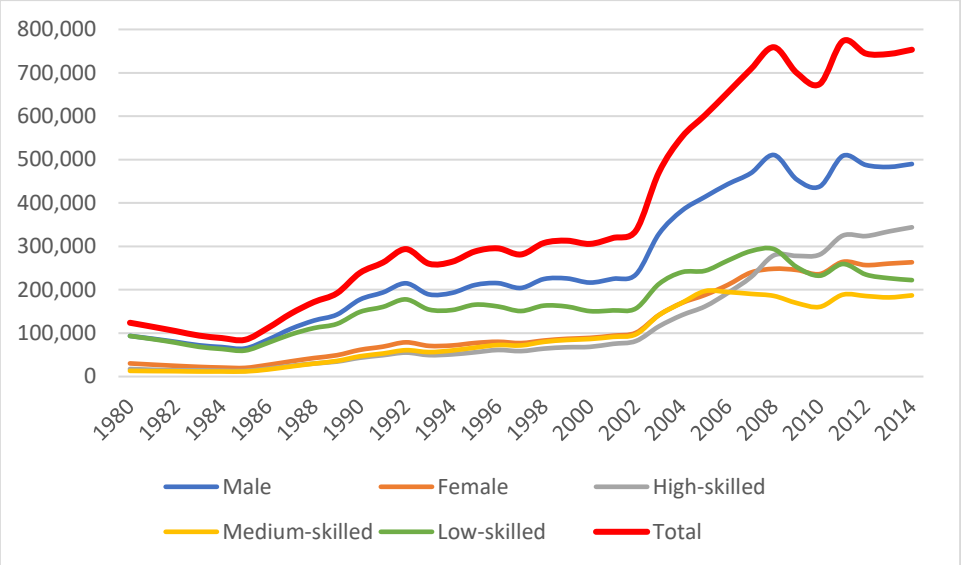
Moving on to skills, disparities were in 2014 higher than in 1980: low-skilled compensations have recently decreased, medium-skilled compensations have stagnated, while high-skilled wages have been continuously increasing and have surpassed the other two.

Figure 4.1. Employment, thousands of workers, Spain, 1980-2014



Source: own work

Figure 4.2. Labor compensations (millions of dollars), Spain, 1980-2014



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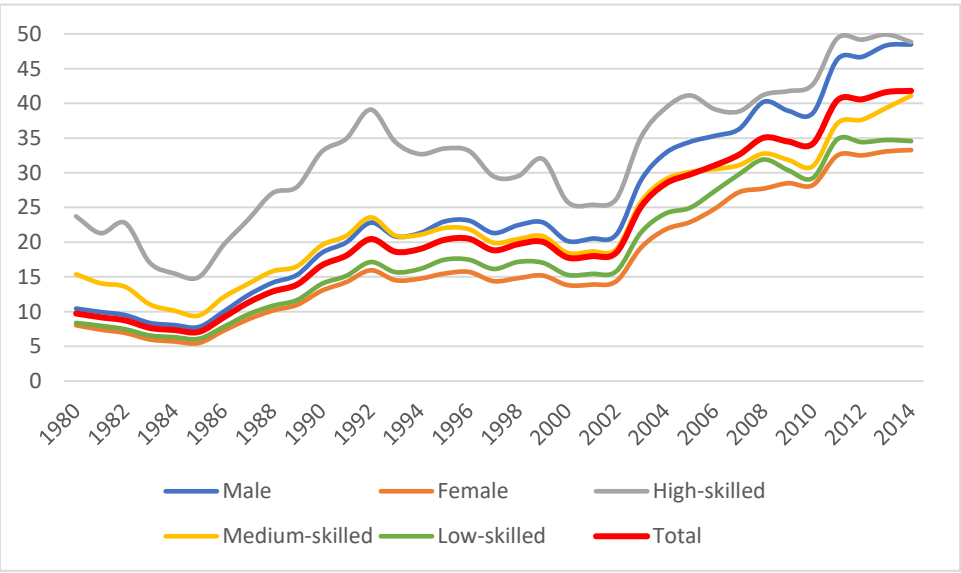
Now, the information in the two figures above can be merged as shown in Figure 4.3, yielding a picture of compensations per worker and labor category. Here, it is interesting to see how each category evolves in respect with the average. First, it can be seen that high-skilled and male compensations per worker are continuously above the average, while medium-skilled compensations fell below it around 2006. Meanwhile, female and low-skilled were below the average all years and have not converged towards it either. It is surprising the dichotomy existing during all the period, on the one hand, between high and low-skilled compensations, and, on the other hand, between male and female.

Figure 4.3. Labor compensation per worker (thousands of dollars), Spain, 1980-2014



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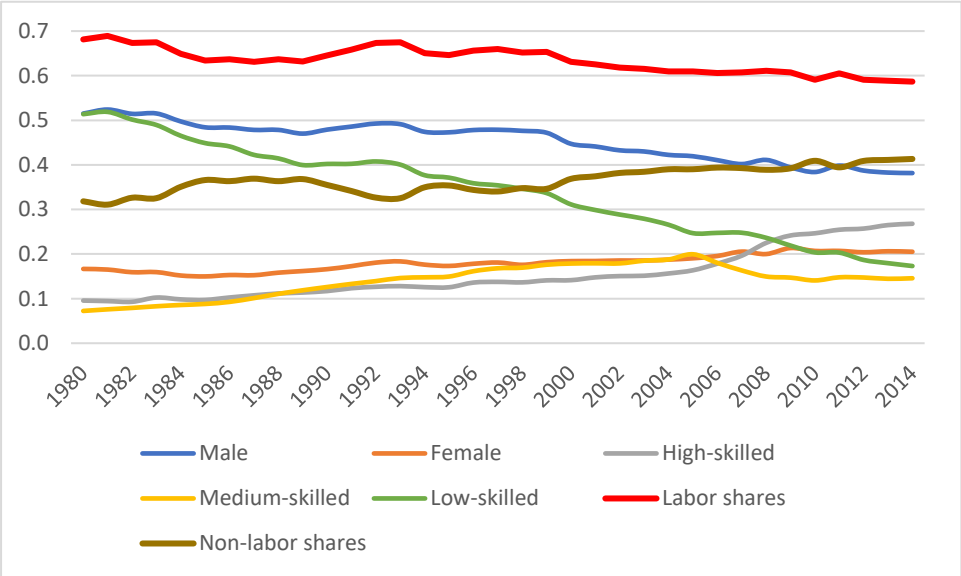
Before finishing this first global and general overview of income distribution in Spain, we can look into the primary distribution of income. Figure 4.4 below shows the evolution of labor (total and by categories) and non-labor shares of income. We cannot fully identify the latter with payments to capital, as these also include mixed income, taxes or amortizations. It can be seen that labor shares have decreased by 10% during the period. Moreover, the shares of value added held by male and low-skilled workers have experienced notable decreases, while the other categories have increased their weights. In short, besides seeming that there exist strong inequalities among workers, there also could be concluded that labor as a whole has experienced losses, in terms of weight over value added.

A couple of questions arise as a corollary of this section: first, can all this information be condensed so that we can confirm a global increase in inequality in Spain from 1980 to 2014? Second, what are the implications of the trends observed in terms of primary distribution? To answer the former, we will construct a Sen index of global inequality and different Gini indexes, while we will deepen in the latter by estimating a prices equation and further decomposing non-labor incomes – which will also be useful to perceive the dual facet of income distribution, both as a competitive and cooperative process.

Figure 4.4. Non-labor and labor compensation shares (proportions of value added), Spain, 1980-2014



Source: own work

4.4.2. Sectoral evolution of labor and wages in the Spanish economy

In this section, we are replicating the analyses above, but from a sectoral perspective. As our sectors are classified according to technology, an alternative focus is thus given to our analyses.

Making use of the constructed tables, we are first focusing on the labor structure of Spain, looking at the evolution of the number of workers (both employees and self-employed). This is shown in Figure 4.5. It must be highlighted that the Rest of Services employs a big proportion of total workers. High Technology Services and Construction follow, but the latter lost around two thirds of its employment from 2008 to 2014. Finally, it should also be remarked that the total number of workers dramatically fell after the 2008 crisis, and it only showed slight signs of recovery in 2014.

Figure 4.5. Total and sectoral number of workers (thousands), Spain, 1980-2014

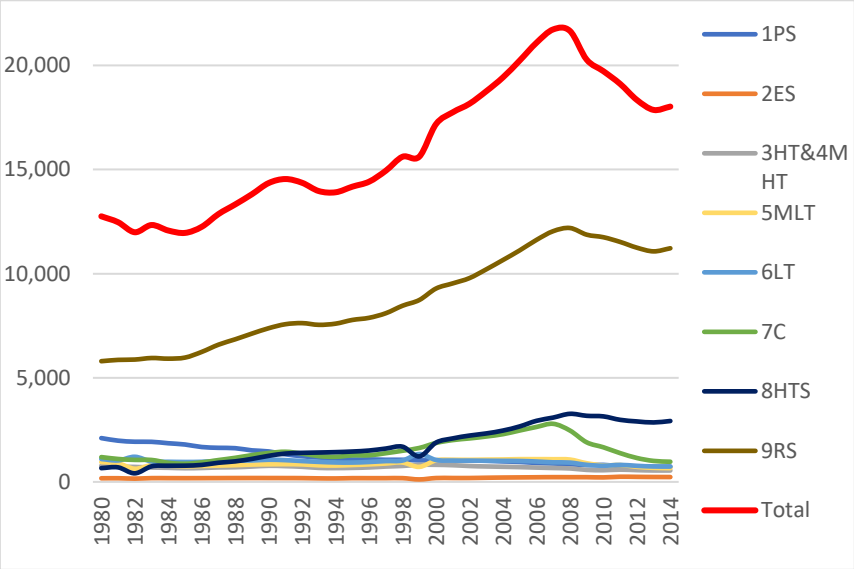


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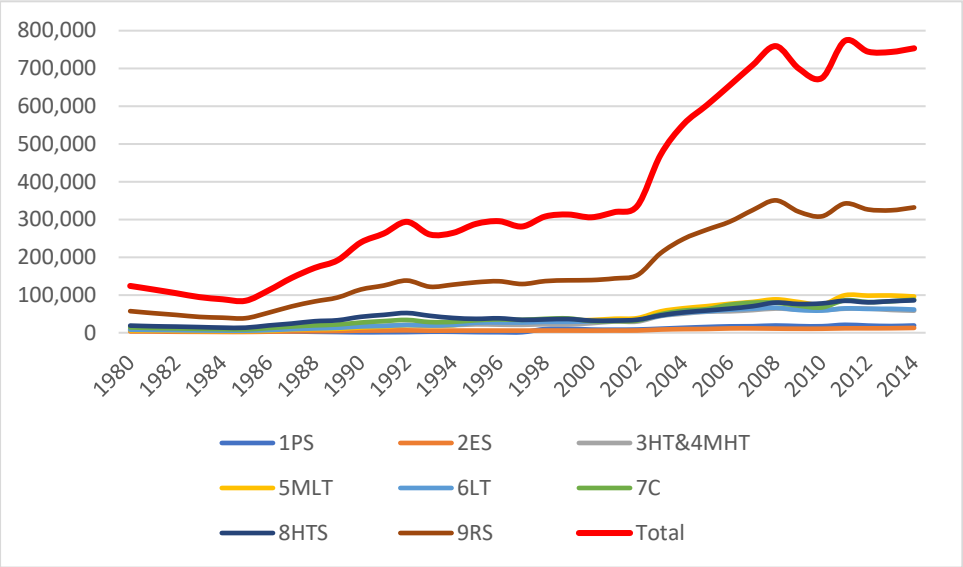
Figure 4.6 shows nominal labor compensations in millions of dollars. The role of the Rest of Services must be highlighted, as it represents almost half of the total. Then, the three Industrial sectors, High Technology Services, and Construction also take a considerable portion of total compensation, while the weights of Primary and Energy sectors are almost negligible. Furthermore, it should be commented that labor compensations seem to be stagnated since the 2008 crisis up to 2014.

Figure 4.6. Total and sectoral labor compensations (millions of dollars), Spain, 1980-2014



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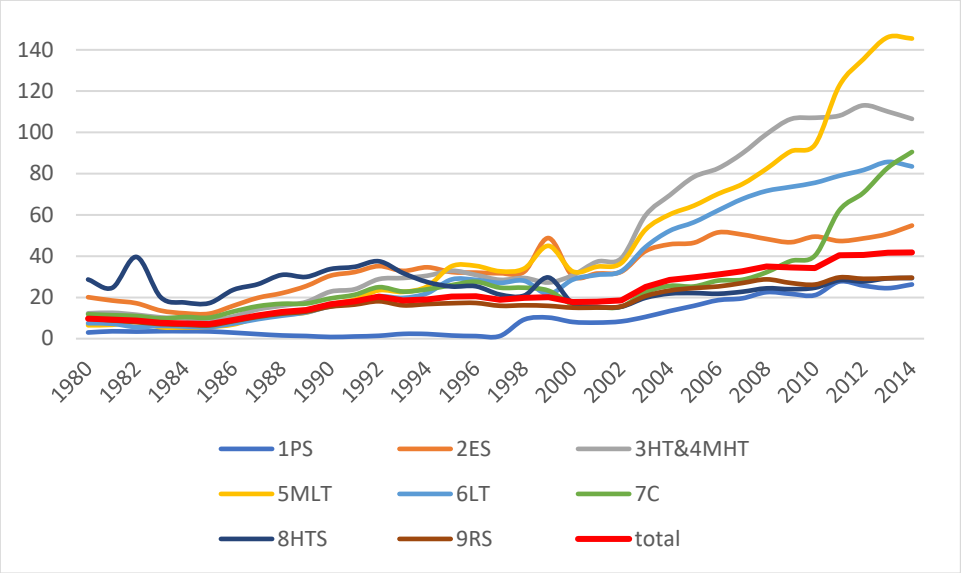
Besides, we can look into labor compensation per worker, as seen in Figure 4.7. While total value added was almost seven times bigger in 2014 than in 1980 (from 182,000 million to 1,280 billion), total labor compensation per worker has only been multiplied by four along this period (from 9,000 to 37,000). It is also interesting to note the impressive increases that took place along 2002-2008, when compensations were growing more than employment. On the contrary, during 2008-2014, total compensations change less, but compensations per worker increased due to the destructions of employment. In sectoral terms, compensations per worker were never above the average in the Primary sector and Rest of Services, and High Technology Services fell below it after 1999 (due to increasing employment). The other five sectors have located above the average for practically the entire period.

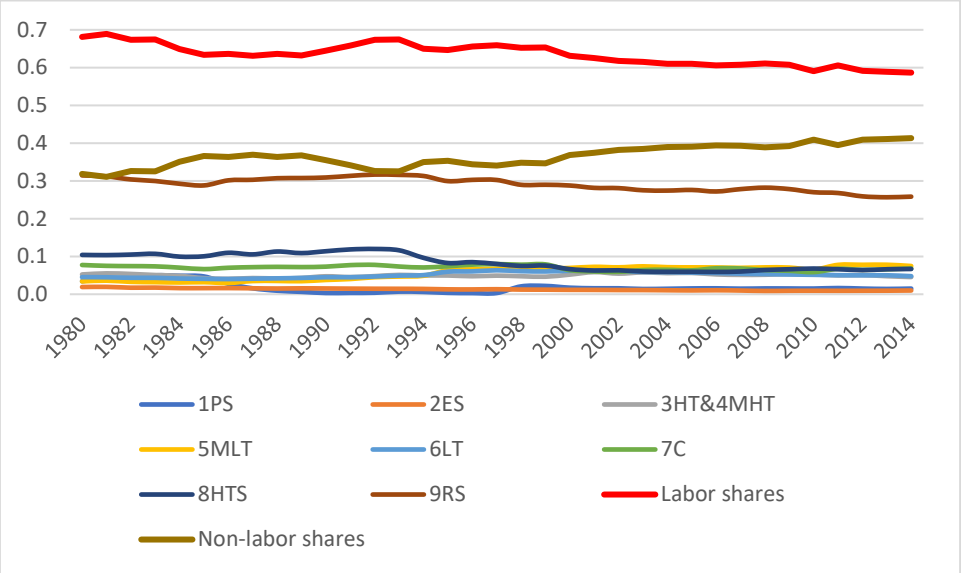
Figure 4.7. Labor compensation per worker (thousands of dollars), Spain, 1980-2014



Source: own work

Once we have seen some general growth-related facts, we are now studying the evolution of the primary distribution of income, that is to say, how much part of total value added has been dedicated to labor compensation, and how much to compensate non-labor-related incomes. Figure 4.8 shows the total and sectoral evolution of labor shares in Spain from 1980 to 2014. This also allows the study of capital shares, as these are the reciprocal of labor shares. There is a general fall in labor shares during this period. In total, labor shares of value added fell almost a 10% (from a 68.17% of value added in 1980 to a 58.67% in 2014). Throughout the period, Rest of Services is the sector that presents the highest labor shares. As for the evolutions, Primary and Energy sectors experienced the highest losses, of around a 50%, while High & Medium-high Technology industries, and Construction decreased around a 10%. Finally, the only two sectors showing increases are Medium and Low Technology industries, the former doubling its weight from 1980 to 2014.

Figure 4.8. Labor compensation shares (proportion of value added), Spain, 1980-2014



Source: own work

Summing up, according to all the information above, the characteristics of the productive structure of Spain during this period seems to have favored some specific sectors. In terms of employment, the two services sectors and Construction ought to be remarked. Regarding compensations, corrected by hours worked, again Construction and the three industrial sectors should be highlighted. Hence, it can be interpreted that, in the last three decades, the Spanish labor structure has established a preference towards sectors with medium-low technology and cheap low-skilled labor demand, which confirms what was seen in the preceding section.

To sum up, the results from the two previous subsections, on inequality and social stratification, are very significative and are being confirmed shortly, with the calculations of Gini and Sen indexes. Moreover, the SDA will allow us to see the contributions of different components of income to that inequality and stratification.

As initial conjectures, we can make the following assertions, which will be checked later:

1) The primary distribution of income has been relatively favorable to capital (or unfavorable to labor), see Figures 4.4. and 4.8. However, the increases in non-labor incomes and, thus, of investments, is beneficial for growth, and so can partially generate quantitative increases in labor compensations.
2) Income per capita and payments to labor have grown throughout the period 1980-2014, see Figures 4.3 and 4.7. This has probably been translated into a decrease in severe poverty since 1980. Nonetheless, the minimum needs of subsistence

have substantially changed since then, so the previous assertion should be carefully interpreted.

3) Undoubtedly, improvements in terms of closing the gender gap has taken place along the period, namely, in the constant increase in the number of female workers, see Figure 4.1. Despite this fact, it is surprising that female labor compensations have relatively increased less than those for male workers, see Figure 4.2. Even more worrying is the fact that, seeing Figure 4.3, retributions per female worker grow less than compensations per male worker.
4) Thus, is the gender gap really closing? It seems to be the trend when looking at specific sectors, but not on terms of the global economy. Figure 4.3 shows that compensations per low-skilled and female workers are below average. In other words, there seems to be a considerable gap between high-skilled male workers and low-skilled female workers, which have increased along the period, generating an important stratification, and showing a very unequal growth in labor retributions by categories.
5) Finally, in a society presenting increasing incomes per capita and household, but also an increasing social stratification, important changes in consumption patterns should be expected, as these might be reflecting these stratification and inequality.

4.4.3. Global evolutions of inequality: Sen and Gini indexes

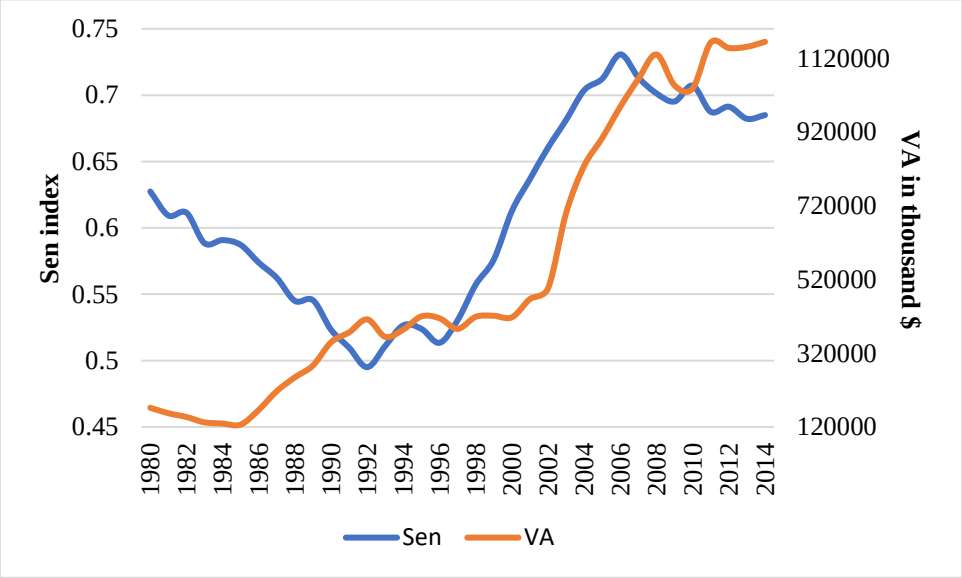
First, as general overview of the Spanish economy from a global perspective, we calculate a Sen index (Sen, 1976). Results, confronted to annual value added, are shown in Figure 4.9.

We observe an increase of 9% in inequality in Spain from 1980 to 2014. Nevertheless, we clearly distinguish two periods[6], with different evolutionary characteristics from the perspective of income distribution. The first one goes from 1980 until 1992, and the second one from 1993 to 2014. During the first period, which corresponds with the consolidation of democracy, we see a continuous decrease of inequality until 1992, from 0.63 to 0.49, with a total fall of around 21%. In contrast to this evolution, from 1993 to 2006, there was a strong increase in inequality, reaching values beyond those of 1980, from 0.49 in 1992 to 0.73 in 2006 (an increase of 47.6%). From 2006 to 2014 (except

[6] As will be seen later, the first one will be divided into two sub-periods, while the second one will be divided into three, according to the economic evolution and the crises that took place.

during the 2008 crisis), inequality decreased slowly, trending to a high value of around 0.69. However, the index is a 10% higher at the end of the period than at the start, revealing a global increase in inequality through these years, despite the decreases that took place during the reestablishment of democracy. Besides these decreases at the end of the period can be explained due to the destruction of male employment, especially of medium and low-skilled occupations (namely, in Construction), see Figure 4.1. These results for Spain support the idea of increasing inequality from the 90s in most developed countries, but also of changes in these trends since the 2008 crisis, as was claimed by many studies seen in Section 4.2.

Figure 4.9. Sen index as a global measure of inequality, Spain, 1980-2014



Source: own work

Figure 4.9 also reveals that, in Spain, economic growth and inequality increases are positively correlated for the most part of the period, although their correlation is negative from 1985 to 1992 (which corresponds to the first years of the integration into the EU). In other words, the causes of inequality are multiple, not only related to economic booms or busts. Thus, the use of the SDA is justified because it shows the joint influence of additional structural factors, such as the labor market, payments to capital, and consumption patterns.

Advancing some results from the following section, we will see that the initial decreasing trend in inequality is supported by higher wages and employment, while the increasing inequality trend in the last years seems to be very related to a higher polarization in the labor market and to changes in consumption patterns. Thus, it seems

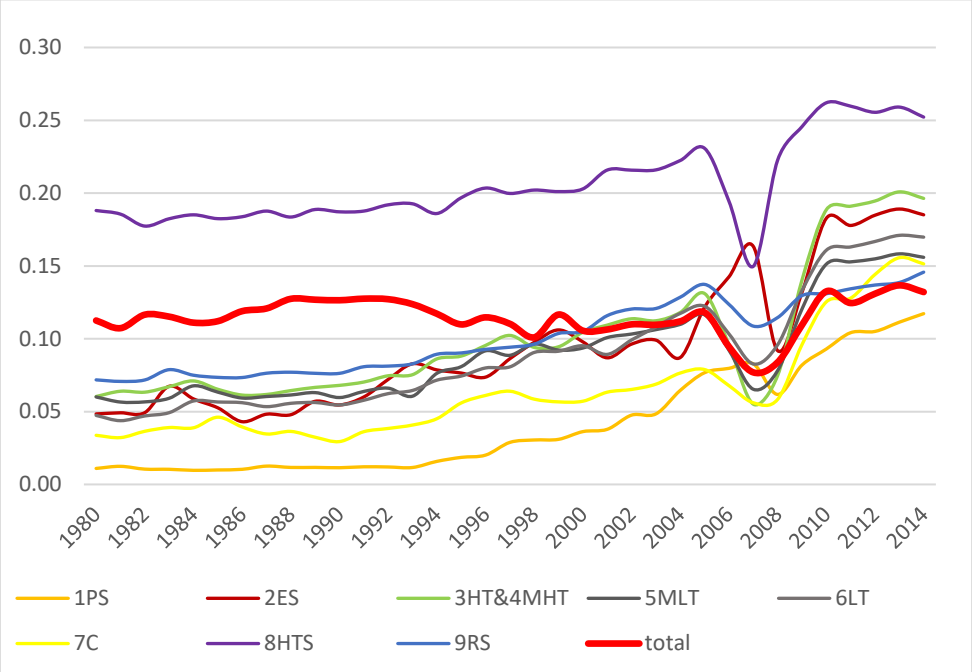
that inequality is explained by a higher stratification of the population, but due to different causes. Later, when we present the results of our SDA, we will be able to obtain deeper explanations to the evolutions observed here.

To go further into our descriptive analyses, we are going to use Gini indexes in labor compensations per hour. We start looking at inequality in labor incomes by skills, at sectoral and national levels. We can see in Figure 4.10 the national Gini index. We should remind that the national index not only embodies intra-sectoral differences between skills, but also disparities between sectors[7].

All sectors in Figure 4.10 show positive trends, with a temporary fall around 2008, and a later recovery. Inequality grows more in the sectors that were initially more egalitarian, Construction and Primary sectors, which means sectors are internally more unequal at the end of the period. In fact, although all sectors, except for the Primary sector, Construction and High technology services, evolve very similarly, disparities in labor by skills are higher in time in all sectors and quite different among each other, especially in the last 15 years. This fact can be interpreted as an increasing fragmentation and stratification by skills in all sectors. It is interesting to note that the lowest inequality by skills along the whole period is found in Construction and Primary sectors. This can be explained by the great weight of low-skilled workers in these two sectors. By contrast, inequality is especially high in High Technology Services, Energy, and High & Medium-High Technology Industry, which, on the contrary, present a higher proportion of medium and high-skilled workers.

[7] The analysis of these differences can be done through decomposition techniques of the Gini index. In this article, we will not resort to them because we are more interested in showing and exploiting the advantages of the Structural Decomposition Analysis.

Figure 4.10. Gini inequality index by skills, Spain, 1980-2014



Source: own work

By contrast, at the national level, the evolution is almost constant until the beginning of the crisis, when we find a slight decline followed by a strong increase: the values for 1980 and 2014 are 0.11 and 0.13, respectively. This almost constant evolution is likely consequence of two facts: on the one hand, wages have grown for all skills, as we will see in the SDA; on the other hand, disparities in wages between sectors remaining almost unchanged during the period.

It is also important to comment the impressive increase from 2008 and its higher diversity across sectors. This reveals that, from the crisis onwards, division by skills is deeper – we can see the same trend in all sectors. This can be related to the higher effect of the crisis on low-skilled labor – including employment reductions. In summary, it is possible to observe a higher stratification, which stabilizes since 2010, due to changes in the labor market. We have also seen the same result in the Sen index. As our Gini compares shares of labor compensation to shares of total hours worked, the evolution here explained can be associated to changes in physical labor (unemployment) or changes in wages. This will be analyzed in the next section.

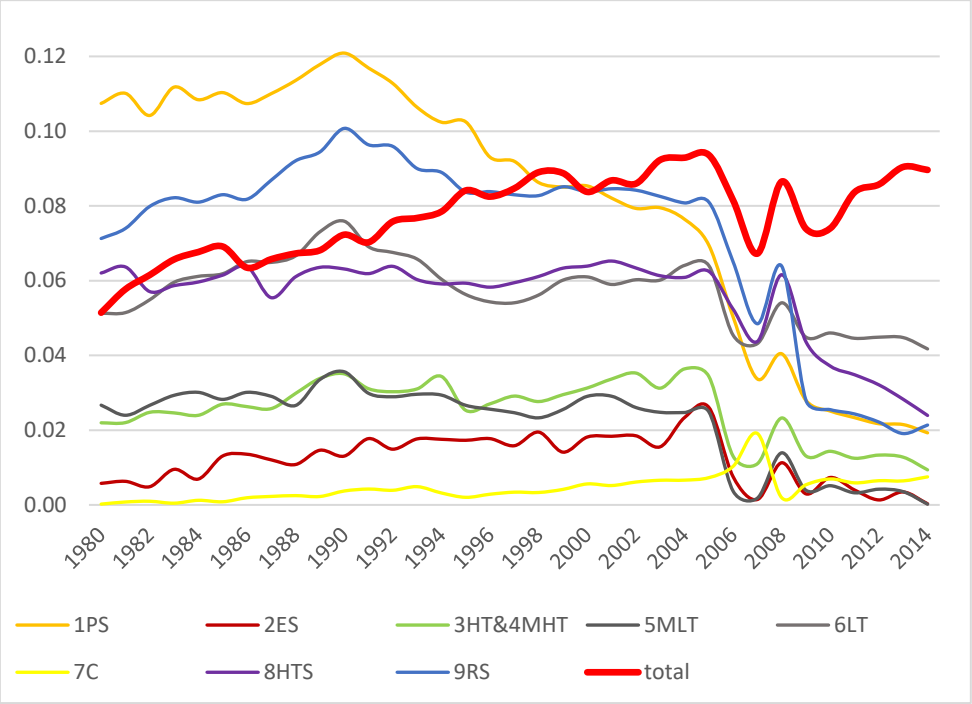
We move now on to inequality by gender (see Figure 4.11). We can see a very different evolution between the national index and sectoral indexes, which is mainly due to inter-sectoral disparities. At a sectoral level, in the Primary sector, Rest of Services, and Low-

tech industries, we find a clear decrease of inequality from the beginning of the 1990s. These are the sectors that fostered the incorporation of women to the labor market during these years. In the rest of sectors, inequality barely changed up to 2007. Even we can observe an increase of disparities between male and female workers in Energy sector and High & Medium-high-tech industries, up to 2005. This might be explained by the higher gap in terms of wages, and the lower number of women working in these sectors. We should also note the strong differences between Primary sector and Construction, despite both being sectors with a high weight of male workers.

Furthermore, figure 4.11 also reveals significant falls in all sectors since 2005. This could be partially explained by the homogenization of wages within sectors, in a context characterized by an increasing sensitivity towards gender equality. This gender homogenization has been especially intense in certain sectors such as social services (education and health care).

The evolution at national level is also significant and shows an additional facet to this gender conflict. The Gini index grew until 2005, followed by a fluctuating evolution between 2005 and 2009, and growing again afterwards. The national index increased a 40% along the period (from 0.05 in 1980 to 0.09 in 2014). In other words, the gender gap has tended to widen throughout the entire period. One explanation could be found in the low female salaries in some sectors. A second one would be the strongly unequal incorporation of women to the labor market across sectors, as well as their different gender structure. In the next section we will be able to obtain better explanations.

Figure 4.11. Gini inequality index by gender, Spain, 1980-2014

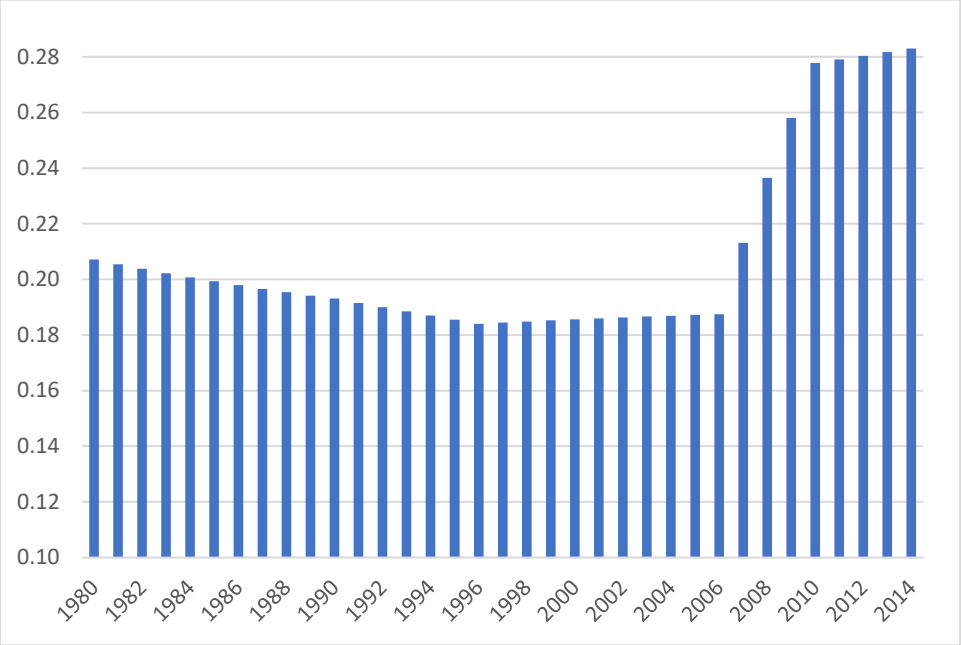


Source: own work

Finally, we now focus on consumption inequalities, other relevant indicator of social disparities and stratification. Figure 4.12 below shows that the period between 1980 and 1996 was characterized by a light reduction in disparities in households' consumption. After 1996, disparities started to grow at a slow pace. Then, after 2006, sharp increases started to take place, which were aggravated with the Great Recession, and stabilized after 2010. Although presenting a slight temporal gap, the evolution of consumption is coherent to that of inequality shown in Figure 4.9. Reductions in inequality until 1992 are reflected in a convergence in consumption patterns by income quintiles. However, since 1996, these start to diverge, accelerating and reaching levels higher than 0.28 (being 0.21 in 1980, an approximate increase of 33%). In the last years, in which according to the Sen index inequality decreased while still being at high levels, consumption patterns keep almost constant, stopping its previous growth.

In other words, differences by quintiles are now stronger than before, revealing a more polarized society. This is not new, as previous literature found the same for the case of the USA (see Section 4.2). All this confirms that inequality and stratification in Spain are associated to other factors apart from labor; factors that are more institutional, such as consumption patterns or wealth accumulation.

Figure 4.12. Gini index for households' consumption by income quintiles, Spain, 1980-2014



Source: own work

To sum up, we observe general increases in inequality, more moderate in the case of labor, while stronger and with two different trends in the case of consumption. In the next section we will try to get some insights about the dynamics behind this phenomenon.

4.4.4. Income distribution in a prices model

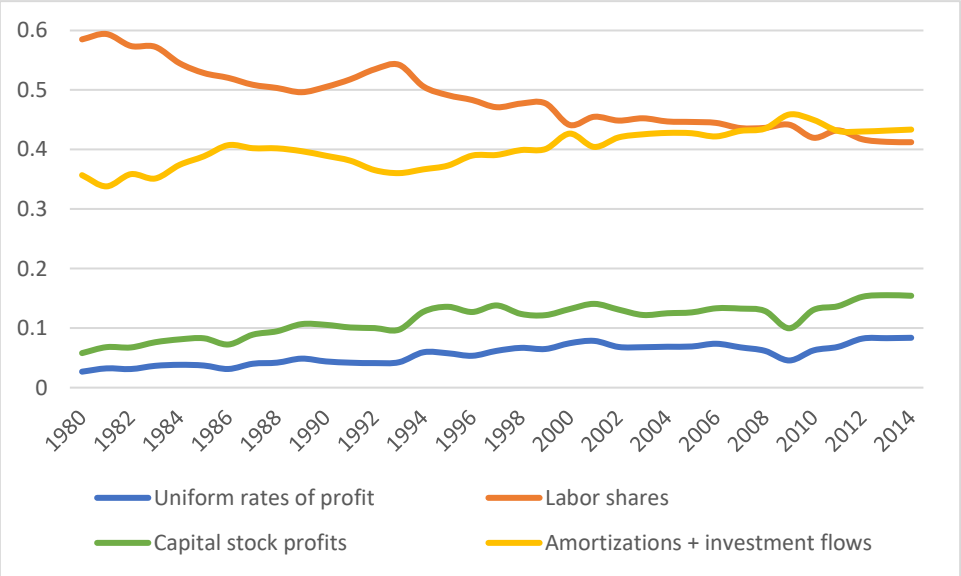
We have just seen that, according to the Sen index, inequality has increased in Spain during 1980-2014. A first step to approach the causes behind might be studying the primary distribution of income, that is, how value added is distributed into the factors of production that generate it. The antagonistic character in the distribution of income between labor and remaining incomes that do not correspond to labor (frequently identified with capital incomes, which is not always true) has been addressed before. We have analyzed some information about distribution and inequality, directly obtained from the Spanish input-output tables for 1980-2014. However, the explicative capacity of the tables has not been fully explored, as these can be used to check the validity of the conclusions obtained through other theoretical models. Specifically, we can use the prices model, described in Section 2, in order to obtain additional estimations of the distribution of income between labor, capital, and other types of income. This will allow us to deepen in in the traditional debate on the relationship between labor and capital

incomes, from an alternative perspective, as well as helping us to characterize the competitive and cooperative characters of the process of income distribution.

In more depth, we use the prices equation to estimate theoretical rates of profit, labor shares (that do not necessarily coincide with those calculated dividing labor compensation by value added in the tables), and non-labor-income shares, which are usually identified with capital shares. Nonetheless, these include other components besides the pure retribution to physical capital stocks and that are compensations to entrepreneurs, namely, capital amortizations and investment flows. These two additional components are essential to the functioning of economic activities and so are not in total opposition to the perception of workers' compensation. Their calculation is then important for income distribution analyses, as these can certainly extenuate the conflict between workers and entrepreneurs, and so can characterize income distribution as a cooperative process to some extent.

Looking at the lines depicted in Figure 4.13 below, we see that the labor shares of income are clearly decreasing during this period, which is consistent which was seen previously. This decrease is continuous during the entire period, even though the evolution of global inequality, as measured by Sen, had a different character during the initial years. The continuous decrease in the participation of labor in total income is undoubtedly one facet or factor of the increase in inequality taking place during our period of study.

Figure 4.13. Income shares in a prices model from 1980 to 2014



Source: own work

We can also look into the evolution of the uniform rate of profit. This is increasing along the period, which could mean that the unitary retribution of capital has been increasing

since 1980. If we focus on the retribution to the capital stock after investments (non-labour income minus amortizations and the investment flows associated to gross capital formation), it can be seen that it is also increasing up until the 2008 crisis, when it started to decrease. Thereafter, it increased again, having a value in 2014 that is slightly higher than in 2008. The situation of capital retribution does not vary much along the period, but it seems to be certainly better off than that of labor.

Finally, we can see that the share of income that is destined to capital amortizations and investment for growth purposes is increasing during 1980-2014. This means that the level of conflict between capital and labor cannot be only measured by the labor share, and it should be addressed while taking into account institutional and productive factors. It seems that labor incomes have been losing weight on total income in Spain during these years, but these losses also correspond to higher amortizations and domestic investment flows, which are essential to growth and so to the improvement of workers' retributions. Thus, the distributive process is competitive, as shown by the inverse wages-profits relation, but it also presents a cooperative facet.

4.5. SDA results: factors of inequality

In this section, we show the results obtained from the SDA. In Table 4.2, we show the national effects as % of annual VA. We use these ratios instead of absolute values because the tables are expressed in nominal values, and so the proportions can show the annual variations. Tables A4.1-4 (see Annex) show all the effects obtained in the SDA, both at national and sectoral levels. We compare the average effects for five sub-periods, which are selected in function of the phases of recession and expansion observed in the Spanish economy during the whole period, namely, 1981-1985, 1986-1992, 1993-2001, 2002-2008, and 2009-2014. As in previous sections, we observe two different trends in terms of inequality (1980-1992 and 1993-2014). We also present the results regarding this division. In Table 4.2, it can be seen that the demand effect and changes in value added are the same. This can be easily explained: according to the equilibrium conditions of input-output tables, total demand and total value added always coincide and, consequently, percentages of change must be equal.

Table 4.2. SDA global economy effects as % of VA, 1980-2014

	VA Change	Wage effect	M Wage effect	F Wage effect	HS Wage effect	MS Wage effect	LS Wage effect	
Average 1981-2014	6.54	2.98	2.24	0.79	0.43	0.68	1.65	
Average 1981-1992	8.48	3.84	3.06	0.84	0.55	0.73	2.82	
Average 1993-2014	5.48	2.50	1.79	0.76	0.37	0.66	1.02	
Average 1981-1985	-7.27	-4.48	-3.15	-1.35	-0.93	-0.38	-2.22	
Average 1986-1992	19.73	9.79	7.49	2.41	1.60	1.52	6.42	
Average 1993-2001	1.98	-0.98	-0.55	-0.35	-0.61	-0.36	-0.43	
Average 2002-2008	14.07	7.01	4.87	2.17	1.19	1.93	3.25	
Average 2009-2014	0.71	2.47	1.70	0.76	0.88	0.71	0.57	
	VA Change	**Labor effect**	**M Labor effect**	**F Labor effect**	**HS Labor effect**	**MS Labor effect**	**LS Labor effect**	
Average 1981-2014	6.54	-3.56	-2.91	-0.70	0.06	-0.52	-2.84	
Average 1981-1992	8.48	-3.95	-3.26	-0.75	-0.31	-0.12	-3.58	
Average 1993-2014	5.48	-3.36	-2.72	-0.67	0.27	-0.73	-2.43	
Average 1981-1985	-7.27	3.29	2.34	0.97	0.93	0.73	1.14	
Average 1986-1992	19.73	-9.12	-7.26	-1.97	-1.19	-0.73	-6.95	
Average 1993-2001	1.98	-0.55	-0.94	0.30	0.80	0.58	-1.51	
Average 2002-2008	14.07	-7.47	-5.55	-1.95	-0.08	-2.42	-4.34	
Average 2009-2014	0.71	-2.76	-2.11	-0.64	-0.13	-0.74	-1.58	
	VA Change	**Labor cost effect**	**M Labor cost effect**	**F Labor cost effect**	**HS Labor cost effect**	**MS Labor cost effect**	**LS Labor cost effect**	**Capital effect**
Average 1981-2014	6.54	-0.59	-0.68	0.09	0.50	0.17	-1.18	0.16
Average 1981-1992	8.48	-0.10	-0.20	0.10	0.24	0.61	-0.76	0.18
Average 1993-2014	5.48	-0.85	-0.94	0.08	0.64	-0.07	-1.41	0.14
Average 1981-1985	-7.27	-1.19	-0.81	-0.38	0.00	0.35	-1.08	-0.49
Average 1986-1992	19.73	0.67	0.24	0.44	0.41	0.79	-0.53	0.66
Average 1993-2001	1.98	-1.53	-1.49	-0.04	0.19	0.22	-1.94	-0.01
Average 2002-2008	14.07	-0.46	-0.68	0.22	1.11	-0.49	-1.09	0.09
Average 2009-2014	0.71	-0.29	-0.41	0.12	0.75	-0.03	-1.01	0.45
	VA Change	**Demand effect**	**Q1 effect**	**Q2 effect**	**Q3 effect**	**Q4 effect**	**Q5 effect**	**Rest FD effect**
Average 1981-2014	6.54	6.54	-0.04	-0.07	-0.10	-0.08	-0.11	6.93
Average 1981-1992	8.48	8.48	-0.07	-0.18	-0.28	-0.23	-0.36	9.59
Average 1993-2014	5.48	5.48	-0.02	-0.01	0.00	0.00	0.03	5.47
Average 1981-1985	-7.27	-7.27	-0.96	-1.38	-1.73	-1.85	-2.54	1.19
Average 1986-1992	19.73	19.73	0.57	0.68	0.75	0.94	1.20	15.59
Average 1993-2001	1.98	1.98	-0.14	-0.17	-0.19	-0.25	-0.31	3.04
Average 2002-2008	14.07	14.07	0.15	0.22	0.28	0.33	0.47	12.61
Average 2009-2014	0.71	0.71	-0.04	-0.03	-0.02	-0.01	0.03	0.79

Note: M: male, F: female, HS: high-skilled, MS: medium-skilled, LS: low-skilled, Q: quintile
Source: own work

While interpreting our results, we should bear in mind the meaning of the effects obtained from the SDA. These are, on the one hand, the quantification of each of the components of variations in value added, thus revealing which variables (employment or type of employment, wages, compensation to capital, consumption patterns, etc...) are contributing more to these changes. On the other hand, to the extent that the change in value added is a function of these variables, which are theoretically independent of each other, they illuminate us about the causal factors behind the change.

4.5.1. Global results

As we have seen, the SDA yields a global vision of how the changes in the VA, and therefore the patterns of income distribution, are determined by the remuneration of the productive factors, labor inputs, consumption patterns, and final demand. For this reason, although we are especially interested in all effects (sectoral and global ones) associated with gender, skills, and consumption, we are first going to see some important global facts in Table 4.2.

First, we can see that the average value of the labor cost effect (representing the change in labor compensation). For the whole period, it is approximately 9% (-0.59/6.54) of the VA change. On the other hand, the contribution of households' consumption is 5.9% (-0.39/6.54). Thus, the changes in consumption patterns, which are usually neglected as factors of inequality change, can be as relevant as changes in wage costs, and should not be ignored as a factor driving inequality.

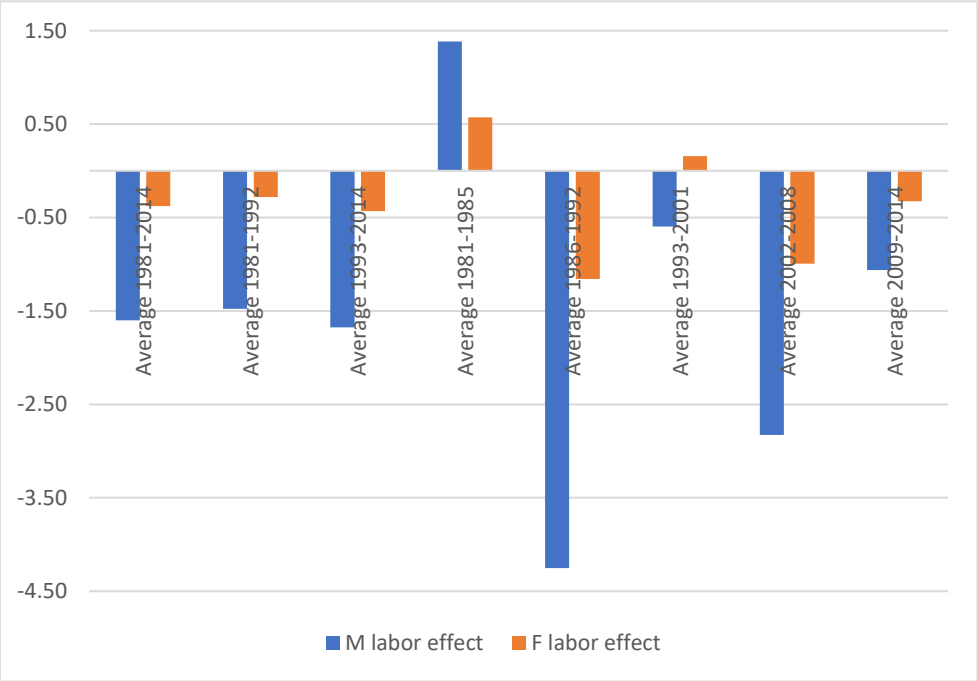
Second, if we focus on productive factors compensations, we see that the effect of labor costs is negative (-0.59), although the wage effect is positive (2.98). This reveals that wages have evolved positively in 1981-2014, although global labor compensation (labor cost) evolved negatively. That is, labor receives a less proportion of income, increasing the disparities between labor and capital remuneration.

Finally, Table 4.2 also warns us about the need to look at productivity to understand the evolution of inequality. The wage effect is 2.98 versus an average change in VA of 6.54. But, at the same time, there is a negative labor effect, indicating productivity improvements, of -3.56, exceeding the wage increases. In other words, the increases in wages have been on par with increases in productivity (that is, reducing the number of employees per output unit). All in all, the result is an increase of inequality explained by the side of labor market.

4.5.2. Labor and wage effects by gender

In Figure 4.14, we can observe that for both genders, the total contribution of physical labor to VA changes is negative, except for two cases: the period 1981-1985, when both male and female labor have a positive impact; and the period 1993-2001, when the impact of female labor productivity decreases a bit. These negative values are showing a continuous improvement of both labor productivities, and partially explain the increase of male and female employment up to the 2008 crisis, with the incorporation of women to the labor market being stronger since 1993. In any case, this incorporation went hand in hand with increases in the national Gini index (see Figure 4.10), due mainly to its higher concentration in a few sectors (increasing inter-sectoral inequality).

Figure 4.14. Labor effect by gender



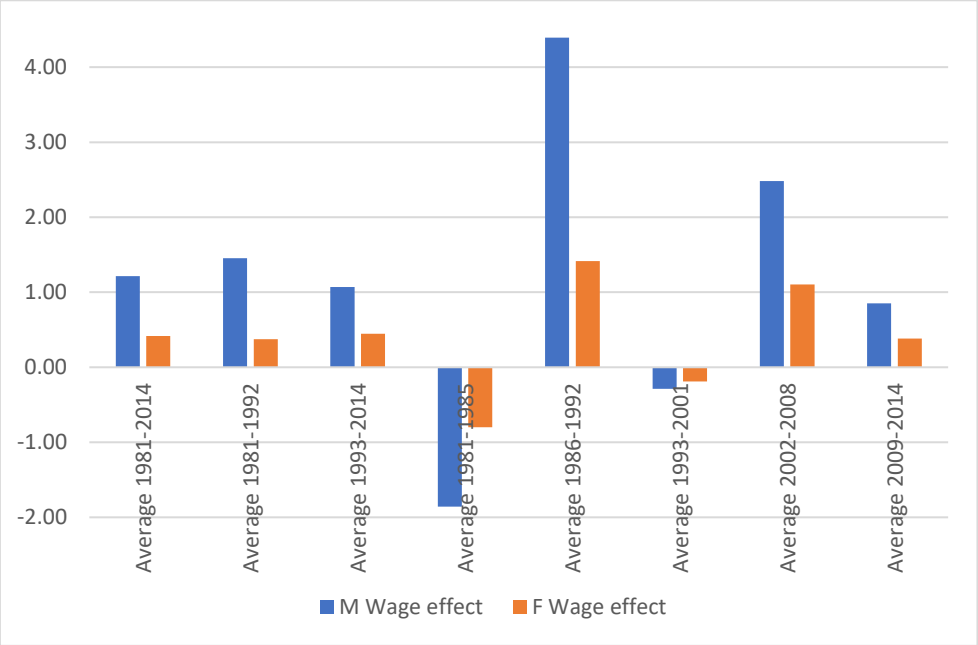
Source: own elaboration

We should also comment the results by sectors, see Table A4.1 in the Appendix. Looking the average sectoral values of the female labor effect for 1981-2014, the highest negative values are found in Rest of services, Low-tech industry and Primary sector. Meanwhile, Rest of services and Low-tech industries achieve the biggest negative values in 1986-1992 and 2002-2008. This shows that female employment increases are due to their incorporation to these sectors, especially services (we confirm this later looking at the wage effects). However, there is still much space left for progress in other sectors

traditionally dominated by men, namely, High & Medium-high technology industries and Construction.

In Figure 4.15, we show the wage effects by gender. Note in Figures 4.14 and 4.15 that labor and wage effects have opposite signs. In other words, wages rose along with productivity, but without surpassing the growth of this, see in Table 4.2 the negative labor cost effects. However, in general, and especially in 2002-2008 and 2009-2014, female labor cost effects were higher than male ones (see again Table 4.2), showing a more favorable evolution of female wages in the long run.

Figure 4.15. Wage effect by gender



Source: Own elaboration

When we look at sectoral wage effects, see Table A4.2 in the Annex, we see that the greatest values of the female wage effect are again reached in Rest of services, Low-tech industry, and Primary sector. Meanwhile, Rest of services and Low-tech industries achieved the biggest negative values in 1986-1992 and 2002-2008. This evolution is similar to that of the labor effect by gender seen before, which confirms the parallel evolution of female wages to labor productivity. We can also see that the best evolution of male wages takes place in High technology industries and Construction, with the highest values in the Primary sector, in 1986-1992. This also confirms the different sectoral patterns of male and female labor, which partially explain the continuously increasing trend of the total Gini index by gender. Besides, the favorable evolution to female wages, especially from 2002 to 2014, forced a convergence between male and

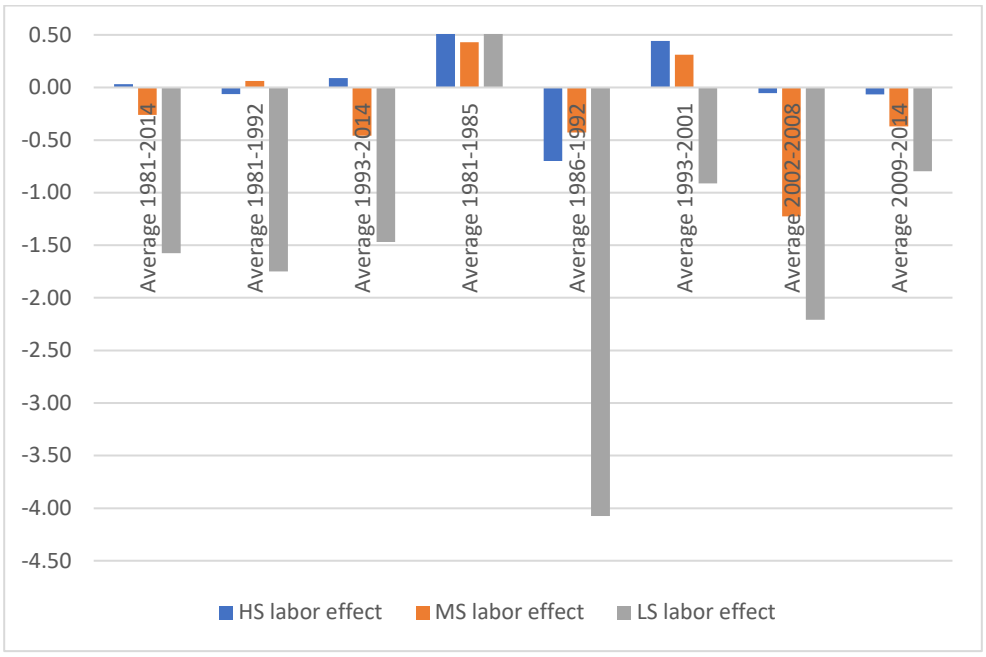
female compensations. This convergence takes place in all sectors, as we can see getting the labor cost effect from Tables A4.1 and A4.2. Comparing average sectoral values for 1981-2014, all female labor cost effects are positive, while the male ones are negative, except for Medium-low technology industries. This could explain the reduction of intra-sectoral inequality by gender since 2005, as shown in Figure 4.11.

In summary, we can assert that increasing gender inequalities at a global level are mainly explained by the labor market and its sectoral stratification, with the incorporation of women there being non-homogeneous, and slow during the first half of the period. Besides, in terms of wages we observe differences, but it seems that the gap within each sector is narrowing, although it remains at the global level. The incorporation of women to the labor market has not been homogenous in all sectors, playing a key role in services. All in all, we can conclude saying that the Spanish economy is still stratified between male and female workers, although this does not fully explain the increases in inequality in Spain.

4.5.3. Labor and wage effects by skills

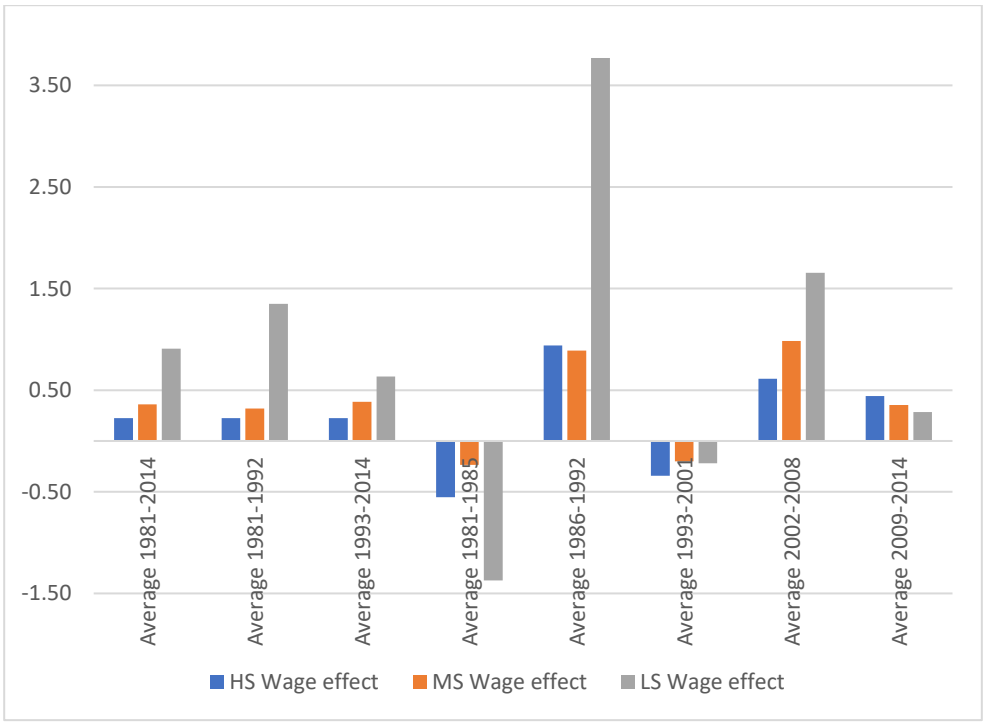
Here, we are going to comment labor and wage effects by skills. In Figure 4.16, we show labor effects for the different periods. The first thing we observe is that high-skill labor is the only one with a positive, although small, contribution in the average of the whole period, revealing both a slight labor productivity fall for high skills, and that productivity improvements were supported by low and medium-skill labor. This is also clear looking at the values for 2002-2008 and 2009-2014, although in both periods the three skill categories improve their productivities. By contrast, in Figure 4.17, we can see positive wage effects (higher wages) for the three labor types, showing very different labor compensations from the perspective of productivity. In Figure 4.18, labor cost effects show that high-skilled labor received compensations above its productivity improvements, which is especially true from 2002. This fact supports the increases in inequality in the two last decades analyzed, as well as the development of a higher stratification in the labor market due to a higher demand of high qualified labor. This would be connected to the increasing processes of automation and the rising technological character of most occupations, which could drive to increases in inequality between high and low-skilled labor.

Figure 4.16. Labor effect by skills



Source: Own elaboration

Figure 4.17. Wage effect by skills



Source: Own elaboration

If we focus on the sub-periods, in 1981-1985 (corresponding to the first decade of the new Spanish democracy), the three kinds of skills have a small negative productivity improvement; meanwhile, in 1986-2001 (after the Spanish integration to the EU) the three labor effects are negative, revealing high productivity improvements, which resulted in wage increases (see Figure 4.16). By contrast, in 1993-2014, the period with increasing and higher inequality, high skills have negative (or small when positive) changes in productivity, while low and medium-skill labor improve their productivity in the two last sub-periods.

We should also focus on results at sectoral levels. We observe improvements in productivity for medium and low-skilled labor in all sectors (see Table A4.1). The biggest values are found in technology industries, Construction, and Primary sector. Otherwise, high-skilled labor slightly improves its productivity in High & medium-high technology industries, in Construction, and Primary sector, but loses productivity in both services sectors. This partially explains the sectoral polarization by skills and the social stratification associated with it.

We now move on to analyze wage effects (Figure 4.17). Note the strong negative correlation between labor and wage effects, as was to be expected. We observe that low-skill wages have in 1981-2014 the highest average impacts in absolute terms, which is related to this group representing the highest employment shares over total. Nevertheless, low-skill wages lose relative weight along the period, as we can see comparing figures from 1981-1992 to 1993-2014. This is further confirmed by looking at 2009-2014, when high-skill wages are those with the strongest impact. Thus, it is clear that wages in the Spanish economy suffered a strong polarization process, with high-skill wages increasing relatively more, and then increasing inequality. It also explains the increasing trend in Gini indexes by skills shown in Figure 4.10.

One more proof of this market stratification is obtained when we look carefully at the sum of both effects (labor cost effect), as seen in Figure 4.18. All the average effects associated with the different time periods analyzed are negative for low-skilled labor, revealing that its productivity has grown more than its compensation per unit of output. On the contrary, the opposite has happened to high qualifications, whose wage compensations overweight productivity. Moreover, we can see that medium-skilled labor lost importance, especially in the two last sub-periods (see Figures 4.16-18), due to the loss of weight of these occupations in the Spanish economy. Thus, the increasing

polarization of the labor market by skills is quite clear. It should also be noted that polarization between high skills and the other two categories deepens since 2002.

Figure 4.18. Labor cost effects by skills

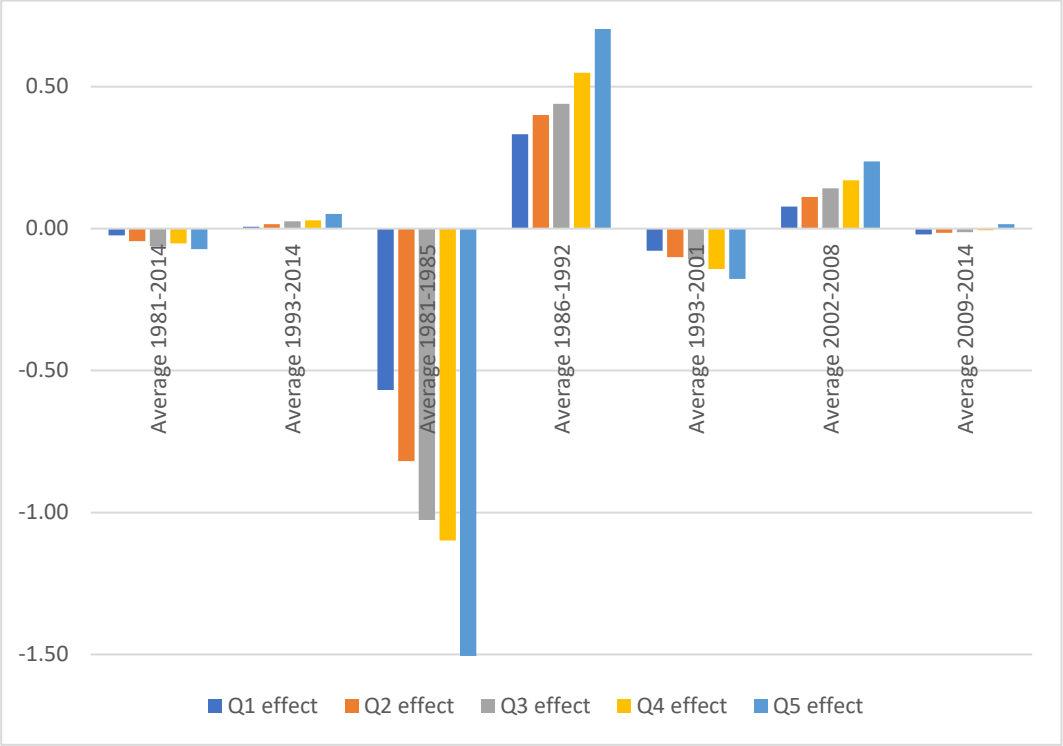
Source: Own elaboration

4.5.4. Consumption effects

To finish with this section, we are going to analyze the households' consumption effects by quintiles. These results are shown in Figure 4.19.

In the average of the entire period, 1981-2014, the contribution of all quintiles has been negative (see Table 4.2). In all the sub-periods, except in 2009-2014, the impact of the richest quintile (Q5), whether it is positive or negative, is the highest, which is a clear indicator of the importance of wealthy consumers in driving total consumption, and so of the underlying inequality in the consumption structure.

Figure 4.19. Consumption effects by quintiles



Source: Own elaboration

In the average of the entire period, 1981-2014, the contribution of all quintiles has been negative (see Table 2). In all the sub-periods, except in 2009-2014, the impact of the richest quintile (Q5), whether it is positive or negative, is the highest, which is a clear indicator of the importance of wealthy consumers in driving total consumption, and so of the underlying inequality in the consumption structure.

We observe a positive contribution in 1986-1992 and in 2002-2008, two periods of great expansion. We can also see negative effects for all quintiles in 1981-1985 and 1993-2001, due to the ongoing crises at the start of both periods. Note that, during the crisis of 2009-2014, the impact of the four lowest quintiles is negative, while the impact of the highest quintile is positive. That is, the 'poorest' and the medium class are the most affected by the recession. It is also interesting to note the differences between 1980-1992 and 1993-2014. In the former period, the impact of all quintiles is negative, but most important, in absolute terms, the contribution of Q3 is as significant as that of Q4, although smaller than that of Q5 (-0.28 vs -0.23 and -0.36). This reveals the importance of the medium class during the first half of our whole period. In the latter, the contribution of Q3 is null and equal to that of Q4, while the effect of Q5 is 0.03, relatively distancing from Q3 and Q4. These results reveal a deepening of the stratification by

quintiles, which would explain the evolution of inequality. As previous literature stated, this stratification is not generated in the low-income social classes but in the higher income groups. In the case of Spain, it seems that the medium class loses relevance along time, while the richest become richer (and so is reflected in their expenditures). The same patterns are observed at sectoral level.

To sum up, we can conclude that inequality can be explained by a higher stratification of the Spanish economy, both in terms of labor and consumption. Indeed, as previously commented, the current stratification by quintiles is also due to the increasingly weak role of the middle class.

4.6. Conclusions

There is a great debate in the literature concerning the link between economic growth and inequality. However, there is an agreement about the increase in inequality in the last four decades in most developed countries. There are many reasons to explain this evolution.

Spain is an interesting case because, from 1980 to the beginning of the 2008 crisis, experienced a continuous and impressive growth of its GDP, with an average rate close to 3%. However, as it is shown in this chapter, we can distinguish two different periods: 1980-1992 and 1993-2014. In the former, which includes the consolidation of democracy in Spain and its incorporation into the European Union, inequality decreases, and we find that growth and lower inequality are positively correlated. On the contrary, since 1993, inequality increases, exceeding the levels of inequality that existed in the 1980s, and this occurs despite growth is maintained, employment grows, and disposable income per capita rises. This second period confirms that growth and equality do not necessarily have to be positively correlated. Furthermore, growth and inequality seem to be related by additional factors besides the purely economic, such as social stratification, both in the labor market and consumption.

Thus, the questions that this chapter tries to answer are: How stratification in the economy is related to increases of inequality in Spain? Which is the role of the labor market and consumption in the income distribution mechanism?

To drive our aim, we work under an input-output framework, and we apply a Structural Decomposition Analysis (SDA). This SDA allows us to assess how different groups of population contribute to changes in value added.

The labor effects obtained from the SDA, insofar as they measure the variation in labor productivity (improves when negative), show that the growth of the Spanish economy has been due to profound improvements in the labor productivity[1] of all sectors. This is also true for any gender and skills stratus. This productivity improvement has been especially high in low-skilled jobs. Much of this improvement has been transferred to increases in wages, as revealed by the positive wage effects, but these have only received a part of the improvements obtained. The wage evolution has relatively favored high-skilled labor, increasing social stratification, but it has also driven gender convergence in wages at intra-sectoral levels, especially since 2002.

As our input-output model incorporates decompositions of labor by qualifications and gender, the SDA allows us to deepen in the analysis of stratification in these two ways. The Gini index has revealed that gender inequality has globally grown, but also that inequality is quite different across sectors and that, in recent years, intra-sectoral inequality has fallen. The SDA makes it possible to explain this apparent anomaly. The incorporation of female labor, starting from very low levels and with generally lower wages, generated an increase in the global index. However, the concentration of female work in certain sectors, in which it tends to become dominant, as well as the intra-sectoral wage convergence, have also caused the sectoral indexes to fall since 2002.

When looking at the results of the SDA, what we see is a double-faceted process. On the one hand, the weight of low and medium-skilled labor falls, while high-skilled labor relatively increases (average labor effects for 1981-2014 are -2.84, -0.52 and 0.06, respectively). These results are also confirmed for 2002-2008 and 2009-2014. On the other hand, compensations of low and medium qualifications approximate converge, but increase their distance from those received by high-skilled workers. In other words, differences between skills increase, which favors stratification, with a clear reduction of

[1] We are aware of the fact that productivity can be measured in several ways. Namely, the ratio of generated income to physical labor used is essentially different to the ratio of income to labor costs. Another difference would arise when using the value of the output, instead of generated income. Besides, productivities could be identified to rates of profit or returns from investment. Thus, we have used one of the simplest and statistically robust definitions of productivity, that is, the ratio of value added to physical labor inputs.

the role of the medium class in the Spanish economy. Besides, the weight of each skill is very different at sectoral levels, also contributing to a stratification in labor.

A shocking result is found in the decomposition of households' consumption. Analyzing consumption effects in the SDA, the first thing we observe is the greater relevance of the richest quintile (Q5), as well as the significant role of the rest of the final demand. Besides, as we can see in Table 2, in the 1981-1992 sub-period, Q3 and Q4, which can be approximated to the medium class, have a significant impact in value added changes (average effects are -0.28 and -0.23, while -0.36 and 0.07 are Q5 and Q1 effects, respectively). However, in the sub-period 1993-2014, the changes in the highest quintile are the only presenting a positive impact (0.03), while Q3 and Q4 effects are null, and Q1 effect is negative. This is in line with previous literature, which shows that inequality in the USA is associated to changes in the highest incomes. Thus, there seems to be a concentration of income in the highest quintile, which would probably be more intense if we were to further decompose it into the top decile or even percentile. Then, it is shown that social stratification also appears in the Spanish sphere of consumption during 1980-2014.

This chapter has some limitations. For instance, we have to work with a level of aggregation of 8 sectors due to the availability of consumption data. Besides, it would be interesting to consider consumption endogenously and to explicitly analyze the role of globalization in income distribution mechanisms, as other authors do, such as Peeters & de Vaal (2003), who analyze if globalization influences wage inequality, finding that the nature and stage of globalization and the relative size of a country are important. In any case, this chapter clearly shows a stratification process in the Spanish society in different ways. This is explaining the increases of inequality happened from the 90s.

Finally, we believe that increasing inequality is an urgent matter in contemporary developed economies. There is indeed much space for policy recommendations, as it is clear that, looking at recent experiences, the market is not fully prepared to correct these issues, and so a strong public interventionism might be desirable. According with our results, we should focus on sectoral policies to reduce the great differences in inequality among sectors. This should help in reducing inequality both by gender and by skills. First, to reduce stratification and inequality in labor incomes by gender, as we have seen that disparities concentrate in employment rather than in wages, the incorporation of female workers in certain sectors, such as High technology industries, should be

fostered. Then, maximum and minimum gender quotas could be established in strategical sectors with increasing compensations. Policies for the labor market undoubtedly connect to the field of education. In this sense, to reduce disparities by skills, educational reforms should be implemented to adapt workers to the new necessities of labor market. For instance, secondary and tertiary education should try to adapt labor supply to the increasingly skills-biased demand, linked to automation and sectoral technologizing. This could help several workers to escape the trap of unemployment, as we have seen that low and medium-skilled occupations are increasingly losing weight. Were this problem to be aggravated, there would be necessary to strengthen social security networks for this vulnerable groups. Finally, stratification in consumption could easily be corrected by redistribution policies. Increasing progressive taxation and reallocating resources in low and middle classes, especially in periods of crisis, seems necessary to reduce these disparities.

4.7. References of Chapter IV

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4.8. Annex: SDA, results detailed by sectors

Table A4.1. Labor effect as % of VA by sectors, 1981-2014

M Labour effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-4,83	-1,96	-5,23	-4,92	-3,75	-5,05	-0,93	-2,10	-2,91
Average 1981-1992	-2,33	-3,12	-4,44	-4,14	-3,73	-4,83	-1,53	-3,20	-3,26
Average 1993-2014	-6,20	-1,33	-5,66	-5,34	-3,75	-5,17	-0,61	-1,50	-2,72
Average 1981-1985	-1,42	2,77	2,26	0,81	1,76	0,28	3,86	3,12	2,34
Average 1986-1992	-2,98	-7,32	-9,22	-7,67	-7,65	-8,48	-5,38	-7,72	-7,26
Average 1993-2001	-11,15	-0,58	-4,96	-4,06	-2,69	-0,69	1,43	-0,18	-0,94
Average 2002-2008	-4,47	-3,29	-9,71	-7,53	-6,72	-8,42	-3,06	-4,05	-5,55
Average 2009-2014	-0,79	-0,17	-2,00	-4,70	-1,90	-8,09	-0,81	-0,49	-2,11
F Labour effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,05	-0,03	-0,66	-0,65	-1,06	-0,15	-0,15	-1,04	-0,70
Average 1981-1992	-0,42	-0,08	-0,32	-0,35	-0,84	-0,02	-0,26	-1,31	-0,75
Average 1993-2014	-1,39	-0,01	-0,85	-0,82	-1,18	-0,22	-0,09	-0,89	-0,67
Average 1981-1985	-0,40	0,28	0,12	-0,12	0,11	-0,07	1,91	1,59	0,97
Average 1986-1992	-0,43	-0,34	-0,62	-0,51	-1,52	0,01	-1,81	-3,38	-1,97
Average 1993-2001	-2,32	0,14	-0,31	-0,21	-0,60	0,06	1,72	0,34	0,30
Average 2002-2008	-1,01	-0,32	-1,87	-1,34	-2,32	-0,20	-1,88	-2,74	-1,95
Average 2009-2014	-0,45	0,13	-0,46	-1,14	-0,73	-0,66	-0,71	-0,59	-0,64
HS Labour effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-0,07	0,08	-0,22	-0,25	0,00	-0,14	0,31	0,15	0,06
Average 1981-1992	0,02	-0,02	-0,21	-0,23	-0,18	-0,18	-0,32	-0,42	-0,31
Average 1993-2014	-0,12	0,14	-0,23	-0,26	0,09	-0,12	0,65	0,46	0,27
Average 1981-1985	0,00	0,73	0,63	0,25	0,36	0,44	2,89	0,75	0,93
Average 1986-1992	0,04	-0,56	-0,81	-0,57	-0,56	-0,62	-2,62	-1,26	-1,19
Average 1993-2001	-0,41	0,06	-0,19	-0,01	-0,03	0,33	2,72	0,89	0,80
Average 2002-2008	0,21	-0,04	-0,48	0,26	0,38	0,32	-1,09	-0,08	-0,08
Average 2009-2014	-0,06	0,46	0,01	-1,25	-0,07	-1,31	-0,41	0,46	-0,13
MS Labour effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-0,39	-0,31	-1,47	-1,11	-0,83	-0,49	-0,26	-0,30	-0,52
Average 1981-1992	0,09	-0,17	-0,13	-0,31	-0,16	0,06	-0,15	-0,13	-0,12
Average 1993-2014	-0,65	-0,39	-2,21	-1,55	-1,20	-0,79	-0,32	-0,39	-0,73
Average 1981-1985	0,16	0,59	1,14	0,20	0,65	0,18	0,89	0,92	0,73
Average 1986-1992	0,04	-0,72	-1,04	-0,67	-0,73	-0,03	-0,89	-0,89	-0,73
Average 1993-2001	-0,91	0,30	-1,03	-0,26	-0,05	0,77	1,30	0,84	0,58
Average 2002-2008	-0,82	-1,68	-4,98	-3,39	-3,16	-1,82	-2,25	-1,89	-2,42
Average 2009-2014	-0,05	0,10	-0,73	-1,33	-0,63	-1,91	-0,48	-0,49	-0,74
LS Labour effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-5,25	-1,71	-3,77	-3,99	-3,49	-4,24	-0,95	-2,63	-2,84
Average 1981-1992	-2,69	-3,16	-4,19	-4,20	-3,73	-4,61	-1,74	-3,95	-3,58
Average 1993-2014	-6,65	-0,93	-3,54	-3,87	-3,36	-4,04	-0,52	-1,91	-2,43
Average 1981-1985	-1,79	1,08	0,62	-0,80	1,55	-0,18	0,21	2,49	1,14
Average 1986-1992	-3,34	-6,19	-7,64	-6,63	-7,51	-7,77	-3,13	-8,55	-6,95
Average 1993-2001	-12,09	-0,69	-3,54	-3,56	-2,84	-1,45	-0,22	-0,98	-1,51
Average 2002-2008	-4,46	-1,68	-5,44	-5,12	-5,55	-6,52	-1,05	-4,06	-4,34
Average 2009-2014	-1,03	-0,40	-1,31	-2,89	-1,58	-5,03	-0,38	-0,80	-1,58

Source: Own elaboration

Table A4.2. Wage effect as % of VA by sectors, 1981-2014

M Wage effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	7,28	1,16	3,89	4,96	3,54	3,73	0,14	1,55	2,24
Average 1981-1992	-1,57	2,09	4,43	5,30	4,05	4,83	1,35	3,04	3,06
Average 1993-2014	12,10	0,65	3,60	4,78	3,25	3,13	-0,52	0,74	1,79
Average 1981-1985	2,02	-4,45	-4,16	-0,95	-2,17	-2,01	-4,76	-3,73	-3,15
Average 1986-1992	-4,14	6,76	10,57	9,76	8,50	9,72	5,71	7,87	7,49
Average 1993-2001	25,64	-0,34	1,99	2,92	2,47	-3,57	-3,73	-0,85	-0,55
Average 2002-2008	4,46	2,08	8,34	7,02	6,22	6,74	2,57	3,64	4,87
Average 2009-2014	0,71	0,46	0,50	4,96	0,97	8,99	0,68	-0,27	1,70
F Wage effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	1,63	0,13	0,66	0,87	1,12	0,24	0,31	1,11	0,79
Average 1981-1992	-0,24	0,11	0,42	0,52	0,93	0,10	0,77	1,32	0,84
Average 1993-2014	2,64	0,14	0,79	1,05	1,22	0,31	0,06	1,00	0,76
Average 1981-1985	0,26	-0,21	-0,49	-0,17	-0,80	-0,06	-2,08	-2,14	-1,35
Average 1986-1992	-0,61	0,33	1,07	1,02	2,17	0,21	2,81	3,79	2,41
Average 1993-2001	5,14	-0,02	0,41	0,41	0,85	-0,15	-2,51	-0,35	-0,35
Average 2002-2008	1,39	0,33	1,72	1,60	2,28	0,37	2,16	3,07	2,17
Average 2009-2014	0,37	0,16	0,28	1,38	0,54	0,94	1,46	0,62	0,76
HS Wage effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	0,44	0,20	0,76	0,99	0,57	0,61	0,11	0,33	0,43
Average 1981-1992	-0,05	0,27	0,57	0,53	0,42	0,28	0,83	0,58	0,55
Average 1993-2014	0,71	0,15	0,87	1,24	0,66	0,78	-0,28	0,20	0,37
Average 1981-1985	0,01	-0,68	-0,61	-0,15	-0,24	-0,18	-3,08	-0,80	-0,93
Average 1986-1992	-0,09	0,95	1,41	1,02	0,88	0,61	3,63	1,56	1,60
Average 1993-2001	1,28	-0,13	0,36	0,36	0,35	-0,39	-3,45	-0,42	-0,61
Average 2002-2008	0,34	0,35	1,86	1,18	1,06	0,39	2,33	1,19	1,19
Average 2009-2014	0,30	0,35	0,47	2,65	0,66	3,01	1,42	-0,05	0,88
MS Wage effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	1,05	0,35	1,37	1,31	1,02	0,69	0,01	0,61	0,68
Average 1981-1992	-0,16	0,46	1,14	1,03	0,73	0,41	0,73	0,79	0,73
Average 1993-2014	1,70	0,28	1,50	1,47	1,17	0,83	-0,39	0,51	0,66
Average 1981-1985	-0,06	-0,29	-0,60	0,04	-0,33	-0,04	-0,65	-0,42	-0,38
Average 1986-1992	-0,23	0,99	2,39	1,74	1,49	0,73	1,72	1,66	1,52
Average 1993-2001	3,17	-0,06	0,71	0,69	0,74	-0,75	-2,16	-0,39	-0,36
Average 2002-2008	0,95	0,82	3,55	2,49	2,40	1,53	1,20	1,80	1,93
Average 2009-2014	0,38	0,18	0,29	1,44	0,39	2,41	0,43	0,35	0,71
LS Wage effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	7,15	0,72	2,05	3,33	2,64	2,47	0,20	1,45	1,65
Average 1981-1992	-2,00	1,70	3,10	4,60	3,49	4,45	1,14	3,23	2,82
Average 1993-2014	12,15	0,18	1,48	2,64	2,17	1,39	-0,31	0,48	1,02
Average 1981-1985	1,60	-2,84	-3,03	0,25	-2,73	-1,28	-0,93	-3,52	-2,22
Average 1986-1992	-4,57	4,95	7,48	7,71	7,94	8,54	2,61	8,05	6,42
Average 1993-2001	26,26	-0,29	0,81	1,83	1,86	-2,85	-1,28	-0,98	-0,43
Average 2002-2008	4,16	1,02	3,97	4,34	4,33	4,59	0,65	2,95	3,25
Average 2009-2014	0,29	-0,11	-0,42	1,88	0,12	4,02	0,04	-0,20	0,57

Source: Own elaboration

Table A4.3. Labor cost effect as % of VA by sectors, 1981-2014

M Labor cost effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	2,44	-0,81	-1,34	0,05	-0,21	-1,32	-0,80	-0,55	-0,68
Average 1981-1992	-3,90	-1,03	-0,01	1,16	0,33	0,00	-0,18	-0,17	-0,20
Average 1993-2014	5,90	-0,69	-2,06	-0,56	-0,50	-2,04	-1,13	-0,76	-0,94
Average 1981-1985	0,60	-1,68	-1,91	-0,14	-0,42	-1,74	-0,89	-0,62	-0,81
Average 1986-1992	-7,11	-0,57	1,35	2,09	0,85	1,24	0,33	0,15	0,24
Average 1993-2001	14,49	-0,92	-2,97	-1,15	-0,22	-4,27	-2,30	-1,03	-1,49
Average 2002-2008	0,00	-1,22	-1,37	-0,51	-0,50	-1,68	-0,49	-0,41	-0,68
Average 2009-2014	-0,09	0,29	-1,50	0,26	-0,93	0,90	-0,13	-0,76	-0,41
F Labour cost effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	0,58	0,09	0,00	0,21	0,06	0,09	0,16	0,07	0,09
Average 1981-1992	-0,66	0,02	0,11	0,18	0,10	0,08	0,51	0,01	0,10
Average 1993-2014	1,25	0,13	-0,06	0,23	0,04	0,10	-0,03	0,11	0,08
Average 1981-1985	-0,14	0,08	-0,37	-0,29	-0,69	-0,13	-0,17	-0,55	-0,38
Average 1986-1992	-1,04	-0,01	0,45	0,51	0,65	0,22	1,00	0,41	0,44
Average 1993-2001	2,81	0,11	0,09	0,20	0,25	-0,08	-0,79	-0,01	-0,04
Average 2002-2008	0,38	0,01	-0,15	0,26	-0,04	0,17	0,28	0,33	0,22
Average 2009-2014	-0,08	0,29	-0,18	0,24	-0,19	0,29	0,75	0,03	0,12
HS Labour cost effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	0,38	0,28	0,54	0,74	0,57	0,46	0,42	0,48	0,50
Average 1981-1992	-0,03	0,25	0,36	0,30	0,24	0,10	0,51	0,15	0,24
Average 1993-2014	0,60	0,29	0,64	0,98	0,75	0,66	0,37	0,66	0,64
Average 1981-1985	0,01	0,06	0,02	0,10	0,12	0,26	-0,19	-0,05	0,00
Average 1986-1992	-0,06	0,39	0,60	0,45	0,33	-0,02	1,01	0,30	0,41
Average 1993-2001	0,88	-0,07	0,17	0,35	0,32	-0,07	-0,73	0,47	0,19
Average 2002-2008	0,55	0,31	1,38	1,44	1,43	0,70	1,24	1,12	1,11
Average 2009-2014	0,24	0,81	0,49	1,40	0,58	1,70	1,01	0,41	0,75
MS Labour cost effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	0,66	0,03	-0,10	0,20	0,19	0,20	-0,25	0,31	0,17
Average 1981-1992	-0,06	0,28	1,01	0,72	0,58	0,47	0,59	0,66	0,61
Average 1993-2014	1,06	-0,10	-0,71	-0,08	-0,03	0,05	-0,70	0,12	-0,07
Average 1981-1985	0,11	0,30	0,54	0,24	0,32	0,15	0,24	0,50	0,35
Average 1986-1992	-0,19	0,27	1,35	1,07	0,76	0,71	0,83	0,77	0,79
Average 1993-2001	2,26	0,24	-0,32	0,43	0,69	0,02	-0,87	0,45	0,22
Average 2002-2008	0,13	-0,86	-1,44	-0,90	-0,76	-0,29	-1,05	-0,09	-0,49
Average 2009-2014	0,33	0,28	-0,44	0,10	-0,24	0,50	-0,05	-0,14	-0,03
LS Labour cost effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	1,90	-1,00	-1,71	-0,65	-0,85	-1,77	-0,75	-1,18	-1,18
Average 1981-1992	-4,70	-1,46	-1,09	0,40	-0,24	-0,16	-0,60	-0,72	-0,76
Average 1993-2014	5,50	-0,75	-2,05	-1,23	-1,18	-2,65	-0,83	-1,43	-1,41
Average 1981-1985	-0,20	-1,76	-2,40	-0,55	-1,18	-1,46	-0,72	-1,02	-1,08
Average 1986-1992	-7,91	-1,24	-0,16	1,08	0,42	0,77	-0,51	-0,50	-0,53
Average 1993-2001	14,17	-0,98	-2,73	-1,73	-0,98	-4,30	-1,50	-1,96	-1,94
Average 2002-2008	-0,30	-0,66	-1,47	-0,78	-1,22	-1,92	-0,40	-1,11	-1,09

Source: Own elaboration

Table A4.4. Final demand effect as % of VA by sectors, 1981-2014

Q1 effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,50	0,44	0,01	0,04	-0,04	-0,02	0,00	0,01	-0,04
Average 1981-1992	-2,38	0,76	0,01	0,14	0,02	0,01	0,07	0,04	-0,07
Average 1993-2014	-1,03	0,26	0,01	-0,02	-0,07	-0,03	-0,04	0,00	-0,02
Average 1981-1985	-8,53	-2,78	-0,32	-0,61	-0,89	-0,39	-0,43	-0,30	-0,96
Average 1986-1992	2,01	3,29	0,25	0,67	0,68	0,29	0,44	0,29	0,57
Average 1993-2001	-2,71	-0,38	-0,05	-0,14	-0,24	-0,09	-0,13	-0,06	-0,14
Average 2002-2008	0,42	1,43	0,10	0,15	0,13	0,04	0,05	0,09	0,15
Average 2009-2014	-0,18	-0,14	-0,02	-0,04	-0,06	-0,02	-0,01	-0,03	-0,04
Q2 effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,89	0,36	0,01	0,01	-0,08	-0,06	0,00	0,00	-0,07
Average 1981-1992	-3,34	0,32	0,00	0,08	-0,06	-0,11	0,09	-0,01	-0,18
Average 1993-2014	-1,11	0,39	0,01	-0,03	-0,09	-0,03	-0,05	0,01	-0,01
Average 1981-1985	-10,88	-4,11	-0,44	-1,23	-1,33	-0,74	-0,61	-0,51	-1,38
Average 1986-1992	2,05	3,48	0,32	1,02	0,84	0,34	0,60	0,35	0,68
Average 1993-2001	-3,04	-0,44	-0,07	-0,24	-0,33	-0,10	-0,19	-0,08	-0,17
Average 2002-2008	0,53	1,77	0,14	0,23	0,20	0,07	0,09	0,15	0,22
Average 2009-2014	-0,11	0,01	-0,01	-0,03	-0,05	-0,02	-0,01	-0,03	-0,03
Q3 effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,93	0,33	0,00	-0,13	-0,11	-0,10	-0,02	-0,01	-0,10
Average 1981-1992	-3,36	0,20	-0,04	-0,36	-0,19	-0,26	0,03	-0,08	-0,28
Average 1993-2014	-1,15	0,40	0,02	0,00	-0,07	-0,02	-0,05	0,03	0,00
Average 1981-1985	-11,23	-5,07	-0,59	-2,33	-1,73	-1,07	-0,87	-0,75	-1,73
Average 1986-1992	2,27	3,97	0,35	1,04	0,92	0,33	0,68	0,40	0,75
Average 1993-2001	-3,24	-0,66	-0,08	-0,24	-0,34	-0,10	-0,21	-0,08	-0,19
Average 2002-2008	0,61	1,93	0,17	0,33	0,26	0,11	0,13	0,21	0,28
Average 2009-2014	-0,06	0,18	-0,01	-0,04	-0,06	-0,03	0,00	-0,03	-0,02
Q4 effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,71	0,41	0,00	-0,16	-0,10	-0,15	0,00	-0,01	-0,08
Average 1981-1992	-2,40	0,37	-0,01	-0,43	-0,10	-0,39	0,12	-0,10	-0,23
Average 1993-2014	-1,34	0,43	0,01	-0,01	-0,09	-0,02	-0,07	0,03	0,00
Average 1981-1985	-9,59	-5,41	-0,65	-3,03	-1,85	-1,50	-1,00	-0,92	-1,85
Average 1986-1992	2,74	4,49	0,45	1,43	1,15	0,41	0,92	0,50	0,94
Average 1993-2001	-3,77	-0,86	-0,12	-0,36	-0,43	-0,13	-0,30	-0,11	-0,25
Average 2002-2008	0,64	2,11	0,20	0,47	0,29	0,14	0,16	0,26	0,33
Average 2009-2014	-0,01	0,39	-0,01	-0,07	-0,04	-0,03	0,02	-0,02	-0,01
Q5 effect	1PS	2ES	3HT&4MHT	5MLT	6LT	7C	8HTS	9RS	total
Average 1981-2014	-1,72	0,15	-0,01	-0,21	-0,11	-0,34	0,01	0,00	-0,11
Average 1981-1992	-2,40	-0,21	-0,06	-0,75	-0,19	-0,94	0,13	-0,13	-0,36
Average 1993-2014	-1,34	0,35	0,02	0,08	-0,06	-0,01	-0,06	0,07	0,03
Average 1981-1985	-10,08	-8,91	-0,96	-4,59	-2,33	-2,94	-1,42	-1,27	-2,54
Average 1986-1992	3,09	6,01	0,58	1,99	1,35	0,49	1,24	0,68	1,20
Average 1993-2001	-3,87	-1,52	-0,15	-0,38	-0,46	-0,18	-0,39	-0,14	-0,31
Average 2002-2008	0,61	2,36	0,25	0,79	0,41	0,23	0,26	0,39	0,47

Source: Own elaboration

Chapter V: New insights on the relationship between intra- and inter-country inequalities and the involvement in global value chains.

Up to this moment, we have put our focus on theoretical aspects of income distribution, as well as in some empirical applications for studying inequality within a country. Namely, we found the case of Spain interesting because of its social and structural properties, showing signs of a strong stratification, this being a potential source of increasing inequality during the last few decades.

However, it is a well-known fact that, nowadays, barely any economy is an island; economic processes are global, especially with the intensification of globalization during the last couple of decades. In this context, income distribution should also be addressed at a global level of analysis, going beyond countries' internal inequalities. In this global world, the fragmentation of production, that is, that phases of production are disseminated all around the globe, the processes of income distribution among the countries that participate in creating value added, each one contributing with different factor endowments, are not trivial. Here, the concept of Global Value Chains (GVCs) may reveal itself as clear, and we think that it could shed some light on how intra and inter-country inequalities have evolved as a consequence of the manifestation of globalization processes in these value chains. We will find that the way that countries engage or integrate in the global production process matter from these two perspectives of inequality, and that these results vary depending on the geographical area and the level of development of the country in question.

5.1. Introduction

During the last three decades, the process of globalization has intensified to the extent that the world we live in is fully interconnected. In this sense, the phases of production are internationally fragmented (OECD, 2011), as commodities are not entirely produced in one country (Feenstra, 1998). In that sense, production is represented by the so-called Global Value Chains (from now GVCs), and "linking into GVCs" has become one of the important new development challenges for many developed and developing economies (Banga, 2016; Ojala et al., 2008). As noted in Gereffi (1995), Rodrik (2018) or Meng et al. (2020), the engagement of countries in GVCs allows countries to participate in the global economy exploiting their comparative advantages concentrating in specific production processes and contributing in this way to creating employment

and boosting technology transfer. In general, the country's specialization in relatively upstream versus downstream stages of global value chains has been related with higher value-added shares and increased technological complexity (Hagemejer & Ghodsi, 2017; Hummels et al., 2001; Kummritz et al., 2017), allowing economic upgrading. Other literature supports the "*smile curve*" hypothesis (see Meng & Ye (2022), Mudambi (2008), and Shin et al. (2012)), finding differential benefits in the two tails of the production chains.

However, recent literature has also highlighted that international competition is not an easy task, achieving economic upgrading cannot be taken as granted (Bernhardt & Pollak, 2016), and that economic upgrading does not necessarily lead to positive social outcomes. Even more important, different authors point out that positive outcomes are neither equally distributed among countries nor social groups (Barrientos et al., 2011; Meng et al., 2020; Rossi, 2013). In other words, the configuration of the global economy around the GVCs and the potential benefits of countries' involvement in them shed lights and shadows on what the effect has been on inequality trends between and within countries. In this sense, the process of globalization has generated an interesting debate concerning whether countries are net losers or winners (Shepherd, 2013). Kaplinsky (2000) determined that integration in GVCs can yield heterogeneous and complex effects on income distribution, while Dollar (2017) showed that the outcomes of this processes are indeed unequally distributed among countries. The most usually commented negative effect is that of international competition provoking outsourcing of low-skilled occupations to developing countries, while pushing down wages in developed countries (Krugman, 1995)

In this context, our work explores how the performance of countries in the GVCs conditions the levels of intra- and inter-country inequality. The question is to what extent the "upgrading" of countries in the GVCs (i.e. moving up in the value chain), that has allowed countries to improve their economic outcomes (Baldwin, 2013; Gereffi & Fernandez-Stark, 2016), has also led to social upgrading in terms of income inequality reductions. There also remains to answer which are the roles of structural and technological factors mediating this process.

This chapter suggests a multiregional and multisectoral framework to address these questions in order to capture how structural, technological and trade patterns in the countries influence their economic and social outcomes. We aim to shed light on the

nature of inequality as a global phenomenon, considering its two perspectives (one related to inequality between countries, and the other linked to inequality within countries), exploring recent trends in the context of GVCs.

In this regard, according to Bourguignon (2016) and Milanovic (2016), total global inequality, understood as the disparities in the international distribution of income in relation to each country's contribution to global value added, has slightly decreased since the fall of the Berlin Wall. This phenomenon can be explained by the convergence between developed and developing countries, that is to say, by decreases in the inter-country component of global inequality (Chen & Ravallion, 2010; Morelli et al., 2015; Ravallion, 2016). On the contrary, inequality within countries has increased along these years, explained by the impressive increase of top incomes that has been experienced throughout the world (Piketty, 2020). Both outcomes are major consequences of the new configuration of the global economy.

Economic literature has studied the connection of global inequality to the process of globalization, (Dreher, 2006; Zhou et al., 2011). Globalization has been alluded as one of the possible factors behind inequality, among others (Atkinson, 2003). Namely, the phenomenon of globalization, which has accentuated over the past few decades, implies that competition is an international process. As a result, companies outsource activities to developing countries where labor costs are low, which also puts a pressure on wages in the countries of origin (Autor et al., 2014). Furthermore, in this competing globalized world, as processes are externalized and countries are increasingly specializing, commodities and services are not fully produced in one country (Eckel, 2008). This international distribution of production determines the way in which part of global value added or income is appropriated by each country. Hence, the configuration, performance and evolution of GVCs might notably explain the global distribution of income. The study of these relationships is the main focus of this chapter.

The multisectoral and multiregional framework has attracted increasing attention to define different metrics to capture the involvement of countries in these GVCs, mainly approaching their participation and positioning in GVCs. Broadly speaking, the concept of participation in GVCs makes reference to the capacity of a sector/country to integrate in these chains, through the generation of value added embodied in their exported goods and services. This degree of participation can either be captured in different ways. For instance, being related to the country's per capita GDP (Los et al., 2015), approaching

in this way the benefits of trade openness; over global value added, which would be a measure of the country's competitiveness (Bolea et al., 2022); or by using backward and forward linkages, which would respectively indicate participation and strength of imports and exports relationships (Szymczak & Wolszczak-Derlacz, 2022).

Meanwhile, position defines a country's specialization regarding its "upstreamness", or the distance of its production to final demand. This can either be measured in terms of the distance of intermediate inputs to final use (Antràs et al., 2012; Antràs & Chor, 2018), or by calculating the average length of backward to forward linkages (Szymczak & Wolszczak-Derlacz, 2022).

However, while the characterization of countries in global chains, their evolution and their relationship to economic performance (economic upgrading) has been widely discussed in the literature, it is only recently that the implications for social upgrading have been studied (Carballa Smichowski et al., 2021; Marcato & Baltar, 2017). And as far as we know, there are very few studies that have connected metrics of GVC participation with income inequality. Timmer et al. (2014) approached income distribution in GVCs by decomposing total value added in labor and capital and finding an increasing contribution of high-skilled labor and capital to the generation of value added from 1995 to 2008, the former being concentrated in high-income countries, while the latter concentrated in emerging countries. Furthermore, studies such as López-González et al. (2015) or Szymczak & Wolszczak-Derlacz (2022) have specifically focused their analyses on effects on the labor market, mainly in employment and wages. More recently, Carpa & Martínez-Zarzoso (2022) study the relationship between participation in GVCs and intra-country income inequality, finding that a higher degree of backward participation (purchases) increases income inequality in developed countries in the short run, while it decreases in the long run.

This chapter builds on this literature and delves into the relationship between the positioning of countries in the GVCs and their impact on inter- and intra-country inequality. More specifically, we aim to address whether the positioning of countries in GVCs, in more upstream/downstream positions, has allowed them to obtain substantial earnings in terms of value added, allowing them to close the income gap to other countries, or to achieve a more equal internal distribution of income. In other words, to check not only if economic upgrading, understood as integration into GVCs, has been translated into social upgrading, but also to study what are the specific ways of achieving

a successful integration. To the best of our knowledge, this is the first work addressing the potential effects of position in GVCs on the different dimensions of income inequality, leaving a promising line of research ahead.

We are also interested in exploring spatial and temporal patterns, as well as the role of other mediating factors such as participation (the other great indicator of GVCs performance), tertiary education, employment, foreign direct investment or corruption.

Empirically, we take advantage of the extensive information provided by 2021 Release of the Inter-Country Input-Output (ICIO) database, published by the OECD. These tables cover a long term and relevant period of time (1995-2018), with a detail of 45 industries for 66 countries (plus a Rest of the World account). See Table A.1 in the Annex for a detailed list of the countries in our sample, and a classification according to the geographical and economic criteria of the United Nations WESP report that we used to classify our sample by geographical areas.

The empirical strategy combines both the input–output approach for the definition of GVCs variables and the econometric estimation to capture the relationship between the proposed inequality measures and the variables referred to global supply chains.

Our variables of interest include Gini indexes, that are synthetic measures of internal inequality within countries as well as the share of income held by the top 1% over the bottom 50% share, which is a complementary and transparent measure of intra-country inequality (Piketty, 2022). For inter-country inequality, the proportion of each countries' value added per capita over the world average (which is a measure of international income dispersion, as seen in Chancel et al. (2022)) is also considered.

The rest of the chapter is structured as follows. In Section 2, the methodological approach and the data are presented. In Section 3, we discuss the main results of the analysis. First, recent trends of inequality, according to the proposed measures of inter-country and intra-country are discussed and, second, the relationship with the measures of involvement in GVCs is explored. Section 4 closes the chapter with the main conclusions and some policy recommendations.

5.2. Methodology and data

5.2.1. MRIOs and GVCs measures

As noted above, the involvement of countries (positioning and participation) in GVCs is explored through measures obtained in a MRIO framework. Our starting point is the equilibrium equation in a MRIO model for the world economy, with *m* countries and *n* sectors in each country (Isard, 1951; Leontief, 1936, 1941; Miller & Blair, 2009)

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{y} \rightarrow \mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{L}\,\mathbf{y} \tag{5.1}$$

Where $\mathbf{A} = (a_{ij}^{rs})$ is the matrix of technical coefficients and each element a_{ij}^{rs} represents the volume of intermediate input *i* sourced from country *r* that is needed to produce a unit of output *j* in country *s*, **x** is the output vector and $\mathbf{y} = (y_i^r)$ is the vector of total final demand of countries, where each element y_i^r represents the worldwide final demand for products of the industry *i* produced in country *r*. In this MRIO framework $\mathbf{L} = (l_{ij}^{rs})$ is the well-known Leontief inverse in which each representative element l_{ij}^{rs} captures all the production generated in sector *i* in country *r* to fulfil the demands of inputs incorporated in all the steps of the production chain and ending in the final demand y_i^r. Let us denote by **V** the vector of value added and by $\mathbf{v} = (v_j^s)$ the associated vector of unitary coefficients of value added.

On the basis of this model, we calculate the position and participation of countries in GVCs as follows. To summarize information at country level, the matrices and vectors in equation (5.1) are aggregated using an **E** matrix of zeros and ones with the adequate structure and dimensions.

After this aggregation, following Antràs et al. (2012), the position (P_1^r) of each country in GVCs can be computed as follows:

$$P_1^r = \frac{y^r}{x^r} + 2 * \frac{\sum_s a^{rs} y^s}{x^r} + 3 * \frac{\sum_s \sum_k a^{rk} a^{ks} y^s}{x^r} + 4 * \frac{\sum_s \sum_k \sum_t a^{rk} a^{kt} a^{ts} y^s}{x^r} + 5 * \frac{\sum_s \sum_k \sum_t \sum_d a^{rk} a^{kt} a^{td} a^{ds} y^s}{x^r} \tag{5.2}$$

According to this measure, higher values represent more upstream economies. That is, countries/regions are more involved on the production of intermediate inputs in GVCs.

By contrast, those countries/regions with lower values are more "downstream", closer to final demand, that is, more involved in finalist goods and services in the GVCs[1].

Second, the involvement of country r in GVCs can be also calculated within this MRIO framework, following Bolea et al. (2022) as follows:

$\mathbf{VE} = \mathbf{E}'\hat{\mathbf{v}}(\mathbf{I} - \mathbf{A})^{-1}\hat{\boldsymbol{y}}\mathbf{E}$, with $\mathbf{E}$ being the aggregation matrix (5.3)

On the basis of this expression, we can calculate each country's share of value added embodied in exports over the total value added embodied in exports in the global economy as follows:

$$P_2^r = \frac{\sum_{s\neq r}^{s} VE^{r,s}}{\sum_r \sum_{s\neq r}^{s} VE^{r,s}} \quad (5.4)$$

The participation is understood here as a proxy for the country's competitiveness in GVC[2].

5.2.2. Inequality measures

As noted before, our interest is to empirically test the potential relationship between the position of countries in GVCs (measuring in this way the economic upgrading), and the intra- and inter-country measures of income inequality (our proxies for social upgrading).

In order to approximate the latter variables, we will use both, information provided by the MRIO in terms of VA distribution and complementary information on intra-country income inequality. Thus, as a first approach to inter-country inequality (W_{INTER1}), we use the ratio of each country's value added per capita over the world's total (Chancel et al., 2022), directly obtained from our tables. That is:

[1] Although it is common to measure position in this way, that is, as the distance to final demand, Antràs & Chor (2018) proposed another complementary measure based on the distance to primary inputs. They show a negative correlation between both measures. In other words, countries that are upstream with respect to final demand are downstream with respect to primary factors at the same time, and vice versa. Thus, both measures are analogue to each other.

[2] Although we refer to participation in the sense that this measure captures the representativeness of each country's exports in the global value flows, there are different measures which focus on the value added achieved by countries through trade. For instance, Johnson & Noguera (2012) and Los et al. (2015) propose meassures based on the ratio of value added embodied exported by each country over their total value added or per capita GDP. On the other hand, Hummels et al. (2001) and Szymczak & Wolszczak-Derlacz (2022) measure the relationship between value added embodied in exports and value added embodied in imports.

$$W^r_{\_INTER1} = \frac{\frac{V^r}{population^r}}{\frac{\sum_r V^r}{\sum_r population^r}} \quad (5.5)$$

where V^r is the total value added of country or region *r*, and $W^r_{_INTER1}$is normalized at unity. $W^r_{\_INTER1}$ measures the differences in per capita income of each country with respect to the world average; moreover, the higher (lower) the concentration of $W^r_{\_INTER1}$ around the world average, the lower (higher) inequality between countries will be. However, the interpretation of this measure for each country *r* in terms of international inequality might not be so straightforward. If $W^r_{\_INTER1}$ increases for a country/region *r* that is below the world average, it can close the gap, decreasing inter-country inequality. Meanwhile, an increase in the indicator if a country/region is far above the world average, can be translated into an increase in inter-country inequality. To avoid ambiguities, we suggest a simple transformation of expression (5.5) as follows:

$$W^r_{\_INTER2} = |W^r_{\_INTER1} - 1| \quad (5.6)$$

Thus, equation (5.6) shows that, when the second measure of inter-country inequality increases, inequality between countries rises (all regions, whether these are above or below the world average, increase their gap with respect to it, as values are expressed in absolute terms).

Moreover, two measures are considered for intra-country inequality. First, we will consider Gini indexes for each country (W_{INTRA1}). Second, we use the income share held by the top percentile over that of the bottom 50%, which is a measure of income concentration (W_{INTRA2}). The formers are calculated from the data available in the World Income Database (WID), provided by UNU-WIDER, while the latter are extracted directly from the aforementioned database. The specific formula for the Gini index used here is:

$$W^r_{\_INTRA1} = \left|1 - \sum_{k=0}^{k-n-1}(X_{k+1} - X_k)(Y_{k+1} + Y_k)\right| \quad (5.7)$$

where Y_k represents the accumulated proportion of income up to income category *k*, while X_k stands for the accumulated proportion of population up to income class *k*.

5.2.3. Variables and econometric strategy

Our database consists of a panel data sample of 67 countries, covering the period 1995-2018. Multiregional input-output tables come from the November 2021 Inter-Country Input-Output (ICIO) tables, released by the OECD.

As stated above, our objective is to study whether the upgrading of countries in the GVCs (in terms of position in GVCs) has implied a reduction in the levels of inequality within and between countries, as well as to study what structural, technological or institutional factors may mediate these relationships.

Dependent variables for our models are the four measures of inequality, which we correlate with our variable of interest, the position in GVCs. Note that, in line with the "*smile curve*" literature (as previously stated), economic outcomes seem to hold a convex relationship with the position measures (Meng et al., 2020; Shih, 1996). This convexity is also explored for our variables of social outcome. In this regard, to control for potential non-linearity, the variables position P_1^r, and squared position $(P_1^r)^2$ are considered.

In addition to this variable, we also consider the variable P_2^r of participation in GVCs as explicative variable. These two variables, participation and position, offer different but complementary sides of the involvement of countries in global value chains.

These variables are complemented with a set of control variables which attempt to capture different mediating factors in the relationships studied. These factors have to do with usual explicative causes of inequality, as well as the control of spatial and temporal differences.

As control variables, we first include unemployment rates (World Bank, estimated from ILO), which provide some insights about global employment, which is important considering that an important facet of increasing inequality is found in decreasing labor shares of income (ILO & OECD, 2015; Karabarbounis & Neiman, 2014). Moreover, differences in education are also important determinants of international inequalities in labor (Bertocchi & Dimico, 2014), so we include enrollment rates in tertiary education, extracted from World Bank data. Following OECD (2008), Foreign Direct Investment in the country is also considered and taken from World Bank data. As a way for controlling institutional effects, we include Corruption control indexes, again from the World Bank (Policardo & Carrera, 2018). Finally, controlling for technological changes in manufacturing and services, which could also be important determinants of inequality and skill-biased compensations (López-González et al., 2015; OECD, 2011), we include specialization indexes in high-technology industries and services (Balassa, 1965). As an additional proxy of innovation, we also use the number of patents, obtained from World

Development Indicators (Law et al., 2020). Finally, to account for differences between countries with a more rural versus urban population distribution, we include the variable urban population, extracted from the World Bank (Young, 2013). It accounts for the proportion that urban population represents over total. Thus, higher values represent urban areas.

Moreover, five main geographical areas are considered in order to capture geographical and development heterogeneity, following the country classification provided by UN's 2021 WESP Report (see Table A5.1 in the Annex). Dummy variables for the different areas are defined. In order to capture differences not only in the constant term but also in the slopes these dummies are also included in a multiplicative way with the position and the squared position variables. Fixed effects for each country are also considered in the estimation. Finally, a time dummy for controlling possible structural breaks around the 2008 crisis is included (D_2008). It takes value 0 from 1995 to 2007, and value 1 otherwise.

To sum up, two sets of regressions are performed. First, we run a global test for all the countries in our sample. Then, regressions are performed distinguishing by geographical areas. Being W_i the four inequality measures and the endogenous variables, our regressions read as follows:

$$GLOBAL\_W_i = \alpha + \beta_1 P_1 + \beta_2 (P_1)^2 + \beta_3 P_2 + \cdots + \beta_j control_j + \cdots + \varepsilon$$

$$REGIONS\_W_i = \alpha + \beta_1 \left(P_1 * D_{developed}\right) + \beta_2 (P_1)^2 * D_{developed} + \beta_3 (P_1 * D_{transition}) + \beta_4 (P_1)^2 * D_{transition} + \beta_i P_2 + \cdots + \beta_j control_j + \varepsilon$$

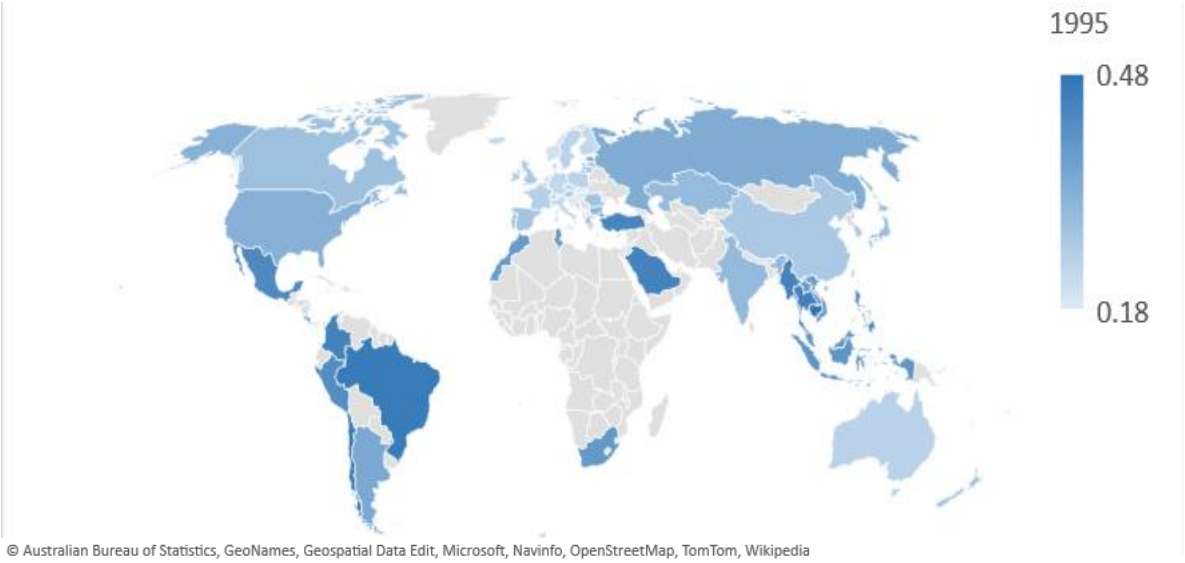
5.3. Stylized facts: Recent trends in global inequality

Before moving on to the empirical analysis of the relationship between position in GVCs and inequality, we are first presenting a general overview of the recent trends in intra- and inter-country inequality observed worldwide and captured with our available information.

5.3.1. Intra-country inequality: Income shares and Gini indexes

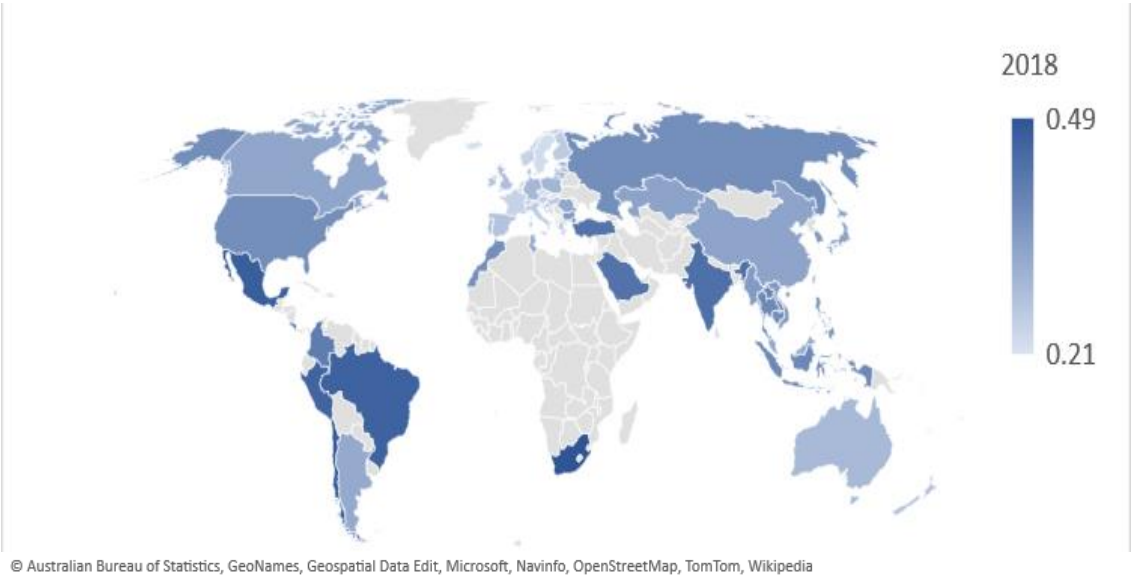
Intra-country inequality, as measured by Gini indexes, both at the start and the end of the period, is shown in Figures 5.1 and 5.2[3]. As shown in the two maps below, internal inequalities have generally increased along the period, especially in Central & Latin America, Africa, Eastern Europe, and some specific countries, such as the United States, India, and China. On the contrary, Southeastern Asia economies seem to have performed well in terms of internal inequality, showing lower Ginis in 2018, in general.

Figure 5.1. Global Gini indexes, 1995



Source: own elaboration

Figure 5.2. Global Gini indexes, 2018



Source: own elaboration

[3] See Table A5.2 in the Annex for detailed results of the evolution of Gini indexes from 1995 to 2018.

At a country level, inequality decreased along the period in only 20 countries out of the 65 that are present in our sample. The lowest average value is found in the Netherlands, 0.21, while the highest values are in Chile, 0.47. We can further group countries regarding the average values of internal inequality. The countries with a moderate level of inequality, which we identify with Ginis lower than 0.25, are European. On the contrary, extreme levels of inequality, higher than 0.35, are concentrated in Latin America, Central & East Asia, Middle East, and Africa. It should also be remarked that these are all developing areas, alongside the United States, which constitutes a noteworthy case.

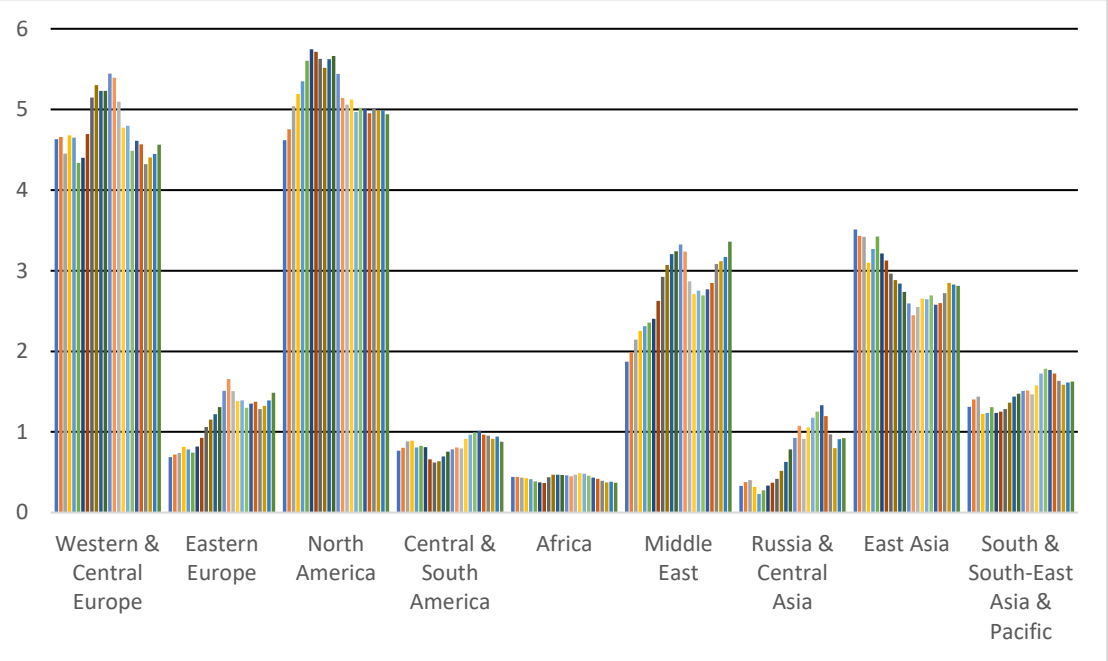
As a complementary measure, Table A5.3 shows the income shares held by the richest 1% over the share of the poorest 50% in each country. This indicator shows that income is globally highly concentrated in the hands of the richest, during the entire period and for almost all countries. This concentration only decreased in 24 countries out of the 67 in sample. It is outstanding that the highest differences are found in Latin American countries, but also in South Africa, Saudi Arabia, and some Asian countries (as Cambodia or Myanmar). There, we find cases where, in average, the income held by the top 1% is 100 higher than that of the bottom 50%. In short, inequality within countries seems to be generally higher in 2018 than in 1995.

5.3.2. Inter-country inequality: income per capita gaps between geographical areas

Our first measurement for inter-country inequality is the per capita income in each country over world average. In order to get a first picture of international income distribution and its evolution over time, countries are grouped by geographical areas. Results are represented in Figure 5.3 below[4].

[4] For the sake of offering a more detailed exposition, the descriptive analysis further disaggregates the regions we are using in the econometric analysis. Namely, Developed countries are here divided into Central & Western Europe, North America, and Eastern Europe, in order to show the different evolution followed by the latter. Furthermore, in the Asian region, here we distinguish between East Asia (China, South Korea, Hong Kong, and Taiwan) and South & Southeast Asia, because the dynamics of both convergence and growth are also clearly different. Finally, Russia & Central Asia fully corresponds to what in the UN's classification is called Transition economies.

Figure 5.3. Inter-country inequality by geographical areas, Value Added per capita over world average (in $), 1995- 2018



Source: own elaboration

Looking at Figure 5.3 above, there can be seen some signal of reduction in inter-country inequality and convergence to the world average per capita income (the average value is 1), along this period. First, there are some areas that have been notably increasing their per capita income levels. On the one hand, Eastern Europe have increased its income per capita levels over the world average and Russia & Central Asia have achieved this world average. On the other hand, Middle East countries and South & South-East Asia, which already were over the world total in 1995, have continued their processes of convergence towards Europe and North America. Second, Latin America and Africa keep under the world average, with no signs of convergence. And finally, Western & Central Europe and North America, the two areas with the higher levels of income per capita in 1995, have sharply reduced their position above the world income average in this century, especially since the international recession in 2008. The same happened in East Asia, with a convergence to the world average from the beginning of the period although there seems to be a slight recovery after the 2008 recession.

To sum up, inter-country inequality could be considered to have fallen from 1995 to 2018, while intra-country inequality has generally increased. The world seems to be relatively more equal in terms of geographical distribution of income, as it is shown by the fact that the geographical areas with higher levels of income per capita have been

losing weight, while some other areas have increased it, closing the gap. Data also show the endemic problem of Latin America and Africa which keep under the world average and without a clear trend to close the income gap.

Global inequality is then a contemporary problem, and to unveil how globalization and the fragmentation of production play a role in this, could help us to make some recommendations, which should differ by types of countries.

5.4. Results: Globalization and inequality

In order to check the relationship between the involvement of countries in GVCs and the proposed measures of inter and intra-inequality, a set of regressions are formulated. As previously explained, we are interested in testing four different aspects, namely, a) if the advance in the positions in GVCs (upstream/downstream) has a significant relationship with the evolution of inter and intra-country inequality, b) if this relation adopts different functional forms (in particular a quadratic form), c) if significant different geographical patterns can be described and, d) the role of other structural and institutional factors at the country level mediating these relationships . Global results for the complete sample appear in Table 5.1 below. Results from the regressions controlling position by geographical areas are shown in Table 5.2 below.

5.4.1. Global results

We first take a look at the global results in Table 5.1. Here, we are mainly focusing on the relationship between *Position* and the inequality measures, as the results obtained for the control variables do not significantly change from that obtained for the results in the following sub-sections, where the effect of *Position* is split into geographical/development areas. Then, we can confirm that, at a global level, the relationship between intra-country inequality and *Position* is shaped as a concave "frown curve", as shown by the positive sign of the coefficient accompanying the position variable and the negative sign of the coefficient corresponding to the squared-position variable[5]. This means that, globally, internal inequality in countries can be reduced when countries move to either tail of the supply chain.

[5] A frown curve has to fulfil two conditions: 1) a negative sign of the squared-position variable, and 2) the maximum belongs to a positive range of values, that is, a positive sign of the linear variable. The smile curve must fulfil two similar conditions: 1) a positive sign of the squared-position variable and, 2) the minimum value belongs to the positive range of values, that is, a negative sign of the linear variable. If

On the contrary, the relationship between the *Position* variable and the inter-country inequality indexes is shaped as a convex "smile curve", as shown by the negative sign of the coefficient of the position variable and the positive sign of the coefficient corresponding to the squared-position variable. This shape is found for the two measures of inter-country inequality. For the first measure, W_{INTER1}, this result suggests that increasing per capita GDP with respect to the world average can be achieved by positioning in either upstream or downstream positions, that is, when countries/regions are specialized on the production of initial production stages in GVCs (upstream economies) or its production is closer to final demand, more involved in finalist goods and services in the GVCs, downstream economies, confirming that intermediate stages offer less opportunities for economic upgrading. Our second measure W_{INTER2}, which is more strictly an index of inequality between countries, shows that reductions in inter-country inequality or convergence (reductions in the index) are achieved in the tails, while increases take place in the middle positions of GVCs.

Participation exhibits positive and significant effects on both intra-country inequality variables, meaning that a higher share of a country's exported value added over the world total is not translated into a more equal distribution of income within the country. This is consistent with the results obtained by Carpa & Martínez-Zarzoso (2022), who found that increasing participation in GVCs can lead to a worse internal distribution of income in the short run. Moreover, the relations with both inter-country inequality measures are also significant and positive, meaning, on the one hand, that increasing participation improves a country's situation in respect with global average income per capita, which is not surprising, as participation is another facet of economic upgrading; on the other hand, when a country increases participation, inter-country inequality, as measured by the second measure, worsens, which is also reasonable, as an improvement in a country's comparative advantage automatically means that other countries are worse-off in relative terms.

condition 2) fails in any of the two cases, only the decreasing part of the function is significant in the former case, while only the increasing part of the function matters in the latter. In either way, a significant relationship is important, but the interpretations change and must be carefully addressed.

Table 5.1. General results, 1995-2018

VARIABLES	(1) W_INTRA1	(2) W_INTRA2	(3) W_INTER1	(4) W_INTER2
P_1	0.283***	1.604	-16.47***	-12.22***
	(0.0886)	(1.272)	(2.035)	(1.924)
$(P_1)^2$	-0.0758***	-0.435	4.131***	3.015***
	(0.0213)	(0.298)	(0.519)	(0.490)
P_2	0.622***	5.603***	18.64***	18.61***
	(0.0677)	(0.548)	(1.883)	(1.866)
D_Developed	-0.108***	-0.713***	0.447***	-0.129
	(0.00433)	(0.0422)	(0.101)	(0.101)
D_Transition	-0.0282***	-0.202***	0.818***	0.360**
	(0.00697)	(0.0754)	(0.134)	(0.151)
D_Africa	0.0267***	0.231***	0.163	0.292**
	(0.00706)	(0.0897)	(0.142)	(0.140)
D_CentralLatinAm	0.0505***	0.773***	-0.633***	-1.011***
	(0.00587)	(0.0693)	(0.133)	(0.133)
D_MiddleEast	0.0467***	0.470***	0.244**	-0.427***
	(0.00484)	(0.0531)	(0.113)	(0.110)
D_EastSouthEastAsia	-	-	-	-
Terc_edu	-5.31e-05	-0.00194***	-0.00248	-0.00609***
	(6.72e-05)	(0.000669)	(0.00190)	(0.00194)
SI_HTI	0.00275	-0.0199	0.869***	0.878***
	(0.00318)	(0.0285)	(0.140)	(0.144)
SI_HTS	-0.0223***	-0.196***	-0.207***	-0.0393***
	(0.00245)	(0.0252)	(0.0763)	(0.0737)
Corruption	-0.00321	-0.00594	1.290***	1.151***
	(0.00201)	(0.0210)	(0.0605)	(0.0618)
Unemp	-0.000333	-0.00471	-0.0807***	-0.850***
	(0.000245)	(0.00303)	(0.00684)	(0.00720)
Patents	6.26e-10	-3.59e-07***	-1.75e-06***	-1.60e-06***
	(2.35e-08)	(1.15e-07)	(4.35e-07)	(4.33e-07)
Urban	-0.000511***	-0.00566***	0.0121***	0.000962
	(0.000108)	(0.00111)	(0.00274)	(0.00267)
In_FDI	0.00177**	0.0136*	0.0148	0.0148
	(0.000760)	(0.00700)	(0.0242)	(0.0242)
D_2008	0.00631**	0.0771***	-0.0209	-0.0209
	(0.00256)	(0.0270)	(0.0684)	(0.0684)
Constant	0.146	0.312	16.55***	13.52***
	(0.0927)	(1.374)	(1.956)	(1.848)
Observations	1,495	1,495	1,495	1,495
R-squared	0.752	0.659	0.790	0.697

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regarding the rest of the control variables, we find that *Tertiary Education* has a negative effect on income concentration, meaning that tertiary enrollment is translated in more equality of opportunities. In a similar vein, the country's *Specialization in High technology services* (HTS) is also a source of reduction of intra and inter-country inequality. On the contrary, a higher *Specialization in high technology industries* (HTI) lead countries to distance with respect to the world income average, thus increasing inter-country inequality. The negative effect of *Patents* on the concentration of incomes in the top 1% and on both inter-country inequality measures also highlight this importance of innovation. Moreover, a higher control of *Corruption* does not seem to significantly affect intra-country inequality, while it broadens the gap between countries.

Regarding *Foreign Direct Investment*, it has a positive effect on both measures of intra-country inequality, showing that capital inflows are not necessarily an equalizer of income, and that capital liberalization might have worsened distribution, especially that of primary shares of factor incomes. In any case, this effect is only significant in the case of the intra-country inequality indexes, at the 90% and 95% of confidence level, respectively. Meanwhile, *Urban population* reduces internal inequalities, probably associated to the fact that living in cities might present a wider variety of opportunities for improving life conditions than in rural areas. This variable presents a positive sign in the case of $W\__{INTER1}$, suggesting that is also a factor of divergence between countries. Finally, *Unemployment* does not significantly affect internal inequalities, while it is a clear factor of economic downgrading, as well as of downward convergence.

Focusing on the territorial dummies, being Asia the control group, it can be seen that structural inequality within countries has been significantly higher in Africa, Latin American, and Middle East countries, while it was lower in Developed and Transition countries. In terms of inter-country inequalities, these controls also show that Developed, Transition, and Middle East countries have also performed better than Latin America, in terms of economic upgrading. Finally, a comment following the inclusion of a temporal dummy controlling for possible structural breaks in 2008 must follow. It can be seen that this variable is significant and positive for both intra-country measures, while it does not significantly affect inter-country inequality. This result confirms a structural leap in internal inequalities from the 2008 crisis onwards. As it is usually acknowledged, the recession had serious global implications on production and income, affecting to the social distribution of that income, and increasing the levels of internal inequality. Moreover, the globalism of the 2008 crisis also justifies that there are not significant structural differences in inequality between countries as a consequence, once the other economic and institutional factors are controlled for.

In sum, the results suggest that countries upgrading is compatible with strategies of specialization in the two tails of the production chains, also allowing reductions in their levels of internal inequality. Nevertheless, the full sample of countries is heterogeneous enough to provide a clear picture of potential geographical and development biases in these relationships. In order to go deeper into the characteristics of this heterogeneity, we explore how the described results are modulated by geographical areas (the world

regions previously defined). These extensions are performed in the in the following sub-section.

5.*4.2. Intra- and inter-country inequalities by areas*

First, we look at the relationship between intra-country inequality and GVCs measures (see columns 1 and 2 in Table 5.2). As in the previous analysis, *Participation* has positive and significant effects on both intra-inequality variables which means that, all other things constant, a higher share of the global value in the countries does not lead to more equal societies.

In order to control for the existence of different smile or frown curves in the relationship between *Position* of countries in global value chains and intra-country inequality indexes, regional dummy variables are included affecting both the linear and the quadratic relationship of the *Position* variables. This allows to control not only for differences in the constant term but also different shapes and slopes in the functional forms.

As we can see, the way in which the country is involved in the GVCs, in relative more upstream or downstream positions, is related with inequality in different way depending on the geographical area of study. On the one side, we find that the relationship between internal inequality and quadratic position is positive (smile curve) in Developed countries, Latin America, Middle East, and Asia (just in the case of top 1% income concentration), meaning that occupying intermediate positions in the chains is related to lower levels of inequality in these areas.

Furthermore, in African and Central & Latin America downstream positions suppose higher intra-country inequality. Otherwise, the story of success when reducing internal inequalities in Eastern & Southeastern Asia, except in India and China (see Figures 5.1 and 5.2), might also be related to the general upgrade that these countries have achieved during these years in the sense of integration into the chains, generally occupying intermediate positions in the chains.

Table 5.2. Position and inequality measures by geographical areas, 1995-2018

VARIABLES	(1) W_INTRA1	(2) W_INTRA2	(3) W_INTER1	(4) W_INTER2
Developed_P_1	-0.623***	-3.655***	-57.37***	-51.85***
	(0.119)	(0.823)	(4.852)	(4.842)
Developed_ $(P_1)^2$	0.146***	0.869***	14.76***	13.47***
	(0.0297)	(0.203)	(1.232)	(1.229)
Transition_ P_1	2.436**	25.69**	-14.23*	0.227
	(1.130)	(10.58)	(8.029)	(13.18)
Transition_ P_1^2	-0.563**	-5.945**	3.542*	0.543
	(0.258)	(2.424)	(1.834)	(3.036)
Africa_ P_1	-0.950	1.001	11.30**	1.520
	(0.611)	(9.636)	(5.089)	(6.573)
Africa_ $(P_1)^2$	0.306*	0.641	-2.660**	-0.503
	(0.158)	(2.468)	(1.310)	(1.740)
CentralLatinAm_ P_1	-1.861***	-26.65***	10.55	34.77***
	(0.469)	(6.220)	(8.610)	(11.40)
CentralLatinAm_ $(P_1)^2$	0.516***	7.322***	-3.892*	-10.06***
	(0.121)	(1.603)	(2.217)	(2.928)
MiddleEast_ P_1	-0.106	-1.801	-20.85***	-28.70***
	(0.307)	(3.716)	(6.965)	(7.747)
MiddleEast_ $(P_1)^2$	0.0232	0.544	5.276***	6.997***
	(0.0762)	(0.929)	(1.716)	(1.998)
EastSouthEastAsia_ P_1	0.0336	-5.932***	-8.774***	5.800***
	(0.104)	(1.420)	(2.295)	(1.998)
EastSouthEastAsia_ $(P_1)^2$	-0.0281	1.164***	2.034***	1.138**
	(0.0239)	(0.321)	(0.581)	(0.500)
P_2	0.515***	4.368***	20.67***	22.73***
	(0.0624)	(0.472)	(1.984)	(2.022)
D_Developed	0.512***	-3.988**	46.18***	42.04***
	(0.160)	(1.704)	(5.352)	(5.186)
D_Transition	-2.703**	-35.07***	5.478	-9.947
	(1.236)	(11.59)	(8.992)	(14.33)
D_Africa	0.691	-10.86	-20.87***	-7.958
	(0.593)	(9.371)	(5.308)	(6.687)
D_CentralLatinAm	1.672***	17.68***	-16.24*	-37.91***
	(0.468)	(6.218)	(8.507)	(11.14)
D_MiddleEast	0.118	-5.284	11.14	21.38***
	(0.328)	(4.012)	(7.341)	(8.039)
D_EastSouthEastAsia	-	-	-	-
Terc_edu	-3.97e-05	-0.00135**	0.000850	-0.00296
	(6.58e-05)	(0.000640)	(0.00177)	(0.00183)
SI_HTI	-0-0150***	-0.0932***	-0.257***	0.231*
	(0.00242)	(0.0221)	(0.0828)	(0.133)
SI_HTS	-0.00825**	-0.103***	0.274**	-0.450***
	(0.00343)	(0.0288)	(0.131)	(0.00797)
Corruption	-0.00658***	-0.0687***	1.483***	1.361***
	(0.00199)	(0.0202)	(0.0612)	(0.0629)
Unemp	-0.00181***	-0.0241***	-0.0776***	-0.0720***
	(0.000257)	(0.00269)	(0.00745)	(0.00797)
Patents	-8.57e-10	-3.85e-07***	-1.43e-06***	-1.33e-06***
	(1.80e-08)	(7.85e-08)	(3.70e-07)	(3.84e-07)
Urban	-0.000183*	-0.000618	0.0119***	0.00178
	(0.000103)	(0.00102)	(0.00266)	(0.00266)
In_FDI	0.00191***	0.0141**	0.00789	0.0105
	(0.000723)	(0.00655)	(0.0229)	(0.0234)
D_2008	0.00773***	0.0758***	0.0126	-0.0492
	(0.00241)	(0.0244)	(0.0665)	(0.0680)
Constant	0.443***	8.730***	10.16***	8.811***
	(0.111)	(1.542)	(2.227)	(1.950)
Observations	1,495	1,495	1,495	1,495
R-squared	0.789	0.748	0.819	0.741

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Finally, a significant negative relation (frown curve) is found between quadratic position and intra-country measures of inequality in Transition economies. Thus, in this area, internal inequality is lower for countries that occupy positions in the extremes of the chains. The downgrades from upstream to intermediate positions that Russia have been experiencing along this period might explain its increasing inequality.

We now move on to the analysis of inter-country inequality (see columns 3 and 4 in Table 5.2). While we have seen that *Participation* negatively affected intra-country inequality, it presents a positive effect on inter-country inequalities (20.67 and 22.73, respectively), meaning that it favors economic upgrading, but also increases disparities between countries. Increasing competitiveness is then a crucial step on achieving economic upgrading (Jangam & Rath, 2020). Nonetheless, its translation into social upgrading, measured in terms of convergence, is not so clear.

More interesting, regarding *Position*, "smile curves" are found in Developed, Middle Eastern, Transition, and Asian countries (for the last two regions, only in INTER1). This means that, for these regions, extreme positions in the global production chains promote economic upgrading, while intermediate positions decrease inter-country inequality.

On the other side, "frown curves" or negative quadratic relations are found in Africa (only in INTER1) and Latin America, demonstrating different paths of economic growth and economic convergence. Their negative performances in terms of economic catching-up (see Figure 5.3) can then be linked to the difficulties of developing countries to move up the chain, as previous literature has shown (Palpacuer et al., 2005; Rodrik, 2018). In fact, as said before, these countries generally specialize in downstream positions, with productions based on low-skilled and resources-intensive productions. As Rivera-Basques et al. (2021) suggest, the unequal exchange of Latin America with other countries is even more intensive in the current context of international fragmentation of production.

It should then be concluded that, in order to achieve economic upgrading (and then, converge to the world average from below), intermediate positions in global chains should be promoted in Africa (e.g., upgrades in Morocco and Tunisia) and Latin America, which means domestic industrialization policies in these areas. Finally, the passive convergence of Developed countries towards global average income can be explained by European countries moving towards intermediate positions, as could be the case of east European countries or Germany specializing in the automotive sector.

To end this section, let us comment that the effects found in the control variables are similar to those seen in the global results (Table 1), and need no further comments.

5.5. Conclusions

The main aim of this chapter is to explore the relationship between inequality, both at inter-country and intra-country levels, and the involvement of countries in GVCs. A particular focus on the *Position* variables, that is, on the more downstream or upstream specialization of countries in the different production stages, and its impact both on internal inequality and inter-country divergences. We are interested in studying if there is room for different but compatible specialization patterns of the economies to achieve social outcomes (in terms of reducing social inequality), in the context of catching-up processes. As we observe different inequality patterns along the world, we do the analysis for different geographical groups.

Our findings suggest that *Position* is relevant explaining inequality in some world regions. In the case of intra-country inequality (measured through Gini indexes and ratios of top 1% incomes over the bottom 50%), we find significant "smile curves" in Developed countries, Latin America, and East & Southeast Asia (just for the INTRA2 measure). That means that, in these areas, intermediate positions in the chains (that is associated with the development of medium technology, and high technology industries such as plastics, chemicals, or electrical equipment) contribute to reduce internal inequality, while the opposite happens in the tails. In fact, internal inequality is especially high in Latin American countries, which could be explained by their downstream character. The success of most Southeast Asia countries in reducing inequality can also be related to their good performances in achieving economic upgrades in terms of moving up the chains into intermediate positions; by contrast, the increasing inequality in China and India is linked respectively with its upstream and downstream character. For Transition economies, we get a "frown curve", that is, being in the extremes of the chains favors low values of inequality. Thus, being located in the first or last steps of the production process benefits these economies in terms of internal equality: namely, high internal inequality in Russia could be explained by its intermediate positioning.

If we focus on inter-country inequality, first measured as economic upgrading, position is significant in all our geographical areas. We find "smile curves" in Developed countries, Transition economies, Middle East, and Asia. Meanwhile, "frown curves" appear in Latin America and Africa. In other words, extreme positions in the GVCs would increase income with respect the world average in the former areas, while intermediate positions are recommendable in order to achieve economic upgrading in the latter. As we have seen the case of Middle East and Southeast Asia countries has been an example of a successful stories of upgrading, while the contrary has happened in Africa and Latin America, its countries being trapped in low-income levels in comparison to the global average, as well as in downstream positions in the GVCs.

Furthermore, measuring inter-country inequality as an indicator of social upgrading (difference of value added per capita with the world average), we find "smile curves" in Developed and Middle East countries, and "frown curves" in Latin America. Therefore, we have found that convergence can be achieved when Developed and Middle East countries occupy intermediate positions, while many Developing countries should move to the extremes. Here, the case of Latin America is outstanding, as these countries would converge by moving to downstream or upstream positions.

All in all, this work opens a promising line of research linking inequality with globalization, exploring this relation from the perspective of GVCs. As we have shown, the MRIO framework reveals as a powerful instrument to study the anatomy and evolution of GVCs and the associated socioeconomic and environmental impacts. Further future research is expected in the design of integrated indicators capturing different perspectives of the social upgrading of countries and the relationship with the current and future globalization perspectives.

5.6. References of Chapter V

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5.7. Annex of Chapter V

Table A5.1. Countries classification

Developed countries	**Economies in transition**	**Developing countries**			
		Africa	Central & South America	Middle East	East & Southeast Asia
Australia	Kazakhstan	Morocco	Argentina	Israel	Brunei Darussalam
Austria	Russian Federation	South Africa	Brazil	Saudi Arabia	Cambodia
Belgium		Tunisia	Chile	Turkey	China
Bulgaria			Colombia		India
Canada			Costa Rica		Indonesia
Croatia			Mexico		Hong Kong, SAR
Cyprus			Peru		Lao PDR
Czechia					Malaysia
Denmark					Myanmar
Estonia					Philippines
Finland					Republic of Korea
France					Singapore
Germany					Taiwan*
Greece					Thailand
Hungary					Viet Nam
Iceland					
Ireland					
Italy					
Japan					
Latvia					
Lithuania					
Luxembourg					
Malta					
Netherlands					
New Zealand					
Norway					
Poland					
Portugal					
Romania					
Slovakia					
Slovenia					
Spain					
Sweden					
Switzerland					
United Kingdom					
United States					

*Note: Countries are classified according to the UN *World Economic Situation and Prospects, 2022*. Taiwan was eliminated from the sample, due to data restrictions for many variables.

Source: own work

Table A5.2: Intra-country inequality, Gini indexes, 1995-2018

Country/ year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	% change	Average
AUS	0.24	0.24	0.25	0.25	0.26	0.27	0.25	0.26	0.26	0.27	0.27	0.28	0.27	0.26	0.27	0.27	0.26	0.27	0.29	0.28	0.28	0.28	0.29	0.29	0.05	0.27
AUT	0.25	0.26	0.26	0.27	0.25	0.27	0.26	0.27	0.28	0.26	0.27	0.29	0.27	0.27	0.26	0.27	0.26	0.24	0.24	0.26	0.25	0.26	0.25	0.25	0.00	0.26
BEL	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.25	0.25	0.25	0.26	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.25	0.00	0.25
CAN	0.29	0.29	0.30	0.30	0.31	0.32	0.32	0.31	0.31	0.32	0.33	0.34	0.34	0.33	0.31	0.32	0.32	0.32	0.33	0.33	0.33	0.31	0.33	0.33	0.04	0.32
CHL	0.45	0.45	0.45	0.45	0.45	0.46	0.46	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.47	0.49	0.50	0.49	0.49	0.48	0.48	0.48	0.48	0.48	0.02	0.47
COL	0.44	0.45	0.45	0.44	0.43	0.42	0.42	0.42	0.43	0.43	0.42	0.42	0.43	0.43	0.43	0.42	0.42	0.40	0.41	0.41	0.40	0.40	0.40	0.41	-0.03	0.42
CRI	0.36	0.36	0.36	0.36	0.36	0.36	0.39	0.38	0.38	0.38	0.39	0.40	0.48	0.44	0.43	0.39	0.41	0.40	0.40	0.39	0.40	0.42	0.40	0.42	0.06	0.39
CZE	0.22	0.23	0.22	0.23	0.23	0.23	0.23	0.22	0.23	0.23	0.23	0.23	0.23	0.25	0.23	0.23	0.22	0.23	0.22	0.23	0.24	0.23	0.23	0.22	0.00	0.23
DNK	0.22	0.22	0.23	0.23	0.24	0.24	0.23	0.23	0.22	0.22	0.24	0.24	0.24	0.23	0.22	0.25	0.25	0.25	0.26	0.27	0.26	0.26	0.26	0.26	0.05	0.24
EST	0.34	0.35	0.34	0.34	0.34	0.34	0.33	0.35	0.35	0.34	0.37	0.33	0.32	0.30	0.27	0.28	0.30	0.32	0.31	0.31	0.29	0.29	0.29	0.29	-0.05	0.32
FIN	0.23	0.23	0.24	0.25	0.26	0.27	0.26	0.26	0.25	0.26	0.25	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.25	0.25	0.26	0.26	0.03	0.25
FRA	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.26	0.25	0.25	0.25	0.25	0.24	0.24	0.24	-0.01	0.25
DEU	0.23	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.30	0.29	0.07	0.27
GRC	0.28	0.29	0.30	0.31	0.32	0.32	0.32	0.30	0.29	0.29	0.29	0.29	0.28	0.26	0.25	0.26	0.24	0.25	0.26	0.29	0.28	0.28	0.27	0.26	-0.02	0.28
HUN	0.18	0.19	0.20	0.20	0.21	0.21	0.23	0.24	0.24	0.23	0.25	0.26	0.26	0.26	0.25	0.26	0.25	0.24	0.25	0.25	0.25	0.25	0.26	0.26	0.08	0.24
ISL	0.23	0.23	0.23	0.23	0.23	0.23	0.25	0.26	0.25	0.24	0.24	0.25	0.28	0.22	0.20	0.20	0.20	0.20	0.22	0.22	0.22	0.22	0.22	0.22	-0.01	0.23
IRL	0.26	0.24	0.26	0.27	0.27	0.28	0.27	0.27	0.28	0.28	0.29	0.29	0.29	0.26	0.25	0.25	0.25	0.25	0.26	0.26	0.28	0.28	0.28	0.28	0.02	0.27
ISR	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.42	0.42	0.41	0.40	0.39	0.39	0.38	0.38	0.38	-0.01	0.40
ITA	0.22	0.22	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.23	0.24	0.24	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.03	0.24
JPN	0.29	0.30	0.30	0.30	0.30	0.31	0.32	0.33	0.34	0.35	0.35	0.35	0.35	0.34	0.33	0.34	0.33	0.33	0.34	0.34	0.34	0.34	0.34	0.34	0.04	0.33
KOR	0.26	0.28	0.29	0.26	0.28	0.29	0.30	0.31	0.31	0.32	0.31	0.33	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.35	0.09	0.32
LVA	0.27	0.27	0.27	0.28	0.28	0.28	0.28	0.29	0.30	0.29	0.31	0.28	0.31	0.30	0.29	0.28	0.30	0.30	0.30	0.29	0.28	0.26	0.28	0.28	0.01	0.29
LTU	0.26	0.25	0.25	0.24	0.24	0.25	0.25	0.25	0.25	0.27	0.28	0.26	0.29	0.29	0.29	0.26	0.27	0.29	0.30	0.33	0.29	0.29	0.30	0.29	0.03	0.27
LUX	0.29	0.30	0.30	0.31	0.31	0.30	0.30	0.29	0.28	0.31	0.33	0.28	0.32	0.31	0.26	0.29	0.28	0.27	0.26	0.25	0.25	0.26	0.27	0.26	-0.03	0.29
MEX	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.43	0.44	0.45	0.45	0.47	0.48	0.48	0.48	0.49	0.49	0.49	0.50	0.49	0.49	0.48	0.47	0.05	0.46

NLD	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.22	0.23	0.21	0.21	0.22	0.22	0.22	0.21	0.22	0.22	0.22	0.23	0.22	0.02	0.21
NZL	0.28	0.28	0.28	0.30	0.29	0.26	0.27	0.27	0.27	0.28	0.26	0.22	0.23	0.22	0.25	0.25	0.26	0.28	0.26	0.26	0.27	0.27	0.27	0.28	-0.01	0.27
NOR	0.20	0.22	0.23	0.21	0.22	0.25	0.23	0.23	0.24	0.25	0.25	0.26	0.26	0.26	0.23	0.25	0.25	0.25	0.25	0.25	0.23	0.23	0.23	0.24	0.04	0.24
POL	0.24	0.23	0.24	0.25	0.25	0.25	0.25	0.26	0.27	0.28	0.29	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.06	0.28
PRT	0.28	0.28	0.28	0.28	0.29	0.29	0.30	0.29	0.29	0.30	0.29	0.30	0.30	0.29	0.28	0.29	0.29	0.28	0.29	0.29	0.29	0.29	0.29	0.28	0.00	0.29
SVK	0.18	0.19	0.19	0.20	0.21	0.21	0.22	0.24	0.22	0.24	0.23	0.24	0.23	0.23	0.22	0.24	0.23	0.23	0.25	0.23	0.24	0.22	0.21	0.21	0.03	0.22
SVN	0.21	0.21	0.21	0.22	0.23	0.22	0.21	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.22	0.23	0.22	0.22	0.22	0.22	0.02	0.22
ESP	0.28	0.28	0.27	0.27	0.27	0.27	0.26	0.27	0.27	0.27	0.26	0.27	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.27	-0.01	0.27
SWE	0.24	0.23	0.24	0.24	0.24	0.23	0.22	0.22	0.23	0.24	0.25	0.26	0.25	0.24	0.23	0.24	0.24	0.23	0.23	0.23	0.24	0.22	0.23	0.22	-0.02	0.23
CHE	0.23	0.24	0.25	0.25	0.24	0.25	0.24	0.23	0.25	0.26	0.27	0.27	0.26	0.24	0.24	0.26	0.26	0.25	0.25	0.25	0.26	0.26	0.25	0.25	0.02	0.25
TUR	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.42	0.39	0.38	0.38	0.39	0.40	0.40	0.40	0.40	0.39	0.40	0.41	0.43	0.43	0.43	0.00	0.42
GBR	0.27	0.28	0.28	0.29	0.29	0.28	0.29	0.29	0.30	0.29	0.31	0.31	0.31	0.30	0.31	0.28	0.28	0.29	0.31	0.29	0.28	0.28	0.28	0.28	0.01	0.29
USA	0.33	0.34	0.34	0.35	0.35	0.35	0.35	0.34	0.34	0.35	0.36	0.37	0.37	0.36	0.35	0.36	0.37	0.38	0.37	0.38	0.38	0.38	0.38	0.38	0.05	0.36
ARG	0.35	0.35	0.34	0.34	0.35	0.35	0.36	0.37	0.34	0.31	0.30	0.31	0.33	0.31	0.31	0.31	0.30	0.28	0.29	0.30	0.30	0.30	0.30	0.32	-0.02	0.32
BRA	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.44	0.46	0.46	0.46	0.47	0.43	0.47	0.48	0.49	0.49	0.49	0.47	0.47	0.48	0.48	0.49	0.47	0.00	0.47
BRN	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.29	0.30	0.29	0.29	0.29	0.29	0.29	0.29	0.30	0.30	0.30	0.30	0.00	0.30
BGR	0.31	0.30	0.29	0.27	0.27	0.26	0.27	0.29	0.27	0.27	0.27	0.28	0.27	0.26	0.27	0.27	0.28	0.30	0.28	0.30	0.31	0.33	0.36	0.35	0.04	0.29
KHM	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.39	0.38	0.40	0.38	0.38	0.38	0.38	0.38	-0.10	0.45
CHN	0.27	0.27	0.27	0.27	0.27	0.28	0.29	0.32	0.32	0.33	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.33	0.34	0.33	0.34	0.34	0.34	0.34	0.07	0.32
HRV	0.24	0.24	0.25	0.25	0.26	0.25	0.25	0.25	0.24	0.25	0.26	0.27	0.27	0.27	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.27	0.27	0.28	0.03	0.26
CYP	0.29	0.28	0.27	0.32	0.28	0.27	0.27	0.29	0.28	0.23	0.23	0.25	0.24	0.27	0.27	0.26	0.29	0.29	0.33	0.29	0.29	0.28	0.27	0.29	0.00	0.28
IND	0.30	0.30	0.31	0.31	0.32	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.13	0.38
IDN	0.40	0.40	0.36	0.32	0.32	0.32	0.33	0.33	0.33	0.34	0.35	0.34	0.35	0.39	0.40	0.36	0.37	0.37	0.36	0.36	0.37	0.35	0.35	0.39	-0.01	0.36
HKG	0.33	0.33	0.33	0.34	0.34	0.35	0.35	0.37	0.38	0.39	0.40	0.41	0.41	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.38	0.38	0.38	0.05	0.38
KAZ	0.30	0.32	0.33	0.34	0.34	0.35	0.36	0.36	0.35	0.31	0.34	0.35	0.33	0.34	0.35	0.34	0.32	0.32	0.32	0.31	0.29	0.33	0.33	0.34	0.03	0.33
LAO	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.40	0.40	0.01	0.39
MYS	0.39	0.39	0.39	0.38	0.38	0.38	0.37	0.37	0.37	0.36	0.37	0.37	0.38	0.37	0.36	0.36	0.35	0.34	0.33	0.32	0.32	0.32	0.32	0.32	-0.06	0.36
MLT	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.24	0.23	0.25	0.26	0.26	0.26	0.26	0.26	0.27	0.26	0.03	0.24

MAR	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	-0.01	0.38
MMR	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.40	0.35	0.35	-0.09	0.43
PER	0.42	0.42	0.42	0.42	0.42	0.37	0.45	0.45	0.46	0.43	0.46	0.41	0.47	0.46	0.44	0.45	0.45	0.43	0.44	0.44	0.45	0.44	0.45	0.46	0.05	0.44
PHL	0.42	0.44	0.45	0.44	0.43	0.42	0.42	0.41	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.38	0.38	0.38	0.37	0.37	-0.06	0.40
ROU	0.28	0.28	0.29	0.28	0.28	0.29	0.27	0.29	0.32	0.32	0.32	0.33	0.36	0.36	0.36	0.32	0.32	0.34	0.33	0.34	0.34	0.31	0.31	0.33	0.04	0.32
RUS	0.34	0.39	0.37	0.36	0.39	0.42	0.43	0.42	0.42	0.41	0.41	0.42	0.43	0.43	0.40	0.37	0.39	0.37	0.38	0.37	0.36	0.37	0.37	0.38	0.04	0.39
SAU	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.44	0.44	0.44	0.43	0.43	-0.01	0.44
SGP	0.25	0.27	0.27	0.28	0.31	0.32	0.35	0.35	0.34	0.32	0.32	0.33	0.32	0.35	0.34	0.33	0.34	0.34	0.34	0.35	0.35	0.35	0.35	0.35	0.09	0.32
ZAF	0.39	0.40	0.40	0.41	0.42	0.43	0.44	0.44	0.45	0.45	0.45	0.46	0.48	0.47	0.46	0.47	0.48	0.49	0.50	0.50	0.49	0.49	0.49	0.49	0.11	0.46
TWN	0.23	0.24	0.22	0.23	0.23	0.24	0.25	0.25	0.25	0.26	0.25	0.26	0.27	0.28	0.26	0.28	0.29	0.29	0.30	0.29	0.29	0.29	0.29	0.29	0.06	0.26
THA	0.45	0.44	0.43	0.42	0.44	0.44	0.46	0.44	0.46	0.45	0.44	0.44	0.44	0.44	0.43	0.44	0.43	0.43	0.41	0.42	0.40	0.40	0.40	0.39	-0.06	0.43
TUN	0.39	0.39	0.38	0.38	0.38	0.38	0.37	0.37	0.36	0.35	0.35	0.34	0.34	0.33	0.33	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.31	0.31	-0.07	0.35
VNM	0.38	0.38	0.38	0.38	0.38	0.39	0.39	0.39	0.38	0.38	0.37	0.37	0.37	0.37	0.39	0.40	0.38	0.36	0.36	0.36	0.36	0.36	0.36	0.36	-0.02	0.37
World	0.45	0.45	0.45	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.45	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.43	0.43	0.43	-0.02	0.45

Source: own work

Table A5.3: Intra-country inequality, top 1% income shares over bottom 50% income shares, 1995-2018

Country/ year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	% change	Average
AUS	0.47	0.46	0.50	0.51	0.59	0.63	0.55	0.59	0.62	0.65	0.67	0.76	0.71	0.61	0.65	0.67	0.62	0.69	0.77	0.73	0.73	0.71	0.79	0.80	0.32	0.64
AUT	0.49	0.50	0.52	0.55	0.47	0.54	0.50	0.54	0.58	0.53	0.53	0.66	0.55	0.58	0.51	0.54	0.51	0.37	0.40	0.51	0.46	0.51	0.44	0.45	-0.05	0.51
BEL	0.39	0.41	0.41	0.41	0.41	0.41	0.39	0.37	0.38	0.42	0.42	0.43	0.47	0.40	0.36	0.37	0.38	0.39	0.39	0.40	0.40	0.41	0.40	0.42	0.03	0.40
CAN	0.61	0.65	0.73	0.74	0.78	0.91	0.83	0.81	0.82	0.88	0.95	1.00	1.01	0.92	0.79	0.85	0.86	0.81	0.90	0.93	0.96	0.78	0.97	0.96	0.35	0.85
CHL	2.36	2.36	2.36	2.36	2.36	2.38	2.42	2.46	2.51	2.60	2.69	2.78	2.76	2.73	2.70	2.91	3.13	2.96	2.79	2.74	2.68	2.64	2.60	2.60	0.24	2.62
COL	2.47	2.53	2.48	2.35	2.15	2.01	2.01	2.01	1.99	1.99	1.85	1.94	2.03	2.14	2.01	1.94	1.94	1.68	1.76	1.79	1.60	1.59	1.57	1.77	-0.69	1.98
CRI	1.14	1.14	1.14	1.14	1.14	1.13	1.42	1.39	1.37	1.34	1.49	1.65	2.72	2.08	1.94	1.51	1.78	1.62	1.71	1.49	1.66	1.98	1.59	2.00	0.87	1.57
CZE	0.42	0.44	0.39	0.46	0.45	0.44	0.44	0.41	0.42	0.43	0.46	0.43	0.45	0.56	0.45	0.43	0.40	0.44	0.40	0.42	0.46	0.42	0.43	0.40	-0.02	0.43
DNK	0.38	0.39	0.43	0.42	0.48	0.49	0.42	0.41	0.37	0.40	0.46	0.48	0.45	0.44	0.39	0.50	0.50	0.52	0.55	0.59	0.58	0.58	0.58	0.57	0.20	0.47
EST	1.08	1.13	1.06	1.03	1.00	1.02	0.97	1.09	1.19	1.02	1.30	0.98	0.94	0.74	0.50	0.61	0.72	0.84	0.81	0.80	0.64	0.71	0.71	0.73	-0.35	0.90
FIN	0.38	0.39	0.46	0.51	0.55	0.60	0.57	0.55	0.52	0.57	0.48	0.53	0.52	0.53	0.42	0.45	0.43	0.41	0.39	0.41	0.45	0.45	0.49	0.48	0.11	0.48
FRA	0.44	0.46	0.49	0.50	0.51	0.52	0.51	0.49	0.52	0.53	0.52	0.52	0.54	0.52	0.44	0.48	0.51	0.46	0.45	0.46	0.44	0.43	0.43	0.42	-0.02	0.48
DEU	0.38	0.42	0.46	0.51	0.49	0.49	0.48	0.48	0.44	0.51	0.61	0.65	0.71	0.70	0.68	0.67	0.67	0.66	0.72	0.73	0.73	0.72	0.71	0.69	0.30	0.60
GRC	0.57	0.60	0.71	0.77	0.82	0.83	0.80	0.66	0.60	0.65	0.66	0.63	0.57	0.45	0.42	0.45	0.37	0.40	0.50	0.67	0.65	0.60	0.54	0.52	-0.05	0.60
HUN	0.26	0.28	0.30	0.31	0.34	0.35	0.40	0.44	0.44	0.42	0.49	0.54	0.50	0.49	0.47	0.50	0.47	0.43	0.50	0.50	0.51	0.52	0.52	0.54	0.29	0.44
ISL	0.33	0.34	0.35	0.35	0.37	0.38	0.47	0.51	0.50	0.41	0.46	0.49	0.69	0.33	0.27	0.23	0.24	0.26	0.35	0.35	0.35	0.35	0.35	0.35	0.02	0.38
IRL	0.48	0.44	0.50	0.58	0.55	0.61	0.56	0.56	0.60	0.62	0.65	0.69	0.64	0.51	0.47	0.48	0.48	0.45	0.50	0.52	0.61	0.63	0.59	0.59	0.11	0.55
ISR	1.45	1.47	1.48	1.50	1.51	1.53	1.55	1.58	1.62	1.65	1.69	1.70	1.71	1.73	1.74	1.75	1.70	1.65	1.50	1.37	1.32	1.28	1.28	1.28	-0.18	1.54
ITA	0.32	0.33	0.34	0.36	0.35	0.38	0.41	0.38	0.38	0.38	0.38	0.38	0.38	0.36	0.35	0.37	0.38	0.38	0.37	0.38	0.37	0.43	0.45	0.45	0.12	0.38
JPN	0.58	0.63	0.60	0.60	0.62	0.68	0.72	0.76	0.80	0.88	0.91	0.91	0.92	0.84	0.75	0.79	0.77	0.77	0.79	0.78	0.79	0.79	0.78	0.78	0.21	0.76
KOR	0.45	0.49	0.53	0.40	0.50	0.56	0.58	0.65	0.67	0.70	0.66	0.78	0.85	0.89	0.86	0.94	0.95	0.92	0.90	0.90	0.92	0.94	0.95	0.94	0.49	0.75
LVA	0.52	0.54	0.55	0.60	0.55	0.60	0.54	0.61	0.66	0.64	0.72	0.58	0.72	0.67	0.64	0.51	0.68	0.68	0.69	0.59	0.55	0.46	0.56	0.56	0.04	0.60
LTU	0.46	0.43	0.40	0.37	0.34	0.40	0.41	0.38	0.42	0.48	0.54	0.46	0.63	0.65	0.60	0.47	0.49	0.61	0.66	0.89	0.63	0.62	0.70	0.63	0.17	0.53
LUX	0.70	0.74	0.77	0.82	0.78	0.73	0.75	0.66	0.61	0.81	0.89	0.58	0.84	0.79	0.48	0.69	0.64	0.56	0.51	0.47	0.46	0.49	0.53	0.50	-0.20	0.66
MEX	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.99	2.14	2.29	2.31	2.32	2.72	3.14	3.11	3.07	3.23	3.40	3.45	3.50	3.41	3.32	3.08	2.85	0.85	2.64

NLD	0.24	0.24	0.25	0.24	0.25	0.25	0.29	0.28	0.29	0.30	0.31	0.31	0.35	0.29	0.28	0.29	0.29	0.29	0.28	0.31	0.30	0.31	0.32	0.31	0.07	0.29
NZL	0.68	0.63	0.69	0.81	0.74	0.50	0.55	0.55	0.59	0.62	0.51	0.36	0.41	0.35	0.49	0.46	0.51	0.60	0.52	0.53	0.56	0.56	0.60	0.61	-0.07	0.56
NOR	0.32	0.38	0.43	0.34	0.39	0.52	0.42	0.45	0.48	0.50	0.53	0.55	0.55	0.58	0.44	0.51	0.51	0.52	0.50	0.48	0.40	0.39	0.41	0.46	0.13	0.46
POL	0.48	0.39	0.42	0.49	0.47	0.48	0.46	0.49	0.50	0.64	0.69	0.72	0.79	0.76	0.69	0.67	0.70	0.69	0.67	0.71	0.75	0.74	0.72	0.75	0.27	0.62
PRT	0.54	0.52	0.54	0.54	0.57	0.57	0.64	0.58	0.56	0.62	0.58	0.61	0.63	0.53	0.51	0.54	0.60	0.53	0.58	0.58	0.58	0.58	0.62	0.57	0.04	0.57
SVK	0.22	0.24	0.25	0.23	0.30	0.30	0.37	0.43	0.34	0.44	0.41	0.42	0.41	0.37	0.38	0.47	0.41	0.39	0.50	0.41	0.46	0.37	0.33	0.32	0.11	0.37
SVN	0.27	0.28	0.30	0.31	0.34	0.31	0.30	0.30	0.33	0.34	0.33	0.35	0.36	0.36	0.31	0.32	0.31	0.31	0.32	0.35	0.32	0.33	0.35	0.35	0.08	0.32
ESP	0.60	0.60	0.55	0.54	0.56	0.55	0.52	0.53	0.55	0.54	0.52	0.55	0.56	0.57	0.63	0.56	0.55	0.58	0.58	0.59	0.61	0.62	0.61	0.59	-0.01	0.57
SWE	0.47	0.42	0.47	0.47	0.48	0.40	0.34	0.36	0.42	0.44	0.48	0.53	0.52	0.47	0.41	0.48	0.45	0.40	0.40	0.41	0.44	0.37	0.41	0.39	-0.08	0.43
CHE	0.40	0.46	0.49	0.50	0.47	0.49	0.45	0.41	0.50	0.53	0.58	0.61	0.53	0.44	0.46	0.55	0.56	0.50	0.50	0.50	0.52	0.52	0.47	0.48	0.08	0.50
TUR	1.80	1.80	1.80	1.81	1.81	1.81	1.82	1.82	1.72	1.61	1.31	1.18	1.12	1.22	1.39	1.34	1.30	1.34	1.22	1.42	1.49	1.68	1.66	1.70	-0.10	1.55
GBR	0.53	0.61	0.62	0.69	0.66	0.61	0.62	0.64	0.71	0.69	0.77	0.80	0.79	0.75	0.80	0.61	0.67	0.67	0.75	0.68	0.62	0.62	0.65	0.64	0.11	0.67
USA	0.95	1.01	1.08	1.10	1.13	1.19	1.11	1.08	1.11	1.18	1.27	1.33	1.33	1.30	1.20	1.31	1.38	1.49	1.41	1.48	1.46	1.45	1.41	1.43	0.48	1.26
ARG	0.99	0.99	0.86	0.87	0.94	0.99	1.15	1.25	0.96	0.74	0.64	0.72	0.92	0.67	0.69	0.67	0.65	0.47	0.55	0.59	0.64	0.68	0.71	0.88	-0.11	0.80
BRA	2.32	2.32	2.32	2.32	2.32	2.26	2.26	1.98	2.24	2.30	2.27	2.41	1.86	2.47	2.61	2.65	2.70	2.72	2.48	2.41	2.47	2.67	2.77	2.43	0.11	2.40
BRN	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.71	0.69	0.69	0.66	0.66	0.64	0.64	0.66	0.68	0.70	0.72	0.71	0.71	-0.02	0.70
BGR	0.79	0.70	0.67	0.58	0.54	0.50	0.56	0.65	0.56	0.56	0.57	0.59	0.50	0.45	0.58	0.58	0.61	0.73	0.62	0.72	0.75	0.95	1.14	1.10	0.32	0.67
KHM	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	2.89	1.52	1.38	1.58	1.35	1.35	1.35	1.35	1.34	-1.78	2.54
CHN	0.51	0.51	0.51	0.52	0.54	0.60	0.65	0.81	0.87	0.92	0.99	1.03	1.08	1.08	1.10	1.10	1.04	0.95	0.99	0.96	0.97	0.97	0.97	0.97	0.47	0.86
HRV	0.35	0.34	0.36	0.38	0.43	0.38	0.39	0.40	0.38	0.42	0.49	0.51	0.55	0.55	0.48	0.50	0.56	0.55	0.57	0.59	0.61	0.54	0.57	0.57	0.22	0.48
CYP	0.58	0.54	0.49	0.78	0.55	0.48	0.53	0.64	0.56	0.34	0.35	0.44	0.37	0.51	0.50	0.44	0.61	0.65	0.92	0.65	0.63	0.57	0.50	0.62	0.04	0.55
IND	0.71	0.71	0.75	0.79	0.81	0.84	0.90	0.96	1.04	1.11	1.20	1.25	1.31	1.37	1.44	1.51	1.57	1.61	1.64	1.65	1.65	1.65	1.65	1.65	0.95	1.24
IDN	1.52	1.58	1.17	0.84	0.80	0.82	0.90	0.89	0.87	0.99	1.07	1.00	1.06	1.43	1.59	1.13	1.27	1.22	1.16	1.16	1.26	1.08	1.04	1.48	-0.04	1.14
HKG	0.88	0.86	0.90	0.94	0.98	1.03	1.07	1.19	1.31	1.44	1.56	1.68	1.66	1.64	1.62	1.60	1.59	1.52	1.47	1.41	1.36	1.31	1.31	1.31	0.43	1.32
KAZ	0.67	0.80	0.85	0.98	0.99	1.03	1.09	1.19	1.06	0.73	0.99	1.06	0.91	0.94	1.04	0.99	0.82	0.85	0.86	0.78	0.67	0.91	0.93	0.94	0.27	0.92
LAO	1.39	1.42	1.45	1.41	1.37	1.39	1.39	1.34	1.35	1.39	1.41	1.41	1.42	1.40	1.35	1.34	1.31	1.27	1.32	1.40	1.44	1.50	1.54	1.57	0.18	1.40
MYS	1.43	1.45	1.47	1.42	1.38	1.35	1.32	1.29	1.24	1.18	1.22	1.26	1.30	1.27	1.25	1.18	1.12	1.05	0.95	0.86	0.86	0.86	0.86	0.86	-0.57	1.18
MLT	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.35	0.39	0.37	0.45	0.48	0.48	0.48	0.50	0.47	0.53	0.47	0.13	0.39

MAR	1.19	1.20	1.21	1.22	1.22	1.23	1.24	1.26	1.27	1.28	1.29	1.30	1.28	1.25	1.22	1.20	1.17	1.14	1.12	1.12	1.12	1.12	1.12	1.12	-0.08	1.20
MMR	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	1.55	1.08	1.07	-1.06	2.02
PER	2.09	2.09	2.09	2.09	2.09	1.39	2.64	2.61	2.89	2.28	2.95	1.96	2.96	2.67	2.18	2.45	2.43	2.07	2.31	2.31	2.43	2.35	2.44	2.61	0.53	2.35
PHL	1.86	2.10	2.34	2.15	1.96	1.87	1.79	1.64	1.48	1.52	1.52	1.50	1.47	1.45	1.47	1.47	1.44	1.42	1.40	1.35	1.32	1.28	1.23	1.18	-0.68	1.59
ROU	0.62	0.61	0.66	0.61	0.60	0.66	0.54	0.66	0.84	0.81	0.81	0.88	1.20	1.18	1.20	0.84	0.86	0.99	0.90	1.05	1.04	0.77	0.81	0.90	0.27	0.84
RUS	0.97	1.62	1.34	1.17	1.50	1.81	2.04	1.91	1.91	1.73	1.79	1.90	2.00	1.91	1.47	1.20	1.33	1.18	1.30	1.19	1.16	1.21	1.22	1.27	0.30	1.50
SAU	2.13	2.12	2.12	2.12	2.12	2.12	2.12	2.11	2.11	2.11	2.11	2.12	2.14	2.14	2.15	2.12	2.08	2.05	2.01	2.04	2.02	1.99	1.97	1.94	-0.18	2.09
SGP	0.46	0.50	0.51	0.57	0.71	0.75	0.93	0.92	0.84	0.76	0.74	0.80	0.78	0.93	0.80	0.77	0.82	0.80	0.81	0.85	0.85	0.85	0.85	0.85	0.40	0.77
ZAF	1.19	1.29	1.40	1.56	1.71	1.89	1.97	2.03	2.07	2.02	2.01	2.26	2.65	2.42	2.27	2.54	2.69	3.32	3.38	3.45	3.36	3.29	3.29	3.30	2.11	2.39
TWN	0.45	0.46	0.33	0.36	0.34	0.40	0.42	0.52	0.55	0.57	0.45	0.45	0.51	0.56	0.45	0.55	0.59	0.58	0.73	0.71	0.69	0.68	0.68	0.68	0.23	0.53
THA	2.23	2.15	1.97	1.81	2.06	2.14	2.70	2.18	2.48	2.18	2.16	2.12	2.00	2.04	1.87	1.98	1.85	1.86	1.61	1.64	1.43	1.48	1.42	1.33	-0.90	1.95
TUN	1.36	1.34	1.31	1.29	1.27	1.24	1.16	1.08	1.01	0.94	0.87	0.84	0.81	0.77	0.74	0.71	0.70	0.69	0.68	0.67	0.66	0.66	0.66	0.66	-0.70	0.92
VNM	1.28	1.27	1.27	1.27	1.29	1.36	1.41	1.40	1.35	1.34	1.28	1.21	1.22	1.25	1.41	1.61	1.38	1.19	1.15	1.13	1.15	1.17	1.14	1.11	-0.17	1.28
World	2.78	2.81	2.80	2.87	2.92	2.98	2.92	2.84	2.86	2.87	2.91	2.91	2.84	2.75	2.56	2.55	2.55	2.49	2.45	2.43	2.41	2.34	2.30	2.32	-0.46	2.69

Source: own work

Capítulo VI: Conclusiones principales y líneas futuras de investigación

La presente tesis ha mostrado, a través de análisis teóricos y empíricos, la importancia del estudio de la distribución de la renta, debido a los incrementos en desigualdad que han estado viviendo las economías contemporáneas durante las últimas cuatro décadas. Estos incrementos en desigualdad se han manifestado, generalmente, tanto en el interior de países desarrollados y en desarrollo, como en los niveles de disparidad entre los propios países. A continuación, vamos a exponer un resumen de los principales hallazgos de la tesis. Después, pretendemos discutir algunas de las posibles herramientas de política que se encuentran en el centro del debate, actualmente, para combatir el problema de la desigualdad creciente. Finalmente, como muestra de que los frutos de la tesis van a poder seguir siendo recogidos con posterioridad, expondremos una serie de líneas de investigación futuras, que serán continuaciones lógicas de la presente investigación.

6.1. Conclusiones del capítulo II: prospecciones acerca del futuro paradigma

Tras una breve presentación, en el capítulo I, de las motivaciones y objetivos de esta tesis doctoral, en el capítulo II, hemos desarrollado el marco teórico, que es evolutivo y no estático, y que ha guiado los análisis teóricos y empíricos de la tesis sobre la distribución de renta. Para nosotros, este marco tiene una visión evolutiva, inspirada entre otros en Bunge (1979, 1997), Schumpeter (1939), o Nelson & Winter (1982), y es resultado de la co-evolución de cuatro elementos interrelacionados y parcialmente autónomos, que a su vez componen el sistema social, siendo la distribución de la renta uno de sus principales resultados emergentes. En el largo plazo, estas interrelaciones evolucionan de forma compleja, lo que nos lleva a considerar dinámicas no lineales, que plasmamos en el concepto de onda larga. Estas ondas tienen un alto carácter tecnológico, de modo que el agotamiento de las tecnologías, siguiendo a Schumpeter (1939), conduce a puntos de saturación, lo que, unido a la aparición de innovaciones radicales, conlleva procesos de ruptura estructural y crisis. Los cambios a distintos niveles manifestados en torno a crisis económicas profundas, como las de 1929, 1973 o 2008, las identificamos con cambios de paradigma que dan inicio a una nueva onda larga, cuyas nuevas características (paradigma) determinarán un régimen estructural de distribución de la renta característico de la onda.

El primero de los cuatro elementos co-evolutivos del paradigma, el sistema económico, se manifiesta, sobre todo, en dos tipos de crisis o fluctuaciones. Por una parte, las comentadas ondas largas y, por otra, las fluctuaciones de entre 7 a 11 años, llamadas usualmente ciclos de Juglar, que van asociadas a los flujos de inversión en innovaciones incrementales y que conllevan también una evolución cíclica de la distribución de la renta. El segundo elemento que consideramos es el paradigma científico de cada periodo, focalizándonos en nuestro análisis en los criterios y desarrollo de la Ciencia Económica, que afectan, sin duda, a la toma de decisiones políticas y económicas e impulsan unas evoluciones institucionales determinadas. En este sentido, el tercer componente son las instituciones, que también son un determinante estructural importante de la distribución de la renta (cabe pensar en el papel del desarrollo del Estado de Bienestar durante la primera mitad del siglo XX). Por último, el último componente es el nivel concreto de la tecnología, que determina el perfil de nuestras ondas largas.

En este sentido, en el capítulo II, determinamos, mediante herramientas empíricas y análisis descriptivo, la existencia de dos ondas largas desde 1929, con dos tendencias a largo plazo de distribución de la renta muy diferenciadas: la primera onda, que se extiende desde 1930 hasta mediados de los años 70, estuvo caracterizada por reducciones en los niveles de desigualdad de una muestra muy característica de países desarrollados; por el contrario, la segunda onda, que sigue a la anterior y acaba con la crisis de 2008, se caracterizó por fuertes incrementos en la desigualdad. Los cambios evolutivos en los paradigmas de cada onda tienen capacidad explicativa para dar cuenta de estos hechos. A grandes rasgos, observamos la capacidad explicativa que pueden tener estos cambios de paradigma sobre la determinación de los dos regímenes de distribución: por ejemplo, en el campo institucional, el cambio en el papel de los sindicatos o el diferente carácter del dinero; mientras, en el ámbito tecnológico, la sustitución del petróleo y el automóvil por las TICs, apoyadas en los procesos de globalización y liberalización. Por lo tanto, consideramos que, a falta de trabajo adicional, hemos dado pasos en la buena dirección hacia la construcción de un marco teórico que pueda explicar el carácter estructural de los fenómenos de distribución de la renta en el largo plazo. Además, insistimos en el no determinismo de nuestro enfoque, que no admite una estructura dada de las ondas, ni en duración, ni en número de ciclos intermedios anidados.

En lo que sigue, como enseñanza directa del estudio de las dos ondas anteriores, vamos a realizar un análisis prospectivo acerca de los cambios de paradigma que están teniendo lugar actualmente. Sin duda, conocer las características estructurales y evolutivas del sistema social, puede darnos muchas pistas acerca de cómo va a evolucionar la desigualdad en las próximas décadas, lo que puede ayudarnos a intervenir y a diseñar las políticas económicas adecuadas. En este sentido, nuestro esquema consideraría el inicio de una tercera onda en torno a 2010, por lo que nos hallaríamos inmersos en el inicio de la misma y deberíamos ser capaces de identificar los cambios evolutivos que están teniendo lugar en los distintos niveles del paradigma, así como la aparición de ciclos de Juglar. Por ejemplo, en lo que respecta al subsistema económico, conjeturamos, con gran probabilidad, un primer ciclo de Juglar de unos 10 años, que se ajustaría a nuestra periodificación y que estaba terminando cuando se produjo el estallido de la pandemia en 2020. Con el paso del tiempo, cuando las series de datos lo permitan, deberíamos ser capaces de confirmar este resultado y de explicar su significado dentro de nuestro marco.

En los componentes estructurales del paradigma, también podrían identificarse otros cambios paradigmáticos importantes. A nivel científico, parece claro que el nivel de desarrollo computacional alcanzado en la onda anterior, así como la capacidad de colección de datos, va a mostrar un encaminamiento hacia la Economía de los Datos, con gran presencia en la investigación del *Big Data* y de técnicas de *machine learning* e Inteligencia Artificial. Quizás no sea inmediato analizar cómo puede afectar esta deriva científica a la distribución de la renta, pero sí que se deberían tener en cuenta componentes éticos acerca de la recolección de datos.

Por otra parte, los cambios institucionales, que están cristalizando en estos momentos, están cada vez más definidos. Por ejemplo, en el sistema monetario, el concepto de dinero está evolucionando hacia una menor tangibilidad. A la progresiva sustitución del efectivo, que ya empezó a verse en la pasada onda, se está sumando la aparición de las denominadas criptomonedas y del Blockchain. Este dinero ficticio, sin contrapartida real, que confirma una evolución que pudo empezar ya con la suspensión del patrón oro al inicio de la anterior onda, puede conducir a situaciones especulativas y tener importantes efectos distributivos, al igual que sucedió en los años 20. Otra cuestión importante, ligada a las evoluciones geopolíticas, es si el dólar va a continuar siendo divisa de reserva internacional, como consecuencia de la puesta en escena de serias

amenazas al liderazgo americano, como puede ser China. En ese caso, las consecuencias distributivas internacionales serían serias, poniendo en serios aprietos a Estados Unidos para pagar su deuda comercial y financiera. Por otra parte, el mercado de trabajo también está haciendo frente a cambios serios, como una reducción endémica del empleo en favor de la automatización, o la aparición de nuevas configuraciones como el teletrabajo, asentado tras los confinamientos, así como la muy probable reducción de la jornada de trabajo, vía menos días de trabajo a la semana o menos horas por semana. Finalmente, el rol del sector público todavía no está claro: por una parte, parece que se abrió la puerta al intervencionismo como salida a la Gran Recesión; por otra, es todavía muy dudoso que los Gobiernos estén optando actualmente por políticas activas para atajar los problemas de insostenibilidad social y medioambiental, cuya solución están reclamando las propias evoluciones económica y climática.

Por último, la parte tecnológica del paradigma es quizás la más palpable y menos discutible; el desarrollo de una base tecnológica diferente es una de las características principales que se usan para caracterizar las ondas largas. A continuación, presentamos los principales avances tecnológicos de los últimos diez años, agrupados por áreas de conocimiento (World Economic Forum, 2012-2021) y que serían, por tanto, puntos de arranque del nuevo paradigma de la actual onda. Primero, en el área computacional, gracias al desarrollo de la Ciencia de datos, destacan los siguientes avances: la analítica predictiva, el control computacional mediante interfaces cerebrales, una nueva generación de robótica con inteligencia artificial emergente y 'deep learning', y los computadores cuánticos. En medicina, los avances principales se están centrando en desarrollos de genética y bioingeniería, en el sentido de que va a ser posible el diseño y la manipulación del genoma humano y de otras especies, gracias al almacenamiento de datos de ADN, al Atlas Celular Humano, o a síntesis genéticas completas; además, la nano-ingeniería también ha abierto posibilidades en el diagnóstico y tratamiento de enfermedades. A nivel medioambiental, destacan los desarrollos de energías limpias, como la eólica o la fotovoltaica (desarrolladas inicialmente durante la pasada onda), los avances en el almacenamiento de energía, nueva generación de baterías (ion de litio) y la obtención de combustibles líquidos a partir de la luz solar (hidrógeno verde), el desarrollo de bioplásticos y plásticos térmicos reciclables, o las posibilidades de utilizar el dióxido de carbono como recurso. También han tenido lugar avances en el campo del transporte, como el desarrollo de vehículos eléctricos, incluyendo aviones. Por último,

también se ha de destacar la segunda revolución verde, con la aparición de cultivos auto-fertilizantes o de fertilizantes inteligentes.

6.2. Conclusiones de los capítulos III, IV y V

En el capítulo III, que es el último de los dedicados a reflexiones teóricas, hemos ahondado en varias de las cuestiones que se han tratado tradicionalmente en el campo de la distribución de la renta. Para abordarlas, dentro del marco temporal e institucional desarrollado en el capítulo anterior, nos focalizamos en el desarrollo de modelos multisectoriales de 'reproducción y excedente' (especialmente, aquellos basados en tablas input-output), porque son fuertemente dependientes de los marcos institucional y estructural y permiten comparando tablas una visión temporal. Las novedades que aportamos al debate en este capítulo radican en que desarrollamos un modelo multisectorial con trabajo y salarios heterogéneos, que llevan asociados diferentes patrones de consumo. Primero, nos preocupamos por probar que la relación entre salarios y beneficios es decreciente en este contexto, que captura la faceta competitiva del proceso de distribución. Para ello, obtenemos las ecuaciones de precios con tasa homogénea, que dependen no sólo de cuestiones técnicas, sino también de otras más institucionales como son los patrones de consumo o los niveles de inversión/crecimiento. Con esas ecuaciones se prueba de forma algo más general, para el contexto definido, la relación decreciente entre la tasa de beneficio y los pagos salariales. Una vez hecho el desarrollo formal para *n* sectores y *m* tipos de trabajo, con sus *m* patrones de consumo, nos apoyamos en un modelo sencillo 3x3 para realizar algunas simulaciones y comprobar las funcionalidades de nuestro modelo extendido. Así obtenemos, una vez más, que los patrones de consumo no son triviales y que, determinadas estructuras pueden influir fuertemente en las proporciones de renta destinadas al factor trabajo. Estas influencias están muy determinadas por las productividades de los distintos bienes y por los cambios en los precios de equilibrio inducidos por cada una de las estructuras de consumo, que alteran la capacidad adquisitiva de los trabajadores. Concluimos el capítulo III viendo que el cambio tecnológico puede contribuir a caracterizar al proceso de distribución de la renta con una segunda faceta cooperativa (además de la tradicionalmente considerada faceta competitiva), ya que empresarios y trabajadores pueden tener intereses comunes.

Una vez terminadas las disquisiciones teóricas de los capítulos II y III, entramos en la parte empírica de la tesis. Así, en el capítulo IV, nos centramos en analizar los niveles de desigualdad interna de España para el periodo 1980-2014, como primera aproximación a un ejemplo representativo de país desarrollado, cubriendo además nuestra segunda onda larga, donde se debería probar que la desigualdad ha aumentado, en relación a lo obtenido en el capítulo II. El caso de España es especialmente importante porque, aparte de que presenta la ventaja de ser conocido para nosotros, tiene unas características estructural atractivas: tal y como muestra un primer análisis descriptivo, la sociedad española está fuertemente estratificada, mostrando importantes brechas tanto en niveles de formación y renta como en género.

Como primer paso, construimos varios indicadores específicos de desigualdad: primero, un índice Sen de desigualdad global nos muestra que ésta se ha incrementado en España durante este período, especialmente desde mediados de los años 90. Mediante el cálculo de índices Gini específicos, vemos que estas desigualdades se incrementan globalmente también en las compensaciones del trabajo por niveles de formación, así como en el caso del consumo por quintiles de renta. El caso de la desigualdad por género es especialmente llamativo, ya que se comprueba cómo ésta decrece sectorialmente, pero se incrementa en términos totales de la economía, mostrando aumentos en las disparidades entre sectores. También construimos una ecuación de precios para descomponer el reparto del valor añadido, viendo que, aunque es cierto que la parte correspondiente a consumos salariales ha decrecido con el tiempo, no ha sido tanto debido a aumentos en retribuciones del capital, sino a flujos de inversión destinada a crecimiento, que puede ser otra muestra de la faceta cooperativa de la distribución.

Para terminar el capítulo, aplicamos un Análisis de Descomposición Estructural del valor añadido en un marco input-output, descomponiendo el efecto de los costes laborales (que a su vez se descompone en efecto empleo y efecto salario) por niveles de formación y género, así como separando el efecto del consumo de los hogares del resto de la demanda final, descomponiéndolo en quintiles de renta. Así, comprobamos desde otra perspectiva la estratificación existente en la sociedad española, asociada a diferencias en las distintas evoluciones de la productividad del trabajo de cada una de las categorías. En más profundidad, vemos la pérdida de importancia, tanto en términos de salario como en empleo, de las ocupaciones con niveles de formación medios. En género, observamos un cierto cierre de la brecha en términos de empleo, aunque no se

encuentran evidencias de avances relativos en salarios. Por último, en términos de consumo, comprobamos que es el quintil más rico el que gobierna el consumo de los hogares, presentando los otros cuatro unos efectos casi desdeñables; ello supone un refuerzo de la desigualdad y de la estratificación social.

Llegamos así al capítulo V, donde pretendemos abrir los análisis de desigualdad desde una perspectiva nacional a una global, mediante la aplicación de un modelo multirregional input-output. Este análisis viene inspirado por el hecho de pensar en la globalización, como un hecho determinante de los procesos de distribución de la renta internacionales o, más concretamente, de pensar que la manifestación de la misma en la fragmentación de la producción y la configuración de estos procesos en torno a las llamadas Cadenas Globales de Valor son elementos claves para explicar el reparto de rentas a nivel entre países y dentro de cada país. Para ello, nos apoyamos en dos medidas comúnmente usadas para medir la integración en el ámbito de las cadenas globales, esto es, la participación (proporción del valor añadido incorporado en exportaciones de un país sobre el total mundial) y la posición (situación en los procesos productivos más o menos alejada del uso final). Buena parte de la literatura encuentra que una mayor integración en las cadenas, aun cuando suponga una mejora económica para el país, no tiene por qué venir acompañada de mejoras en la parcela social del país. En consecuencia, a la hora de investigar la evolución de la desigualdad a nivel global, tenemos que estudiar tanto la desigualdad interna dentro de cada país como la desigualdad entre países, y para avanzar en ello, son guías en nuestro análisis dos conjeturas, que se confirman con los resultados; la primera, que las manifestaciones de la desigualdad se diferencian por áreas geográficas; la segunda, que la relación entre posición y desigualdad no es lineal, por lo que incluiremos la dependencia cuadrática.

Un primer análisis descriptivo nos muestra cómo, en la mayoría de los 67 países de nuestra muestra, los niveles internos de desigualdad se han incrementado entre 1995 y 2018. En cuanto a los niveles de desigualdad entre países, aparecen algunas historias de éxito, como las del Sudeste asiático y los países de Oriente Medio, mientras que las regiones de Latinoamérica y África han permanecido estancadas.

En el análisis econométrico, donde utilizamos dos medidas de desigualdad intra-país y dos medidas inter-países como variables endógenas, encontramos resultados diferentes por áreas geográficas. Por ejemplo, encontramos relaciones en “forma de sonrisa” (signo de la variable cuadrática positivo) entre medidas de desigualdad intra-país y

participación para el grupo de países Desarrollados, así como para Latinoamérica y este y sudeste asiático, mostrando que los países pertenecientes a estas áreas pueden reducir sus niveles internos de desigualdad logrando posiciones intermedias en la cadena. Por el contrario, las economías en transición (Rusia y Asia central) muestran relaciones en "forma de ceño", con implicaciones contrarias.

En términos de desigualdad entre países, los resultados más interesantes son que, para Latinoamérica, una de las dos áreas rezagadas en términos de convergencia, los niveles de desigualdad con el resto del mundo se reducirían logrando posiciones extremas en las cadenas; por otra parte, encontramos "curvas de sonrisa" tanto en países desarrollados como en Oriente Medio, lo cual implica que estos países convergen a la media mundial situándose en posiciones intermedias de las cadenas.

6.3. Recomendaciones de política

Tras comentar las conclusiones principales de la tesis, veamos ahora algunas recomendaciones de política que se siguen de nuestros resultados. En primer lugar, consideramos que es fundamental la concienciación, para tratar de lograr una sociedad sostenible, tanto en niveles de desigualdad como medioambientalmente (Piketty, 2022). Este es uno de los principales desafíos a los que nos tenemos que enfrentar en los próximos años. Del capítulo II y de su análisis de las dos últimas ondas, se implica que los gobiernos actuales deberían realizar un seguimiento y la previsión de los patrones evolutivos que van siguiendo las economías, especialmente de cómo las innovaciones radicales que van conformando el nuevo paradigma tecnológico. Sólo así podrán suavizar las fluctuaciones económicas de medio largo plazo y los efectos perniciosos de las crisis de inversión y estructurales. Negar la existencia de estos ciclos económicos o defender su total imprevisibilidad, no parece nada razonable científicamente. Especial interés pueden tener la estimación de los cambios previsibles en el empleo, que se hacen muy evidentes con la Gran Recesión y que están, sin duda, asociados a los cambios paradigmáticos en el mercado laboral que se desarrollarán con la nueva onda (nuevas instituciones, nuevos marcos laborales…). Así tenemos que, en USA, ya se ha discutido sobre la posible aplicación de políticas de garantía federal de empleo para todos y bien remunerado (Darity, 2021; Ellwood, 2021; Shierholz, 2021). También, en algunos países, se ha debatido recientemente acerca de la introducción de una renta básica y se han dado algunos pasos en esa dirección, aunque no haya todavía un claro consenso

sobre su adecuación. Sus detractores afirman que puede desincentivar la búsqueda de empleo, pero un buen diseño podría incorporar estas contingencias (Van Parijs & Vanderborght, 2015). Los debates recientes sobre la reducción a 35 horas semanales o la implementación de la semana de cuatro días de trabajo van en la misma dirección.

Atendiendo a los resultados teóricos obtenidos en el capítulo III, debería recomendarse la posibilidad de tratar los patrones de consumo como instrumentos de política. Hemos visto que su influencia sobre la distribución primaria de la renta no es trivial, por lo que se podría plantear el establecimiento de regulaciones que puedan forzar cambios hacia patrones de consumo más sostenibles, en el contexto actual de consumos excesivos y medioambientalmente insostenibles. Además, políticas de incentivación de inversión en innovación en determinados sectores, si van asociadas a mejoras de la productividad, podrían ayudar a poner freno a la caída en la proporción de las rentas del trabajo, sin conllevar necesariamente pérdidas en términos de beneficios.

Del capítulo IV, varias recomendaciones se siguen para reducir los niveles de desigualdad en España. En primer lugar, para reducir los niveles de desigualdad por niveles de formación, deberían plantearse políticas enfocadas a la educación, en concreto, a la adaptación de las ocupaciones con niveles de formación medio y bajo a las nuevas tecnologías, para lidiar con la automatización (Acemoglu, 2021; Aghion, 2021). En segundo lugar, para reducir la brecha de género, deberían aplicarse políticas directas de igualación de salarios, así como un establecimiento de cuotas mínimas de contratación para ambos géneros (Bertrand, 2021). Un hecho que han puesto de manifiesto los datos es la necesidad de romper las barreras sectoriales para avanzar en una verdadera igualdad de género. Se ha avanzado en la igualdad de género dentro de cada sector económico, pero las diferencias y estructuras sectoriales hacen que, a pesar de ello, la desigualdad de género a nivel nacional se mantenga o crezca. Ello supone que debe combatirse seriamente la feminización y la masculinización de ciertas actividades, lo que supone potenciar la educación, las condiciones de acceso e introducir reformas institucionales.

Por último, reducir la creciente estratificación vía consumo de los últimos años, supone entrar directamente en políticas de redistribución, que incrementen la capacidad de compra de las clases más bajas y que además penalicen los consumos más suntuarios. Recientemente, se ha debatido mucho sobre la adecuación del impuesto de patrimonio, que puede ser un buen instrumento de redistribución con un diseño adecuado (Mankiw,

2021; Saez, 2021; Summers, 2021; Zucman, 2021). En cualquier caso, se debería impulsar una mayor progresividad del sistema impositivo, así como su simplificación y transparencia (Kopczuk, 2021; Stantcheva, 2021).

Por último, el capítulo V, al abordar las dos facetas de la desigualdad en el mundo global, la desigualdad interna de cada país y la desigualdad entre países, nos revela la necesidad de analizar si, en cada país, las políticas de avance económico asociadas a la globalización (integración en las CGVs) y las asociadas a la mayor igualdad interna del país son compatibles o contradictorias entre sí. Si son contradictorias, como hemos visto para algunos países latinoamericanos, estos países tendrán que buscar un equilibrio en el trade-off de ambas políticas. También puede ocurrir que la contradicción sea muy débil o no manifiesta, como ocurre en algunos países desarrollados.

Los resultados por zonas geográficas pueden ser muy diferentes, estando éstas caracterizadas por unas condiciones de desarrollo parecidas y por una cierta homogeneidad institucional. En ese sentido vemos que China se ha desplazado hacia posiciones "upstream", ganando posiciones relativas en el valor añadido por cápita, pero a costa de aumentar la desigualdad interna del país. Similarmente, los países de Oriente Medio también han ganado posiciones en el contexto mundial en nivel de renta e incrementado los niveles de desigualdad interna, pero lo han hecho desplazándose hacia posiciones "downstream". Por el contrario, muchos de los países europeos, que podemos incluir en el bloque de desarrollados, han mejorado económicamente y socialmente desplazándose hacia posiciones intermedias de las CGVs. Todo ello plantea, sin duda, la necesidad de profundizar en los motivos de esas diferencias en los efectos de la posición en las cadenas de valor, pues ¿cuál es el efecto de la capacidad tecnológica, de la disponibilidad de ciertos recursos o de la proximidad territorial?

Para finalizar, no podemos olvidar el desafío que supone el desarrollo de la nueva onda y de sus nuevas características paradigmáticas. Ello obliga a repensar más todavía el papel de la CGVs y su relación con la distribución de la renta a nivel mundial, mucho más cuando, por una parte, la pandemia reciente ha acelerado las transformaciones pendientes, introduciendo ya graves distorsiones graves en las cadenas de valor previas; y, por otra, cuando se está configurando un nuevo orden mundial, donde los papeles de China y Estados Unidos van a ser muy diferentes.

6.4. Líneas futuras de investigación

Finalmente, terminamos esta sección dando unas pinceladas de posibles líneas futuras de investigación sugeridas por lo realizado en la presente tesis. El capítulo II sugiere que se debería seguir avanzando en conferir al marco teórico de una mayor robustez, así como de seguir atentamente los procesos de co-evolución para poder ir determinando cómo cristaliza el nuevo paradigma (Almudi & Fatas-Villafranca, 2021). Del capítulo III se colige que se debería avanzar en la definición de la ecuación de precios, así como afinar el cálculo de sus componentes, incorporándolos tanto como sea posible en los modelos IO, ya sean nacionales o multirregionales. En este sentido, ha habido importantes avances recientes en la estimación de matrices de uso y destino de capital (KSUTs), que permitirían recoger este elemento, superando una de las limitaciones de las tablas input-output (Södersten et al., 2018, 2020; Södersten & Lenzen, 2020). Así, se podría plantear la construcción de este tipo de matrices para evaluar, por ejemplo, inversiones en energías renovables, para hacer mejores simulaciones de proyecciones futuras. Por su parte, el capítulo IV sugiere introducir análisis complementarios al aportado por el SDA, pudiendo ser un ejemplo la construcción de Matrices de Contabilidad Social para España, enfocadas especialmente al tema distributivo. Finalmente, el capítulo V sugiere extender el análisis desde una perspectiva de especialización sectorial, conectando con el concepto de "capacidades" de un país, y extendiéndolo a los factores productivos que hacen que un país sea capaz de absorber una mayor parte de la renta mundial (Fagerberg et al., 2010; Fagerberg & Verspagen, 2007; Los & Verspagen, 2006; Verspagen, 2010; Verspagen & Kaltenberg, 2015). En particular, es importante avanzar en cuáles son las características económicas e institucionales que determinan un tipo u otro de ligadura con la CGVs. Por último, también queda pendiente un tema central, que ha salido a la palestra como resultado de la pandemia y de la reciente guerra en Ucrania, esto es, ¿cómo van a cambiar las cadenas de valor y como se formarán los futuros grupos geográficos de países con características similares en los procesos internacionales de distribución de la renta?

6.5. Referencias del capítulo VI

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Chapter VI: Concluding remarks and future lines of research

This dissertation has shown the importance of the study of income distribution, both from theoretical and empirical perspectives, due to the increases in inequality that contemporary economies have been experiencing for the last four decades. These increases in inequality have taken place both within developed and developing countries, as well as between countries. Next, we are going to present a summary of the main findings of this thesis. Then, we will discuss some of the policies that are at the center of the debate for combating rising inequality. Finally, we will present a series of future lines of research that logically follow the path of the work we have conducted up to now.

6.1. Conclusions of Chapter II: comments on the future paradigm

After a brief presentation of the motivations and objectives of this thesis in Chapter I, Chapter II deals with the development of a theoretical framework. This evolutionary and dynamic framework is the foundations of our theoretical and empirical analyses on income distribution. Our evolutionary framework, inspired in works such as Bunge (1979, 1997), Schumpeter (1939), or Nelson & Winter (1982), is formed of four co-evolutionary components, which are interrelated and partially autonomous. These form a superstructure called the social system, being income distribution one of its main emergent results. In the long run, these interrelations complexly evolve, which is why we consider non-linear dynamics, which are represented by the concept of long wave. These long waves present a clear technological character, in the sense that the exhaustion of radical innovations, following Schumpeter (1939), lead to a saturation point, which, jointly with the appearance of new technologies, provoke processes of structural breaks and crises. Then, we identify these deep economic crises (namely, such as those in 1929, 1973, and 2008), with processes of structural change. The adjustments to the new situation bring about a new long wave, whose characteristics (paradigm) will determine the structural regime of income distribution that will be present during said wave.

The first of these four co-evolutionary components of the paradigm is the economic system, which manifests in two types of crises or fluctuations. On the one hand, the aforementioned long waves; on the other hand, intermediate length fluctuations of around 7 to 11 years, which are associated to investment flows in incremental innovations, and linked to the cyclical evolution of income distribution. The second

element is the scientific system, focused on the development of Economics, considering that the paradigmatic state of the art affects policy makers, promoting a determined institutional evolution. In this sense, the third component is the institutional system, which is another important structural determinant of income distribution (let us think, namely, of the development of the welfare state during the first half of the twentieth century). Last, the fourth component is the technological system, which determines the profile of the evolution of long waves, as noted earlier.

Thus, in Chapter II, we determine, both by empirical and descriptive analyses, the existence of two long waves since 1929, each one presenting different long-run trends of income distribution: the first wave, going from 1931 to the mid-1970s, was characterized by reductions in inequality in a characteristic sample of developed countries; on the contrary, the second wave, starting at the end of the previous one and ending with the 2008 crisis, was features by strong increases in inequality. The evolutionary changes in the paradigms of each wave can yield explanations of these phenomena. Broadly, we observe how these changes can explain the two different regimes of income distribution: namely, at the institutional level, the change in the role of trade unions or the evolution of the concept of money; meanwhile, at the level of leading technologies, the substitution of oil and automobiles for ICTs, which was supported by the intensification in globalization and liberalization processes. Hence, we consider that, even though additional work is required, we have given important steps towards the construction of a theoretical framework that can explain the structural character of income distribution in the long run. Furthermore, we insist in the fact that our focus is non-deterministic, not admitting a given structure of long waves, concerning neither length nor the number of nestled intermediate cycles.

In what follows, as a direct results of the study of the two previous long waves, we are going to present a brief descriptive analysis of the paradigm changes that are taking place nowadays. Undoubtedly, knowing the structural and evolutionary characteristics of the social system can give many insights about the trends of income distribution in the next decades. This can be helpful to intervene and design adequate economic policies. Thus, our scheme would consider the start of a third long wave around 2010, so being in the midst of its beginning, we should be able to identify preliminary evolutionary patterns in the paradigm, as well as the appearance of Juglar cycles. Namely, in respect with the economic system, we conjecture that a first Juglar cycle would have probably taken

place during 2010-2020, ending with the pandemics. As time goes by, when new data series are available, we should be able to confirm this result and to explain its meaning in our framework.

The structural components of the paradigm also show important changes. At the scientific level, it seems clear that the level of computational developments reached in the past wave, as well as the capacity for collecting data, is leading our discipline into Data Economics, with a big presence of Big Data and machine learning techniques applied to research. The effects of this scientific evolution on income distribution might not be so evident, but perhaps some debates should be started on the ethical implications and limits of personal data collection.

Moving on to institutions, some changes are clearly crystalizing at the moment. For example, in the monetary system, the concept of money is evolving towards an even more intangibility. The progressive substitution of cash money, which started during the previous wave, is taking place jointly with the birth of cryptocurrencies and the Blockchain. This fictitious money, with no real counterpart, confirms an evolution that already started with the suspension of the gold standard. This can bring about rises in speculation, with important distributional implications, as happened during the 1920s. Another important question, linked to geopolitical evolutions, is whether the dollar can continue to be the international reserve currency, as a consequence of the uncertain American leadership, threatened by China. In this case, the international implications on income distribution would be serious, putting the USA in serious concerns to pay its commercial and financial debts. Moreover, regarding the labor market, there seems to be an endemic reduction in employment linked to automation, as well as the establishment of teleworking during the pandemics, which can bring the debate of the reduction in the work week, via less working days or less hours worked. Finally, the role of the public sector is not so clear: on the hand, it seems that the Great Recession opened the gates to more interventionism; on the other hand, is dubious if governments are actually opting for active policies to tackle problems of environmental and social unsustainability, which seem to be urgent.

Finally, the technological component of the paradigm is perhaps the most tangible and less open to discussion; the development of a different technological base is one of the main necessary conditions for characterizing a new long wave. Now, we are briefly presenting a list of the main innovations of the last decade, grouped by area of

knowledge, and so would be important feature of the present wave's new paradigm (World Economic Forum, 2012-2021). First, in computing, thanks to the development of data science, some advances can be highlighted: predictive analytics, the computational control by brain interfaces, a new generation of robotics with emerging artificial intelligence and deep learning, and quantum computing. In medicine, the main innovations are focused on the development of genetics and bioengineering, namely, in the genomic design and manipulation of humans and other species, thanks to DNA data storages, the Human Cellular Atlas, or complete genetic syntheses; moreover, nanoengineering is also opening possibilities to the diagnosis and treatment of several illnesses. Concerning, the environment, the establishment of clean energies, such as wind and solar (which were initially developed during the previous wave), innovations in energy storage, the new generation of batteries (lithium-ion) and the obtention of liquid fuels from solar energy (green hydrogen), the development of bioplastics and recyclable thermic plastics, or the possibilities of using carbon dioxide as a resource. In transportation, the development of electric vehicles must be highlighted, even applied to aeroplanes. Finally, the Green Revolution 2.0 must also be noted, due to its alleged distributional implications for developing countries, characterized by auto-fertilizing crops and intelligent fertilizers.

6.2. Conclusions of Chapters III, IV, and V

In Chapter III, we have deepened in some of the theoretical questions that have traditionally been discussed in the topic of income distribution. For achieving this, still considering our previously defined framework, we focus on the development of multisectoral 'reproduction and surplus' models (especially, on those based on input-output tables). These are strongly dependent on the structural and institutional frameworks and allow to carry out a temporal vision by comparing annual tables. The novelties with which we contribute to the debate in this chapter are found in the development of a multisectoral model with heterogeneous labor and wages, associated to different consumption patterns. First, we test if the relationship between wages and profits is decreasing in this specific context, trying to capture the competitive facet of the income distribution process. For this aim, we obtain prices equations with a uniform rate of profit, which depend not only on technical factors, but also on institutional ones, such as consumption patterns or growth/investment levels. By using these equations, it

can be proved that, for the defined context, the wages-profits relationship is indeed inverse. Once the forma development for *n* sectors and *m* labor types and consumption patterns, we focus on a simple 3x3 model, in order to run some simulations and test the functionality of our extended model. Thus, we obtain, once again, that consumption patterns are not trivial, and that determined structures can directly affect labor shares of income. These effects are linked to sectoral productivities and changes in equilibrium prices that take place when consumption structures change. This, in turn, affect the purchasing power of workers/consumers. We conclude Chapter III by checking that technological change can characterize income distribution with a cooperative facet (besides the traditionally considered competitive one).

Once finished the theoretical part of the dissertation, in Chapters II and III, we move on to the empirical part. Thus, in Chapter IV, we focus on the analysis of inequality in Spain during 1980-2014, as a first approach to a case of a representative developed country. Moreover, we cover our second long wave, which is a period characterized by general increases in inequality. The case of Spain is especially important as, besides being a well-known example for us, it presents some attractive structural features: namely, as shown in an initial descriptive analysis, the Spanish society is strongly stratified, which manifests in important inequalities by levels of skills, gender, and income.

As a first step, we construct several specific indicators of inequality: first, a Sen index, which shows that inequality has increased at a national level during this period, especially since the 1990s. Furthermore, we calculate Gini indexes to measure inequality in terms of labor compensations by levels of skill, and in consumption by income quintiles, showing increases in both cases. The case of labor compensations by gender is impressive, as it shows sectoral decreases in inequality, but an increase for the total economy, which indicates that inter-sectoral disparities have increased. We also construct a prices equation to decompose value added into several parts: here, we see that, even though labor compensations have decreased along time, it has been due to increases in investment flows destined to growth, instead of by increasing capital compensations, which can again show the cooperative facet of income distribution.

Finally, we apply a Structural Decomposition Analysis to value added in an input-output framework. We decompose changes in value added into several effects: the labor costs effect by skills and gender (which is further disaggregated into employment and wages effects), as well as the households' consumption effect by income quintiles. Thus, we

check, from another perspective, the existing stratification in the Spanish society, associated to different evolutions in labor productivities by each category. In more depth, we see the loss of importance of medium-skilled occupations, both in terms of employment and wages. By gender, we observe that the gap in terms of employment has closed, but the contrary happened in terms of wages. Last, in terms of consumption, we see how the highest income quintile drives consumption, the other four quintiles presenting almost negligible effects. In short, all this implies a higher degree of social stratification and, thus, inequality.

Finally, in Chapter V, we open our analysis to a global perspective, by using a multiregional input-output model. This analysis takes inspiration in the fact that globalization has been key in the international distribution of income. More specifically, we think of the manifestation of this phenomenon as the fragmentation of production and its configuration around the so-called Global Value Chains, which are key for explaining income distribution within and between countries. To this purpose, we use two measures of integration in these chains, that is, participation (the proportion of a country's value added embodied in exported goods and services over the world's total) and position ('upstreamness' or more distance to final use). A big part of the literature finds that the more the integration, the higher the economic upgrading. However, this economic upgrading is not necessarily translated into social upgrading within the country. Consequently, for researching the evolution of global inequality, we are studying both intra- and inter-country inequalities, and we start from two hypotheses: first, that inequalities appear differently by geographical areas; second, that the relationship between position and inequality is not linear, so we include a quadratic dependence.

An initial descriptive analysis shows that, for our sample of 67 countries, internal levels of inequality generally increased from 1995 to 2018. Regarding inequality between countries, there are some stories of success, such as those in Southeast Asia or the Middle East. On the contrary, regions such as Latin America and Africa have not been successful in reaching convergence.

In the econometric analysis, we use two measures of intra-country inequality and other two for inter-country inequality as endogenous variables. Concerning intra-country inequality, we find significant 'smile curves' (positive sign for quadratic position) in Developed countries, Latin America, and East & Southeast Asia, which shows that

countries belonging to these areas can reduce their internal inequalities by reaching intermediate positions in the chains. On the contrary, Transition economies (Russia and Central Asia) show 'frown curves', with opposite implications.

Regarding inter-country inequality, we find interesting results for Latin America, which would achieve convergence by locating in the extremes of the chains. Meanwhile, we find 'smile curves' in Developed countries and the Middle East, which implies that these areas converge to the world average by situating in intermediate positions of the chains.

6.3. Policy recommendations

After commenting the main conclusions of this dissertation, we are going to discuss some policy recommendations related to our results. First, we consider that is fundamental to work on establishing a social conscience focused on achieving a sustainable society, both in levels of inequality and environment (Piketty, 2022). This might be one of the main challenges to be faced in the future. From Chapter II and the analysis of the two last long waves, it follows that governments should perform a close screening of the economies' evolutionary patterns, especially regarding the radical innovations that are forming the new technological paradigm. This way, intermediate-length and long-run economic fluctuations could be smoothened, reducing the effects of investment and structural crises. It seems that denying the existence of these economic cycles might not be scientifically reasonable. Returning to paradigmatic changes after the Great Recession, those in labor markets seem of special interest. Namely, in the USA, it has already been discussed the possibility of addressing federal policies for guaranteeing well-paid employment for all (Darity, 2021; Ellwood, 2021; Shierholz, 2021). Furthermore, in several countries, it also has been discussed the adequacy of introducing basic income, although without reaching a clear consensus. A good design of this initiative would consider eliminating negative incentives over employment search (Van Parijs & Vanderborght, 2015). Finally, recent debates on the reduction of the work week to 35 hours, or to four days, follow the same direction as the previous measures.

Concerning the theoretical results obtained in Chapter III, it should be addressed that consumption patterns could be policy tools. We have seen that their influence on the primary distribution of income is not trivial. Thus, some regulations could be introduced to force changes towards more sustainable consumption patterns, in a context of

excessive or environmentally unsustainable consumption. Moreover, policies for fostering investments in innovations in determined sectors, if these come along increases in productivity, can also be useful for reducing the decreasing trends in labor shares of income, without necessarily implying losses in terms of profits.

From Chapter IV, some recommendations follow to tackle increasing inequality in Spain. First, for reducing inequality by levels of skills, education policies could be applied, namely, for the adaptation of medium- and low-skilled occupations to new technologies, in order to face automation (Acemoglu, 2021; Aghion, 2021). Second, for reducing the gender gap, policies for achieving equality in wages for the same occupations should be applied, as well as establishing minimum hiring quotas for both genders (Bertrand, 2021). Another important fact to attain gender equality is the need of ending sectoral barriers. In fact, inter-sectoral barriers are high and have recently increased. This implies that the feminization of certain activities should be avoided, which could also be achieved by education policies, fostering equality in access.

Last, to reduce the increasing stratification in consumption, redistribution policies might be necessary. These could increase the purchasing power of low-income classes, as well as penalizing sumptuary consumption. Recently, the adequacy of wealth taxes as redistribution instruments has been discussed (Mankiw, 2021; Saez, 2021; Summers, 2021; Zucman, 2021). Anyway, a higher progressivity, simplification, and transparency of the fiscal system should be promoted (Kopczuk, 2021; Stantcheva, 2021).

Finally, in Chapter V, when approaching the two facets of global inequality (within and between countries), and linking it to globalization and integration in GVCs, diverse policies would be recommended, depending on geographical location and levels of development. For Latin American countries, there seems to be a certain trade-off between the objectives of reducing internal inequalities and achieving convergence, so a compromise or an equilibrium of both policies would be desirable.

As commented earlier, results by geographical areas can differ sensitively. In this sense, we see how China has moved towards upstream positions, gaining weight in terms of value added per capita over the world average, but in detriment of their internal inequality. Similarly, Middle East countries have also converged in terms of income, as well as increasing their internal inequalities, but by moving to downstream positions. On the contrary, many European countries have economically and socially upgraded by moving to intermediate positions in the chains. All this suggests the need of deepening

in the causes behind these different effects of position in GVCs, namely: what are the effects of technological capacities, the availability of certain resources, or territorial proximity?

To sum up, we cannot forget the challenges ahead due to the development of a new long wave and its paradigm changes. This should make us think even more in the role of GVCs and their relationship to global income distribution, even more so when, on the one hand, the pandemics has accelerated pending transformations, introducing serious distortions in the chains as we knew them; and, on the other hand, when a new world order seems to be configurating, where the roles of China and the USA are still going to be important, but probably very different.

6.4. Future lines of research

Finally, we end this chapter with some comments about future lines of research that have been suggested by this thesis. Chapter II offers the possibility of going further in the construction of the theoretical frameworks, as well as of closely looking into the co-evolutionary processes that are crystalizing in a new paradigm (Almudi & Fatas-Villafranca, 2021). Chapter III opened the gates to the incorporation of prices into IO models, either national or multiregional. In this sense, the calculation of the components of the prices equations is also linked to another line with recent and important developments, that is, the estimation of capital use and supply matrices (KSUTs), which would allow to account for capital in an input-output framework, being this an important limitation of these models (Södersten et al., 2018, 2020; Södersten & Lenzen, 2020). Thus, a specific example would be that of constructing this type of matrices for collecting investments in renewable energies, in order to make projections for the future. In addition, Chapter IV suggests the introduction of complementary analyses to the SDA, namely, the construction of Social Accounting Matrices for Spain. Finally, Chapter V suggests the extension of the analysis to a perspective of sectoral specialization, linking to the concept of 'capabilities' of a country for absorbing a higher share of global income (Fagerberg et al., 2010; Fagerberg & Verspagen, 2007; Los & Verspagen, 2006; Verspagen, 2010; Verspagen & Kaltenberg, 2015). In particular, it seems important to determine which are the economic and institutional characteristics that yield each kind of linkages to GVCs. Last, other central topics would be those most recent, such as the pandemics or the Ukraine conflict, leaving important questions,

namely: how are GVCs changing, and how are going to be the groups of countries with similar characteristics in the international processes of income distribution?

6.5. References of Chapter VI

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