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Deindustrialization paths and growth models: Germany and Spain in comparative perspective

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Deindustrialization paths and growth models: Germany and Spain in comparative perspective

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Abstract: This paper investigates the deindustrialization process in Germany and Spain from 1995 to 2018. It is argued that the deindustrialization trajectories of each country are partially related to their growth models. An analysis in two steps is conducted. First, using the OECD input-output tables, a Hierarchical Structural Decomposition Analysis is applied, and the variation in the manufacturing value-added share is decomposed into five deindustrialization drivers: income, investment, relative prices, outsourcing and globalization. Second, building on the growth model perspective, an interpretative framework to analyze the evolution of the five abovementioned drivers is presented. The interaction between institutions, aggregate demand and the economic structure is explicitly considered in this framework. The comparative study of the German and Spanish cases and the distinction between the pre- and post-crisis periods illustrates the consequences of the distinct growth models (and the economic policies on which they are grounded) on structural change. The results suggest that the evolution of the deindustrialization drivers (and thus the manufacturing value-added share) in both countries is well-explained by their specific fiscal, labor, and industrial policies.

Keywords: deindustrialization, growth models, input-output analysis, macroeconomic policies, industrial policy

JEL: E12, E25, P16, C67, O14

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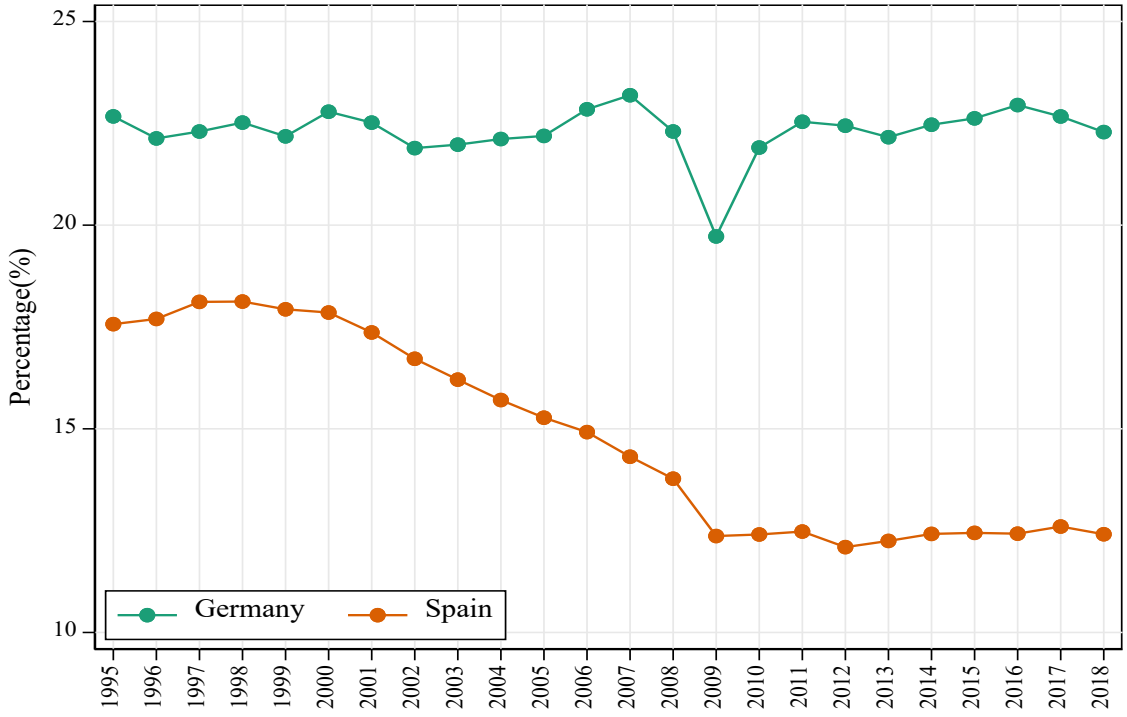
1. Introduction

Over the last three decades, the deindustrialization process, understood as the decrease in the manufacturing value-added share, has remained outside the scope of the EU's economic policies. However, the 2008- and Covid-19 crises have manifested the need to support a strong manufacturing sector through the renaissance of sector-specific industrial policies targeting a reindustrialization effort that raise the contribution of manufacturing up to 20% of the GDP (Gräbner et al., 2020a).

Although most countries in the EU have experienced deindustrialization, there has been an important heterogeneity between them. In this sense, the European integration process led to the emergence of a 'manufacturing divide' within the EU, meaning that the manufacturing activity has been increasingly concentrated in Central and Eastern Europe (Germany being the leading country), while it has shrunk sharply in Southern Europe (Celi et al., 2018; Gräbner et al., 2020b), being Spain the archetypical case. Therefore, understanding the macroeconomic and institutional factors behind the abovementioned heterogeneous deindustrialization paths becomes scientifically relevant and politically essential.

At the same time, two main growth models emerged in Europe after the onset of the euro (Köhler & Stockhammer, 2022). On the one hand, the export-led growth model, represented by Germany, is characterized by the central role of exports in economic growth, along with a structurally constrained domestic demand that keeps imports under control. On the other hand, the debt-led growth model, delivered by Spain, Greece, or Portugal before the 2008-crisis, is characterized by the importance of domestic demand in economic growth and by displaying commercial deficits, thus reflecting the dependence on foreign capital inflows to grow. Then, during the 2008-crisis, capital inflows halted and eroded the underpinnings of debt-led growth in Southern Europe, and these countries shifted towards a more balanced growth model from 2014 onwards after implementing aggressive fiscal austerity and wage devaluation policies.

Figure 1. *Value-added share (%) of the manufacturing sector*



Source: ICIO OECD database, authors' calculations.

This paper investigates the relationship between growth models -and the economic policies on which they are grounded- and deindustrialization. To do so, we draw upon two archetypical cases that have exhibited different growth models and deindustrialization trends: Germany and Spain (Figure 1).

Using the OECD input-output tables, a Hierarchical Structural Decomposition Analysis (HSDA) is employed to measure the drivers of deindustrialization. This technique decomposes the evolution of the manufacturing value-added share into five effects: income, investment, relative prices, outsourcing and globalization. Then, a novel analytical framework that considers the interaction between institutions, demand components and the economic structure is employed to interpret the results. This way, the evolution of each deindustrialization driver is connected to country-specific institutional dynamics.

The obtained evidence suggests that the mentioned institutional dynamics behind growth models have important implications on structural change (and not only on the macrodynamic), although the literature frequently neglects them. Furthermore, through the distinction between the pre- and post-crisis expansionary periods, we show that the transition from unbalanced debt-led growth towards a balanced growth model correlates with structural change.

The paper offers several contributions. First, the deindustrialization drivers' literature is linked with the growth model approach. Second, specific macroeconomic policies are connected to each deindustrialization driver, thus going beyond the structural change literature, which principally focuses on economic rather than institutional/political factors. Third, five deindustrialization drivers are captured. In this sense, the role of investment and the role of changing consumption patterns are considered separately in our HSDA.

This paper is structured as follows. The next section presents the theoretical insights about the drivers of deindustrialization and the growth model perspective. Section 3 reviews the German and Spanish industrial policies. The fourth section illustrates the methodology developed in the research. Then, we examine the drivers of deindustrialization in the two economies with particular attention to the evolution of the economic policies that characterize each growth model strategy. Finally, the last section summarizes the main conclusions.

2. Deindustrialization and growth models

2.1. The drivers of deindustrialization

One of the central debates on deindustrialization has to do with the identification of its drivers (Tregenna, 2016). Following Rowthorn & Coutts (2004) or Van Neuss (2019), the drivers of deindustrialization can be classified into five types: the relative prices effect, the income effect, the investment effect, the outsourcing effect, and the globalization effect. The first three drivers are considered internal factors since they depend on final demand channels (i.e., the demand for final services or final manufacturing goods). The remaining ones are external factors, as they are related to international productive fragmentation and its reorganization into global (or regional) value chains (Milberg & Winkler, 2013).

Firstly, the *relative prices effect* is based on the cross-sectoral technological differences (heterogeneous sectoral production functions) prompting the redistribution of economic factors, particularly labor, from progressive to stagnant sectors. This is reflected in a change in relative prices between sectors. It can be attributed to three factors. Firstly, differences in productivity growth between sectors lead to higher employment growth in services than in manufacturing, i.e., the cost disease hypothesis (Baumol, 1967). Secondly, differences in factor intensity of production

(Acemoglu and Guerrieri, 2008) result in employment shifts from manufacturing to other sectors when the capital-labor ratio increases. The last factor concerns the differences in the elasticity of factor substitution between sectors (Álvarez-Cuadrado et al., 2017). Essentially, sectors with higher elasticity between capital and labor can adjust their capital-labor ratio in response to changes in wage and rental rates. Ultimately, the relative prices effect results from manufacturing sectors experiencing higher productivity growth, greater capital intensity, and lower substitutability. This, in turn, triggers a structural shift in employment toward services, thus implying lower relative prices for manufacturing.

Second, the *income effect* is associated with variations in income elasticities across sectors. This effect results from the non-homothetic preferences of consumers, which arise from heterogeneous marginal rates of substitution of different goods when income per capita increases, leading to non-linear Engel curves. In accordance with Engel's law, an increase in real income causes shifts in the composition of domestic demand aligning with higher hierarchical needs, consequently reallocating economic resources. Services present a higher demand-income elasticity than manufacturing products. Therefore, as income rises, consumption shifts towards them, fostering deindustrialization (Clark, 1940; Comin et al., 2021).

Third, the *investment effect* captures changes in final investment spending. Frequently, the majority of investment spending has to do with manufactured goods purchases; that is, the investment rate of the economy is positively correlated with manufacturing gross value-added (GVA) share (Rowthorn & Coutts, 2004). As investment goods generally incorporate greater value-added from industry than services, a fall in the investment rate will imply a shift towards services. At the same time, growth in this variable will drive the manufacturing share up (García-Santana et al., 2021).

Paradoxically, most structural change models do not identify this driver and include it as a part of the income effect. Only some works have incorporated it to distinguish consumption from investment's impact on deindustrialization (Herrendorf et al., 2021).

The *outsourcing effect* recognizes the importance of intermediate inputs in driving structural change. Economic sectors are both producers and consumers from other sectors. In this sense, the growth of the service sector as an intermediate input supplier has affected sectoral interlinkages and has emerged as a driver of deindustrialization, particularly due to the externalization of services activities previously performed within manufacturing firms (Ciriaci & Palma, 2016; Montresor & Marzetti, 2011).

Lastly, the *globalization effect* derives from the changing in the productive specialization of national economies when opening up to international trade through a two-fold channel. First, the dynamic effects of trade, affecting both productivity and income growth, foster structural change through the impact of trade on internal drivers. Second, the development of Global Value Chains (GVC) has played an important role in changing international trade patterns for final products and intermediate inputs (Milberg & Winkler, 2013). The imports' penetration of intermediate and final manufacturing products in developed from developing countries and the relocation of industries to the latter economies result in a decline in employment and manufacturing GVA in developed countries (Krugman, 1996; Matsuyama, 2019).

So far, the question of which factors are the most important in driving deindustrialization in advanced economies remains open. Most structural change models have focused on internal drivers, agreeing that non-homothetic preferences and heterogeneous sectoral production functions are the main drivers of the process. Some of them capture the relative prices effect as the most important factor (Herrendorf et al., 2013; Ngai & Pissarides, 2007), while others point

to the income effect (Álvarez-Cuadrado & Poschke, 2011; Álvarez-Cuadrado et al., 2017; Comín et al. 2021).

However, these models have not extensively incorporated the outsourcing and the globalization effects. To address this gap, Van Neuss (2018) estimates the contribution of these two effects, drawing on a panel of 15 OECD economies. His findings suggest that the globalization effect is relevant, although internal factors take precedence in driving deindustrialization. Similar results are obtained by Peneder & Streicher (2018) and Liboreiro et al. (2021).

All in all, this literature informs policymakers in counteracting deindustrialization. Nevertheless, the most important works just measure the importance of the drivers through different quantitative methods such as econometric analysis or input-output tools (Van Neuss, 2018). In this sense, the different profiles of deindustrialization across developed countries cannot be fully explained by the traditional quantitative analysis of its drivers. In our view, some institutional factors help explain the different trajectories of deindustrialization that are not considered by these studies and that we do take into account in the present paper.

2.2. The growth model perspective and the productive structure

The so-called growth model perspective is a research agenda that combines socio-institutional insights from comparative political economy with post-Keynesian macroeconomics. Essentially, this agenda focuses on how national institutions and political coalitions affect the functional income distribution and economic growth from the demand side (Baccaro & Pontusson, 2016; Hein et al., 2021).

A growth model is mainly characterized by two factors. First, the relative importance of consumption, investment, and net exports in aggregate demand. Second, how investment is financed (via domestic or foreign savings). Furthermore, it should be noted that a growth model is a dynamic, rather than a structural, attribute of an economy, i.e., it can change throughout time due to the implementation of economic policies and other macroeconomic issues.

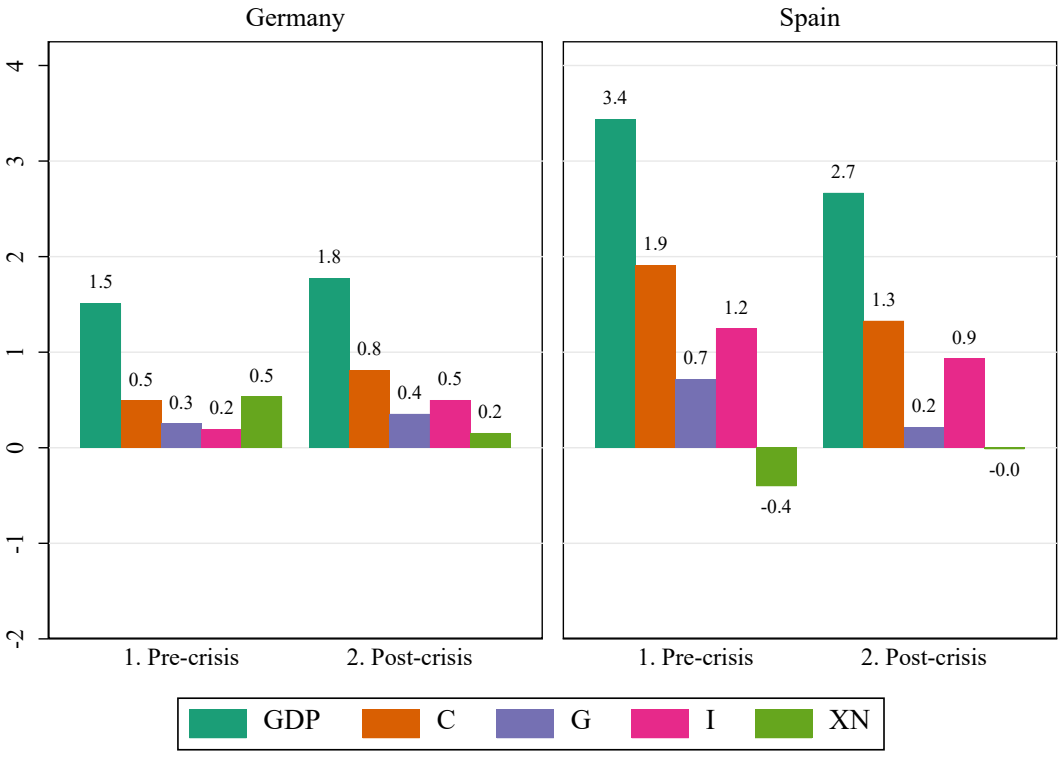
So far, two main growth models have been identified. On the one hand, an export-led growth model is characterized by displaying positive contributions of the trade balance to economic growth. In this case, the archetypic economy is Germany (Figure 2), which has been exhibiting increasingly positive trade surpluses since the mid-1990s, especially since the euro's inception (reaching values of around 7% of the GDP). Germany displays export-led growth before and after the Great Recession. This pattern is grounded in at least three pillars that conformed during the 1990s and early 2000s. The first one is the technological superiority of German goods, on which the non-price competitiveness of the country is based (Storm & Naastepad, 2015). The second one is the long process of wage devaluation that fostered exports price-competitiveness, and particularly restrained domestic demand growth and imports during the decade before the 2008-crisis, but also after that period (Hein et al., 2021).

Moreover, domestic demand repression is also based on Germany's traditional fiscal conservatism, exemplified by the black-zero rule. The third pillar is the restructuring of the German manufacturing sector through both the outsourcing of low-level services (Goldschmidt & Schmieder, 2017) and the offshoring of the most labor-intensive manufacturing activities (mainly towards Central and Eastern Europe) (Baccaro & Benassi, 2017). This allowed large German manufacturing firms to channel cost-competitive pressures into domestic services and external manufacturing suppliers (Herrero & Rial, 2023b). After the 2008-crisis, Germany undertook a slight re-institutionalization of its labor market. The introduction of a statutory minimum wage in 2015 or the improvement in the working conditions of agency workers are two

important milestones that helped rebalance the German economy (Marx & Starke, 2017). Although net exports still play a key role in economic growth, domestic demand is much more relevant. As will be carefully discussed in Section 4, all these features of the German growth model might have contributed to containing the process of deindustrialization.

On the other hand, the literature defines debt-led growth as a pattern in which domestic demand plays the leading role in economic growth, and the trade balance deteriorates. During the pre-crisis expansionary period, the main debt-led growth model in the eurozone is probably Spain (Figure 2). This country displayed high real GDP growth rates during the period (3.4% per year) while presenting an increasingly negative trade balance (it reached the value of -5.8% of the GDP in 2007), particularly due to the increase in imports. Such a growth pattern was based on the expansion of private investment, especially in the construction sector, around which a financial bubble existed, as well as on consumption growth (Buendía, 2020). Real wages in Spain barely grew during this expansionary period. However, consumption demand growth relied on credit expansion, the wealth effect derived from real estate assets, and wage bill growth thanks to employment creation (Cárdenas et al., 2021). In turn, the stagnation of real wages had to do with the progressive liberalization of the labor market and the country's productive specialization in low-level services (Buendía, 2020).

Figure 2. *Output growth and demand growth drivers before and after the 2008-crisis*



Note: Pre-crisis period: 1995-2008; post-crisis period: 2011-2018 for Germany and 2014-2018 for Spain.
Source: Eurostat, authors' calculations.

Moreover, it is worth highlighting that the fiscal policy stance of Spanish governments was conservative during the pre-crisis period, although less than Germany's: public spending displayed positive contributions to economic growth, but its share on the GDP decreased from 44.8% in 1995 to 39.2% in 2007, and from 2004 onwards it exhibited primary fiscal surpluses.

However, Spain transformed its growth model after the 2008-crisis and shifted away from debt-led growth thanks to the implementation of labor market deregulation policies and fiscal austerity. Although these measures were inefficient for both employment and GDP growth, they contributed to rebalancing the external sector. Nevertheless, they did so thanks to the sharp decrease in domestic demand and imports rather than a substantial increase in exports (Villanueva et al., 2020; Köhler & Stockhammer, 2022). The post-crisis Spanish growth model cannot be labelled as export-led (Cárdenas et al., 2021; Baccaro & Pontusson, 2022) since the trade balance exhibiting growth contributions close to zero. Nonetheless, both the constraint of domestic demand and the absence of a financial bubble seem to be the causes of the slower economic growth compared to the previous expansionary period.

Again, as will be detailed in Section 4, the features of the Spanish debt-led growth model might have exacerbated the deindustrialization process during the years before the crisis, while the rebalancing of the economy after it has the potential to explain the slowdown in this process.

To the best of our knowledge, few studies explicitly incorporate the existing linkages between national growth models and the productive structure in general and between the former and the deindustrialization trajectories in particular. In this sense, two studies within the growth model literature deserve attention. Baccaro & Pontusson (2016) suggest that export-led economies present a robust manufacturing sector, while debt-led ones are more specialized in services. Moreover, these authors argue that countries' performances depend on the different price elasticities of their exports. Within export-led economies, German exports are very price-sensitive because they consist of high-quality but standardized goods, which benefited from the internal devaluation. The contrary occurs with Sweden's exports, which are less price elastic due to being specialized in ICT products and services. Additionally, Bürgisser & Di Carlo (2023) label Southern European economies as tourism-led. The productive structure of these countries -namely Spain, Italy, Portugal and Greece- is heavily specialized in tourism services provided to Northern Europe. According to them, this productive specialization is a principal driver of the external rebalancing of Southern European economies after the Great Recession.

The relationship between growth models and the productive structure has been considered more explicitly by structuralist post-Keynesian macroeconomics. This strand of the literature has identified the emergence of an industrialized core and a deindustrialized periphery dependent on the former within Europe (Simonazzi et al., 2013). According to these scholars, the main causes of such a structural polarization process are country-specific institutional factors and the European integration process, which consolidated an unequal integration pattern in the international division of labor of the different European regions (Celi et al., 2018).

In this sense, Gräbner et al. (2020a) propose a novel framework that connects the different productive structures due to their core or peripheral position in the EU with the literature of growth models. They link the high technological capabilities of firms in Northern Europe to the export-led growth strategy because it is grounded in non-price competitiveness factors. On the contrary, countries with lower technological capabilities are likely to follow a debt-led strategy. Therefore, differences between core export-led and peripheral debt-led economies are rooted in technological capabilities' structural polarization. In a similar vein, Gräbner et al. (2020b) highlight the non-convergence in these technological capabilities among EU countries after the financial crises due to country-specific characteristics.

Herrero & Rial (2023a) combine an IO-analysis with panel-data regressions to study the effect of labor costs on export performance by comparing the Mediterranean periphery and Germany. They find that uneven productive structures in services-manufacturing linkages have affected export performance due to the important role of non-price factors in external competitiveness. According to this work, Mediterranean economies, which are specialized in low-tech manufacturing sectors,

exhibit lower linkages with innovation-related services (KIBS) compared to German industries, which are more technologically advanced and KIBS-intensive. These structural differences make it difficult for the European periphery to transit from a debt-led growth pattern towards an export-led one, prevailing the polarization in the EU.

All these works suggest that EU countries' disparities in productive structures and their different deindustrialization trajectories are somehow linked with their growth model. However, they do not provide insights about the factors that cause their different deindustrialization paths. To fill this gap, it aims at providing this analytical framework.

3. Industrial policy in Germany and Spain

Industrial policy is understood as any type of state intervention aiming at supporting the development of specific sectors, technologies, or capabilities in the economy, with the ultimate goals of fostering employment and output growth and transforming the economic structure in the medium or long run (Katzenstein, 1985; Warwick, 2013). Therefore, industrial policy is a key element for containing deindustrialization and deserves a review.

However, the institutional design of the EU has considerably limited the scope for interventionist vertical industrial policies targeted at specific firms or sectors. On the contrary, both the rhetoric and the regulatory environment of the EU principally allowed horizontal interventions, consisting in fostering free competition by restricting state aid, lowering corporate taxes and labor market regulations and strengthening education systems and, in some cases, improving the infrastructure network (Bulfone, 2023). The fiscal constraints on the European countries have reinforced this stance.

Interestingly, Germany has somehow benefited from this low policy space for conducting industrial policy suffered by EU countries (Pianta et al., 2016): the EU market and monetary integration allowed German firms of core manufacturing sectors (i.e. chemicals, automotive industry, mechanical and electrical engineering) to access new markets thanks to its superior competitiveness and consolidate its export-led growth model. Furthermore, incorporating the Central and Eastern European countries into the UE facilitated the abovementioned offshoring process undertaken by large German manufacturing firms, configuring regional value chains to save labor costs (Celi et al., 2018).

Officially, Germany has adopted an ordoliberal stance toward industrial and competition policies, as the state's role predominantly focused on enabling markets to function adequately and without frictions (Ergen & Kohl, 2019).

Nevertheless, it has performed hidden proactive vertical industrial policies through its state-owned development bank, the Kreditantstalt für Wiederaufbau (KfW). Since the post-war era, the KfW has been acting as an agent for allocating long-term credit to strategic sectors, such as shipbuilding, aircrafts, machinery or renewable energy, which have problems obtaining private finance due to risk aversion (Naqvi et al., 2018). The KfW role has remained central despite the constraints of globalization and EU regulations. In fact, the bank has taken advantage of globalization by participating in international capital markets (Naqvi et al., 2018). In doing so, the KfW could meet the increased demands for its funds from industrial firms from the mid-1980s onwards, when large German private banks moved from their traditional lending business towards speculative activities (Deeg, 1999).

At the same time, the country has implemented a ‘stealth’ horizontal industrial policy focused on promoting innovations to help manufacturing firms gain positions in international markets and build technological capabilities (Kattel et al., 2020). The close links between research institutes, the public sector, and private firms are a central feature of such policy. Research institutes are

located all over the German territory (even in the less populated areas) and create linkages with local industries. For instance, the Fraunhofer Gesellschaft is a main research institute financed by both government funds and private contracts whose most important contractors are SME firms (the so-called Mittelstand). This institute is one of the largest producers of transnational patents and has helped the industry to increase its productivity (Kattel et al., 2020). Besides, the government supports the dual vocational training system, which is also funded by the private sector, to supply the required skills for manufacturing production.

Furthermore, although it is beyond the time span of this paper, it is worth noting that from 2019 onwards the German industrial policy scope has drastically changed, exemplified by the National Industrial Strategy 2030 (NIS 2030), which promotes vertical industrial policies targeting key technology areas and industries (Schneider, 2023).

Regarding Spain, its strong deindustrialization process is partially related to the industrial policies applied since mid-1980s. First, the industrial reconversion program, configured to adapt the industrial legislation to the European integration process, consisted in market selection mechanisms to promote industries (Andreoni & Chang, 2019). This policy aimed to restructure tradable manufacturing sectors, like steel or shipbuilding, by implementing more technologically advanced production methods and cutting losses. This led to reduced the productive capacity of industries that previously embodied developmentalism within the Fordist production model (Caloghirou et al., 2000). In contrast, the liberalization and privatization process in the energy, telecommunications, and banking sectors ('protectionist liberalization') took place under controlled measures, resulting in the emergence of national champions in these sectors (Bulfone, 2020).

Then, there is a lack of a specific industrial policy to address the weaknesses of the Spanish productive model and the challenge of deindustrialization derived from the reconversion program (Sebastián, 2019). Four types of horizontal measures were proposed to support Spanish manufacturing without violating the new EU regulations. These included regional development aid to attract investments, R&D support initiatives managed by the Center for the Development of Industrial Technology (CDTI), industrial observatories serving as forums for discussions among various sectoral actors, and the development of industrial clusters (Šćepanović, 2020).

In order to face the financial crisis, the Integral Plan for Industrial Policy 2020 (PIN 2020) was passed in 2010. It aimed to address the structural weaknesses of the Spanish production model in terms of low manufacturing share in production, low technological intensity, and lack of external competitiveness (Ministry of Industry, Trade and Tourism, 2010). The focus was on improving external competitiveness, integrating into international markets and internationalizing companies (Sebastián, 2019). This measure formed part of the measures aimed at rebalancing the economy and improving the trade balance.

In short, both countries have adapted their industrial structures to the market-competition system within the EU. However, this adaptation has positively affected German manufacturing companies due to their superior competitiveness but negatively affected technologically lagging Spanish manufacturing industries. Furthermore, while Germany could apply hidden industrial policy benefiting shipbuilding or machinery, the Spanish soft industrial policy, together with the 'protectionist liberalization' of the services sector, left its weak manufacturing sector aside. Yet, there are other political factors related to their growth models that shaped the deindustrialization trajectories of Germany and Spain, as we will see below.

4. Methodology

Deindustrialization has traditionally been assessed using three indicators: (i) changes in the sectoral GVA share in total GVA, (ii) changes in the manufacturing employment share (measured

in either jobs or hours worked), and (iii) changes in final consumption expenditure. Each indicator can lead to different conclusions both quantitatively and qualitatively and has its own limitations. Thus, they are often presented together complementary (Herrendorf et al., 2013). Tregenna (2009) proposes a widely accepted definition of deindustrialization, which occurs when both the share of manufacturing in employment and output decrease.

Peneder & Streicher (2018) note that a decrease in output leads to a decline in employment, but the reverse is not necessarily true. Therefore, considering the greater data availability, this paper opts to use the change in value-added as an indicator of deindustrialization. Using the value-added indicator facilitates the application of the HSDA method to measure the drivers of deindustrialization.

4.1. Hierarchical Structural Decomposition Analysis (HSDA)

Following Liboreiro et al. (2021), a Hierarchical Structural Decomposition Analysis (HSDA) based on the nominal value-added share is employed to identify the drivers of deindustrialization. The HSDA addresses the limitations of traditional SDA methods (see Dietzenbacher & Los, 1998; Fernández-Vázquez et al., 2008). It tackles the *non-uniqueness problem*, where multiple mathematically valid solutions for decomposition can exist, calculating the arithmetic mean of possible solutions, establishing a hierarchy among determinants based on a well-defined theoretical model, and considering the cumulative contribution of each variation from year to year. This ensures that the weight of each effect on the total variation of the variable is determined by its actual trajectory. HSDA offers a versatile approach to decompose any variable, regardless of complexity, that results from additions or products of others.

In this paper, this model is applied to explain the differences in the deindustrialization processes between Germany and Spain. The ICIO tables of the OECD database are used, and the 1995-2018 period is analyzed. This dataset provides GVA data for 45 sectors (ISIC Rev. 4). This database is preferred over the WIOD because it allows us to extend the analysis period to 2018 with a consistent industry classification.

4.2. Application of HSDA to manufacturing value-added

Let us consider y_i industries in the manufacturing sector, where $y_{man} = \sum_{i=1}^{n} y_i$, and n the set of industries that make up the manufacturing sector. The share of each industry in total GVA (Y) can be expressed as:

$$s_i = \frac{y_i}{Y} \qquad (1)$$

Then, the time variation of each industry expressed in percentage points (p.p.) can be defined:

$$\Delta s_i = \sum_{i=t_0+1}^{t_1} \left(\frac{\Delta y_i(i) - \Delta Y(i) \frac{y_i(i-1)}{Y(i-1)}}{Y(i)} \right) \qquad (2)$$

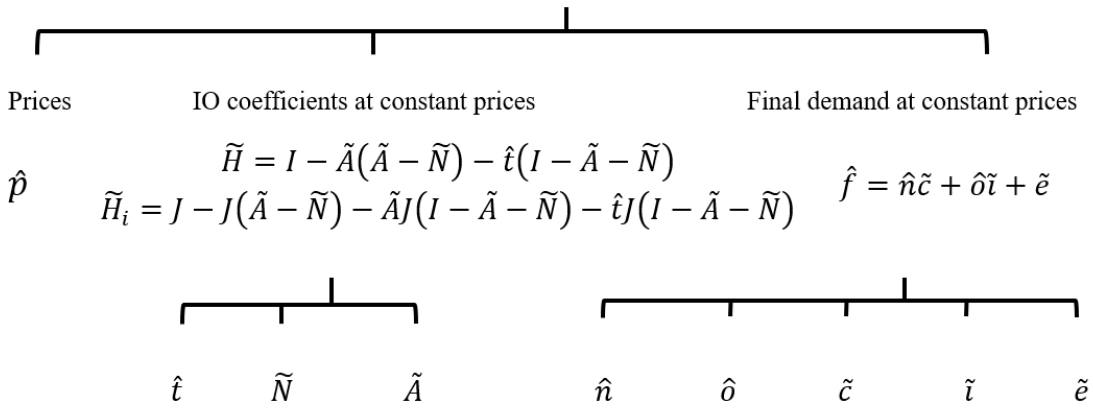
Developing the extension of the hierarchical structure proposed in Liboreiro et al. (2021):[1]

[1] See Appendix 1 for the development of the equation of value-added share.

Diagram 1. *Hierarchical Decomposition of value-added.*

$$Y^* = g'\hat{p}\widetilde{H}\tilde{f}$$

$$y_i^* = g'\hat{p}\widetilde{H}_i\tilde{f}$$



As Diagram 1 illustrates, the contribution of changes in the determinants is grouped into a set of effects according to the drivers of deindustrialization collected by the literature.

a. Price effect

The variation of the price vector would be the equivalent of the relative prices effect in the literature on drivers of deindustrialization. It comes from the cost/productivity differentials existing between sectors.

$$Price\ effect\ = C(\Delta p) \qquad (3)$$

b. Income effect

It is the effect of the variation of the final domestic demand vector at constant prices, excluding the gross fixed capital formation vector. It captures the changes due to Engel's law.

$$Income\ effect\ = C(\Delta \tilde{c}) \qquad (4)$$

c. Investment effect

The investment effect is equivalent to the variation of the gross fixed capital formation vector (plus the inventories vector change) at constant prices. Investment demand goods are collected in this effect.

$$Investment\ effect\ = C(\Delta \tilde{\imath}) \qquad (5)$$

d. Outsourcing effect

The effect of the variation of the matrix of technical coefficients at constant prices. The literature interprets the changes in the composition of inputs as the effect of outsourcing.

$$Outsourcing\ Effect\ = C(\Delta \tilde{A}) \qquad (6)$$

e. Globalization effect

This is the effect composed of the variation in the vectors of consumption and investment coverage rates, the variation in the vector of imported intermediate inputs and the variation in the

vector of external demand. This effect can be decomposed into the imports effect and the exports effect.

$$Globalization\,Effect = C(\Delta n) + C(\Delta o) + C(\Delta \tilde{N}) + C(\Delta \tilde{e}) \quad (7)$$

f. Residual effect

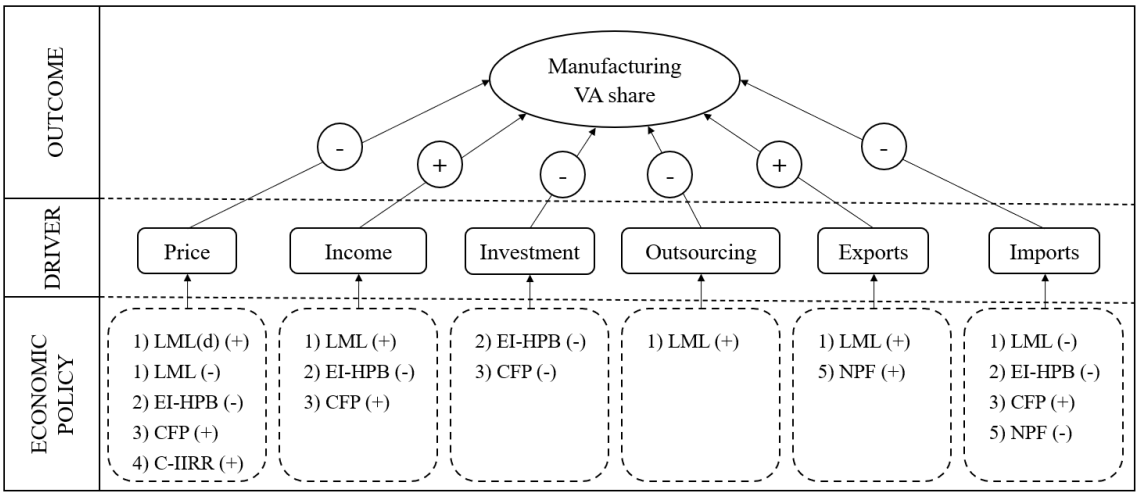
It is the effect of the residuals, i.e., the difference between the first-order approximation and the effective result, to which we add the contribution of the vector of taxes minus subsidies on products per unit produced.

$$Residual\,effect = C(\Delta t) + Residuals \quad (8)$$

4.3. An analytical framework to study the deindustrialization drivers

Once we have defined the effects, we propose an analytical framework to link each deindustrialization driver with a set of macroeconomic policies. As represented in Diagram 2, this framework incorporates the expected effect of each economic policy on the manufacturing value-added share channeled through each deindustrialization driver.

Diagram 2. *Relationship between economic policies and deindustrialization drivers*



Legend: 1) Labor market liberalization (dualization); 2) External indebtedness / Housing prices boom; 3) Conservative fiscal policy; 4) Coordinated industrial relations; 5) Non-price factors. The sign of the arrows indicates the expected effect that each deindustrialization driver has on the manufacturing value-added share. The sign next to the economic policies considered in the diagram represents each policy's expected effect on the manufacturing value-added share. If the sign of the policy and one of the drivers are not the same, this means that the policy contains the natural effect of the former. If the contrary occurs, the policy will enhance the driver effect. Source: own elaboration.

Firstly, each deindustrialization driver's expected effect is specified per Section 3.2. It is expected that relative prices, income, outsourcing and imports negatively impact the manufacturing GVA share, while investment and exports display a positive impact.

Secondly, the effect of each economic policy is represented. Each effect is channeled through a specific driver, thus either reinforcing the original effect of the latter (the sign of the arrow and the one of the economic policy are the same) or containing it (the signs are different).

Regarding *labor market liberalization* (LML), it contributes to the evolution of deindustrialization through five channels. Initially, if LML adopts the form of dualization, then it moderates the price

effect by inducing a divergent evolution between protected manufacturing workers and unprotected service workers, implying a decoupling of wages from productivity growth that it is more pronounced in services. On the contrary, if the liberalization takes place throughout the entire labor market, this sign of the effect is negative. Additionally, as the Engel law explains the income effect, LML mitigates its impacts since it limits the rise of aggregate consumption through wage moderation. It also influences the outsourcing effect by accelerating deindustrialization because manufacturing industries would find it easier to externalize parts of their production processes in order to save costs to sectors with lower labor costs. Finally, it contributes to curbing deindustrialization through the globalization effect, enhancing the price competitiveness, boosting exports growth and restricting imports.

The combination of *external indebtedness* and *housing prices boom* (EI-HPB) contributes to deindustrialization through three avenues. Financial liberalization and deregulation policies result in a boom in international capital inflows, which, in the absence of active industrial policies, are channeled to households (which access to cheap credit) and the construction and real estate sectors, giving rise to a speculative bubble around them. These occurrences accelerate the relative prices effect due to inflation driven by the speculative bubble, primarily impacting construction and services industries such as financial services or real estate, broadening price differential between manufacturing and non-manufacturing sectors. Second, EI-HPB generates a wealth effect that spurs consumption. Lastly, EI-HPB negatively affects deindustrialization by harming manufacturing investment, as the housing prices boom tends to concentrate investment in the construction sector.

Conservative fiscal policy (CFP) contributes to containing deindustrialization through three channels while accelerating it through one. CFP hits less protected sectors like services, constraining the cost differential between manufacturing and non-manufacturing relative prices and limiting the price effect. Moreover, this policy restricts domestic demand, reducing the income and the import effects. Conversely, it also accelerates the deindustrialization hampering the investment effect due to the reduced income available for investment.

Coordinated industrial relations (C-IIRR) impact deindustrialization through the relative prices effect. C-IIRR allow to restraint wages in the non-exposed sector to international trade, which usually comprises services.

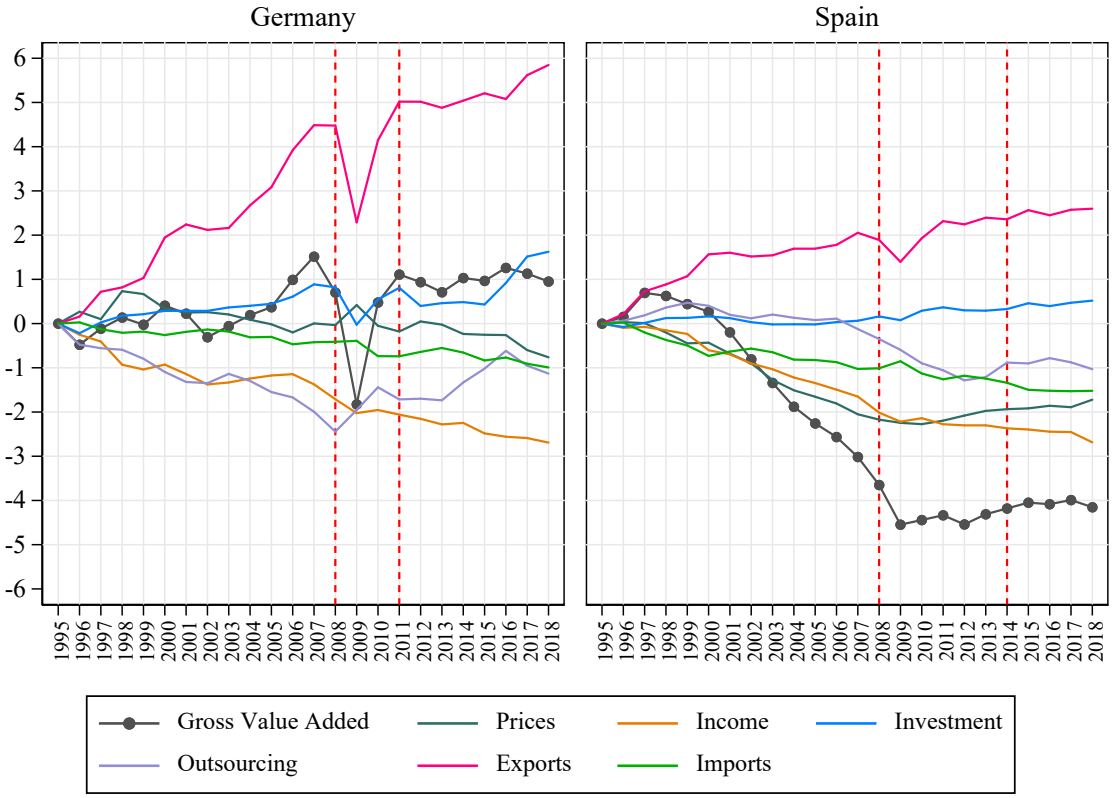
Finally, *non-price factors* (NPF), such as technological sophistication, affect the country's external competitiveness. Considering that most exports are manufacturing goods, an improvement of NPF positively affects the manufacturing VA share due to the improvement in exports and the decline in imports.

5. Results: the process of deindustrialization and growth models

This section aims to present the results of the HSDA model and disentangle how institutional dynamics might have affected each of these drivers before and after the 2008-crisis.

Figure 3 shows the contribution of each effect to the cumulative variation in the value-added share. The results are expressed in percentage points (p.p.). Both countries exhibit very different trajectories in the manufacturing value-added share: while Germany presents a positive evolution throughout the whole period, Spain undergoes a strong deindustrialization process. We argue that these divergent paths are partially the consequence of the economic policies on which growth models are grounded in. We carry out the analysis by distinguishing two expansionary periods: the pre-crisis period and the post-crisis one.

Figure 3. *Cumulative variation in the share of manufacturing in GVA and its effects in Germany and Spain, in p.p., 1995-2018*



Source: ICIO OECD database, authors' calculations

5.1. The pre-crisis expansionary period

The 1995-2008 period is characterized by opposite dynamics in the deindustrialization process between the two economies under study. Whereas the manufacturing GVA share increases in Germany by 0.7 p.p., particularly from 2003 onwards, it sharply decreases in Spain (around 4 p.p.). The average contributions of each effect are presented in Figure 4.

When looking at Germany, deindustrialization is contained thanks to the fact that both the price effect is close to zero until 2008, as well as to the positive effect of investment and globalization. On the contrary, the income and outsourcing effects drive the manufacturing share down, although the former stagnates from 2003 to 2007.

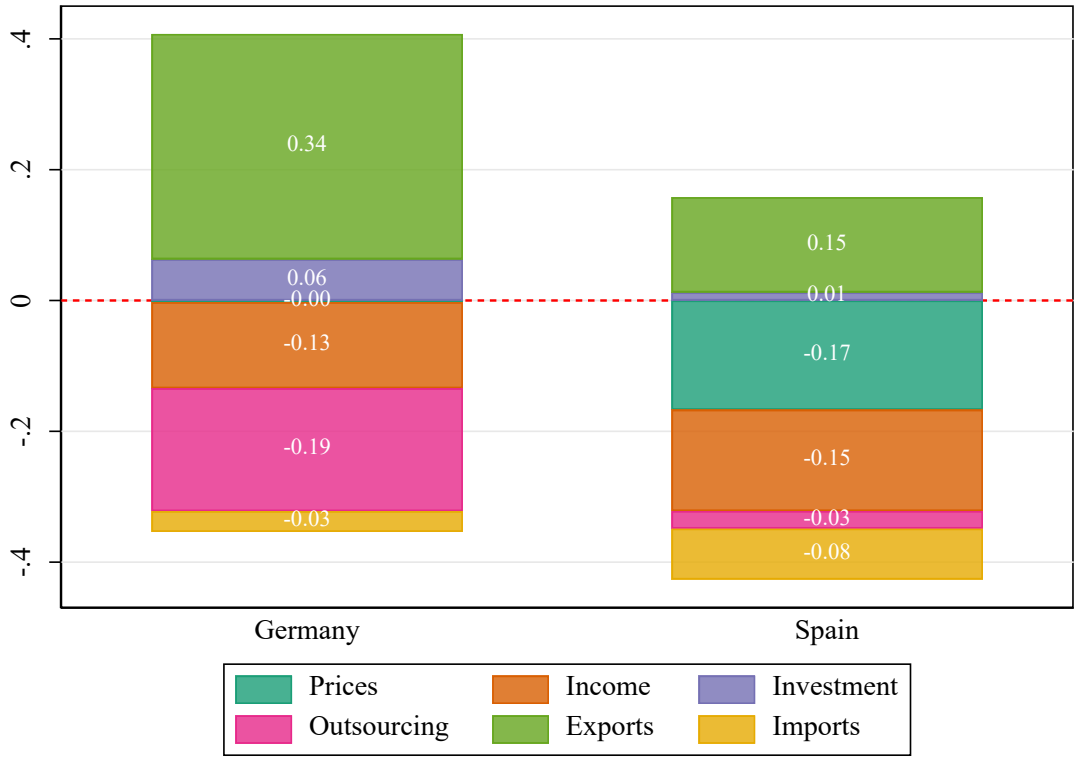
In the first place, the *price effect* captures how the differences in the evolution of price growth between sectors drive down the manufacturing share in the aggregate value-added. This divergence in relative prices is due to manufacturing exhibiting larger productivity growth than the rest of the sectors, which in turn implies lower unit costs and unit prices. Empirically, this effect is the primary driver of deindustrialization in mature economies (Betts et al., 2017). However, in Germany, it drives deindustrialization up by only 0.01 p.p. on average, which is a rather low value.

We contend that the price effect in Germany is partially overcome by means of the institutional setting due to two reasons. The first one has to do with its traditional coordinated wage-setting system. Moreover, the second relates to the type of internal devaluation implemented by this country from the mid-1990s to the mid-2000s.

On the one hand, the German coordinated wage bargaining system consists in *pattern bargaining, i.e.,* the metalworking collective agreement in Baden-Württemberg set the pace for other industries and regions for wage growth. This mechanism seeks to promote price stability, and it worked particularly well in the past when the collective bargaining coverage was high and there were few options for firms to use opening clauses (Herrero, 2022).

On the other hand, Germany implemented a set of reforms in its labor market and industrial relations system to address the high unemployment and improve its trade balance, thus transitioning towards an extreme export-led growth model. The deregulation of the German economy was a slow process that consisted in the liberalization of the margins or periphery of the labor market by the progressive inclusion of legal facilities to use atypical contracts - namely, temporary contracts, agency work and marginal employment or mini-jobs -, the reduction of dismissal costs for these contracts, and the decentralization of the wage bargaining and the work council coverage. The last and most paradigmatic step of this liberalizing process was the Hartz Reforms (2003-2005), which included, among other measures, the reform of marginal employment (mini-jobs), the reduction of unemployment benefits duration and the introduction of means-tested social assistance for the long-term unemployed, with the aim of reducing the reservation wage.

Figure 4. *Average contributions to deindustrialization during the pre-crisis expansionary period*



Source: OECD STAN database, authors' calculations.

The liberalization of the labor market was possible thanks to the weakening of unions and the poor economic situation the economy was going through in those years. Most scholars point out that Germany has experienced a dualization process, and two regions have emerged in the economy. On the one hand, there is an institutional core around the manufacturing sector, where unions remain relatively strong. These unions exchanged internal flexibility measures and wage restraint for employment protection and training for their members, as well as investment

compromises. Through the pattern bargaining system, collective agreements of metalworking industries set a limit for bargained wage growth to the rest of the industries in the economy in which collective bargaining coverage is high. Furthermore, although wage negotiations were decentralized, core workers -who are represented at the firm level in work councils- can renegotiate sectoral working conditions with guarantees. Additionally, despite liberalizing reforms, non-standard employment levels are much below the average (Hassel, 2014; Herrero, 2022).

On the other hand, the margins or periphery of the labor market is the region in which labor institutions' erosion is concentrated, and wages have fallen dramatically. In this region, frequently identified with services, collective bargaining coverage has fallen abruptly, and union coverage is much lower. In contrast, work councils in establishments are unusual, so workers are not strong enough to resist wage restraint at the firm level. Furthermore, atypical work has grown a lot.

This sort of liberalization process implied a severe decline in wages at the lower end of the wage distribution, resulting in a sharp expansion of the German low-wage sector. Furthermore, this segmented system generates a specific structure of wage inequality, consisting in the divergent evolution of wage growth between manufacturing and services. Although there are other variables shaping the dualization of Germany's labor market (e.g., the skill level or the firm size) as well, this story explains why the decoupling of wages from productivity growth has been larger in services than in manufacturing (Baccaro & Benassi, 2017). According to the literature, the liberalization of the service periphery is a mechanism to protect the working conditions and wages of core manufacturing workers by containing labor costs throughout the manufacturing value chain (services provide inputs to manufacturing firms) and driving down consumer prices (Herrero & Rial, 2023b).

Interestingly, this type of economic policies -unequal wage restraint between manufacturing and services- have the potential to moderate the price effect. Otherwise, in absence of this type of institutional tools, like in Spain, we expect that the price effect would perform as the theory suggests. This is partially collected in Table A.1 (Appendix 2), which shows that Germany is the economy where the price relationship between manufacturing and services has deteriorated less.

Secondly, the *income effect* incorporates the changes in consumer patterns as income per capita grows. This implies an increasing share of services in the consumption basket due to the higher income elasticity of this sector. In Germany, this effect contributes 0.13 p.p. per year to deindustrialization.

The German export-led growth model is based on structurally constrained domestic demand and imports, implying low economic growth rates (real income per capita grew 1.55% per year between 1995 and 2008; source: Ameco). This is achieved by means of the wage devaluation process described above (a large part of the personal income comes from wages). In this sense, this process implied a shift in income from labor to capital (the wage share decreased sharply between 1995 and 2008) thanks to an overall wage restraint that particularly affected the periphery of the labor market, giving rise to a sharp increase in low-end wage inequality. Usually, the marginal propensity to consume out of wages is larger than for profits, as well as for low-wage earners relative to high-wage ones (Stockhammer, 2015). Therefore, the wage devaluation might have contributed to slowing down the income effect by restraining domestic demand.

Another source for domestic demand repression is the fiscal policy design. Germany is characterized by a conservative fiscal policy stance guided by the black zero rule (*Schwarze Null*). The country obtains continuous primary fiscal surpluses through weak public spending during

expansionary economic periods[2], i.e., it embarks on an ongoing path of fiscal consolidation that further constrains domestic demand.

Thirdly, the *investment effect* reflects the evolution of gross fixed capital formation in the final domestic demand. Frequently, this effect is positively correlated with manufacturing dynamism. In the case of Germany, this driver, after exports, is the main one in containing deindustrialization. This happens even at the cost that public investment is quite restrained due to the abovementioned fiscal conservatism (Dullien et al., 2020).

Fourthly, the *outsourcing effect* captures the growing importance of domestic services inputs required to produce manufacturing goods. Essentially, manufacturers have tended to externalize some service activities that were previously performed in-house to gain both cost competitiveness and flexibility against changes in demand. In Germany, this effect largely pushes deindustrialization forward (-0.19 p.p. per year).

Along with the institutional reforms undertaken by Germany, the transition towards an export-led growth model during the precrisis expansionary period was implemented through a profound restructuring of the manufacturing sector (Baccaro & Benassi, 2017). Core manufacturing firms outsourced, particularly, low-level services (e.g., canteens, security, or call centers) to externalize cost pressures to firm suppliers. For instance, Goldschmidt & Schmieder (2017) estimate a wage penalty of outsourcing of between 10% and 15% in logistics, cleaning, security, and food services. Furthermore, this business strategy contributed to enlarging the periphery mentioned above of the labor market by transferring workers from the institutionalized to the liberalized part of the economy (Doellgast & Greer, 2007).[3]

Lastly, the *globalization effect* incorporates the impact of the international fragmentation of production on the value-added share of manufacturing, and it accounts for both the positive effect of exports and the negative effect of imports. Both effects include intermediate and final consumption and investment goods.

Regarding the effect of exports, it drives the manufacturing value-added share up by 0.38 p.p. per year, which is a very high value compared to Spain. This reflects the commercial strength of Germany during the period, grounded in the abovementioned price-competitiveness gains due to deflationary policies and in the country's non-price competitiveness.

Furthermore, the contribution of imports (-0.03 p.p. per year) is much lower than that of exports - thus implying a positive net effect of globalization - and, again, much lower than the one captured for Spain. The evolution of imports during this period reflects the offshoring of labor-intensive upstream manufacturing activities to Central and Eastern European countries, substituting domestic production (Sinn, 2006). Figure A1 (Appendix 2) represents the contribution to deindustrialization of final consumption, investment and intermediate imports. Until the crisis, imports of intermediate inputs lead the *import effect*. Most of these imported products were previously manufactured in production lines within Germany. During the period, German firms set up their plants and/or started to purchase inputs abroad. Then, these imported

[2] It should be noted that during the economic downturns, like in 2009-2010 or the Covid-19 crisis, the government did launch a series of fiscal stimulus and incurred in public deficits and increased public debt.
[3] This effect also captures the increasing role of knowledge-intensive business services in manufacturing production. These services provide technical knowledge and assessment to manufacturing firms and foster technical progress and innovation (Ciriaci & Palma, 2016). It should be noted that it is not possible to distinguish whether the increase in these services' share is due to outsourcing or the greater demand of new services not previously performed within manufacturing firms. However, the literature finds that they are particularly important for the production of high-technology manufacturing sectors and, although their share in manufacturing employment is larger in core European countries (Ciriaci & Palma, 2016), some convergence is observed from the side of Southern European countries (Herrero & Rial, 2023a).

products are assembled and re-exported (Sinn, 2006). On the contrary, the contribution of imported final consumption and investment products is lower due to domestic demand restraint.

Now, let us focus on Spain. The manufacturing value-added share in this country suffers a sharp fall, particularly from 2000 onwards. The most important drivers in this period are the price and income effects, as each contributes 2 p.p. to drive the manufacturing value-added down.

Regarding the *price effect*, it drives manufacturing value-added share down by 0.17 p.p. per year. Notably, the pre-crisis period is characterized by the 'Spanish productivity paradox,' wherein the country experiences very high economic growth rates along with a poor labor productivity performance[4] (Cárdenas & Fernández, 2020). Due to the country's sectoral structure, this paradox results in a countercyclical productivity trend. During economic expansions, investment is allocated in labor-intensive sectors with low capital efficiency, like construction, real estate, and tourism services -where productivity growth is low-. Therefore, aggregate productivity stagnates. However, these same sectors experience huge employment losses during economic downturns, thus fostering labor productivity growth (Cuadrado-Roura & Maroto, 2016). The great share of these type of services in both employment and value-added affect the evolution of relative prices. Furthermore, labor productivity growth in Spain's manufacturing is structurally lower than in most European countries (Fernández & Palazuelos, 2018).

As mentioned above, Spain witnessed a huge speculative bubble around the construction and real estate sectors, accelerating overall inflation and accentuating the price effect. Three factors are behind this speculative episode. First, regional governments undertook many infrastructural projects -like the construction of highways, airports, or railway tracks - financed by the EU Structural Funds. Second, the liberalization of the financial sector -mainly for saving banks- laid the foundations for the spread of credit to the private sector, thus fostering private residential investment. Furthermore, changes in urban planning -accompanied by corrupt actions of local governments- fostered the expansion of the housing market and the construction of hotels and all services linked to the tourist industry. Third, the entrance into the eurozone facilitated lower real interest rates for a highly inflationary economy like Spain.[5] Given the weak situation of the manufacturing sector after the industrial reconversion program in the 1980s (Caloghirou et al., 2000), capital inflows went mainly towards construction and tourism services (Buendía, 2020).

Additionally, the deregulation of the Spanish labor market was based on a long pathway of disempowerment of the trade union movement, as well as on the high unemployment rate that the country usually exhibits. It principally consisted of two processes (Sola et al., 2013; Buendía, 2020). On the one hand, the liberalization of atypical employment, especially temporary contracts, was the centerpiece of the deregulation. With the aim of incentivizing employment growth, facilitating the entry of young people into the labor market, and lowering labor costs, several labor market reforms have been undertaken since the 1980s. As a result, Spain exhibited a temporary employment share of around 35%, the largest in Europe. On the other hand, the labor market reform of 1994, included a substantial reduction in dismissal costs.

In this case, the labor market deregulation involved both services and manufacturing sectors. Although some scholars claim that it was a dualization process with insider-outsider dynamics (Bentolila et al., 2012), it definitely affected equally to both sectors.

Moreover, from a labor market view, unlike Germany, Spain lacks the institutional tools to coordinate wage growth between the exporting and the domestic-oriented sectors (Cárdenas et al., 2021). As Table A.2. (Appendix 2) shows that these events result in nominal (but not real)

[4] Yearly growth rate of -0.1% between 1995-2008 (Source: Ameco).
[5] Long-term real interest rates fell from 6.1% in 1995 to 0.1% in 2005 (Baccaro & Pontusson, 2022).

hourly wages grew much more than in Germany due to the inflationary scenario, and services wages rose above those in manufacturing, thus accentuating the price effect.

When looking at the *income effect*, it displays a significant decline (-0.15 p.p. per year). The accelerated rise in income per capita during the pre-crisis period in Spain resulted in shifts in consumer behavior, which favored the relative consumption of services. This observation aligns with most studies that emphasize the importance of domestic demand as a key explanatory factor for structural change in Spain (Sánchez-Chóliz et al., 2021).

As mentioned above, real wages remained stagnant during this period due to the deregulation of the labor market. This event, which should have hurt domestic demand growth, was compensated by the expansion of credit (thanks to increasing external indebtedness) and the wealth effect derived from the evolution of housing prices. Therefore, even though real wage restraint was stronger in Spain than in Germany, the Spanish debt-led growth model stimulated domestic demand growth with private debt. Furthermore, the incorporation of new workers -especially immigrants and women- into the labor market also contributed to driving private consumption up.

Moreover, like in Germany, the Spanish fiscal policy scope was rather conservative, but it played a role in expanding the domestic demand because it was more dynamic (public consumption contributed 0.7 p.p. to growth). Spain passed several laws to decrease fiscal pressure that affected public revenues and the government's expenditure capacity. However, thanks to the high economic growth rates and the relatively low public expenditure, Spain achieved primary surpluses from 2004 to 2007 (Martínez & Zubiri, 2014).

Additionally, the *investment effect* barely contributes to the containment of deindustrialization (0.01 p.p.). We argue that precisely the abovementioned rise in investment rate was allocated to the leading sectors of the Spanish growth model, i.e., construction and financial services. In fact, 40% of the investment was residential investment. Furthermore, this investment was principally financed by loans from abroad (Buendía, 2020), helping to explain the development of the debt-financed, consumption-led demand model (Cárdenas et al., 2021). For these reasons, the strong investment growth is only partially reflected in the manufacturing value-added share.

When focusing on the *outsourcing effect,* we can see that it is close to zero (-0.03 p.p. per year). Contrary to the German economy, there is no relevant growth in the domestic services inputs within manufacturing value chains in Spain. Cadarso et al. (2008) have attributed the stability of domestic provision of inputs from other sectors to the fact that manufacturing industries have increased their intermediate demand for imported inputs. Therefore, the outsourcing effect has not played a significant role in Spain, according to our results.

The *globalization effect*, which results from the contribution of exports minus the one of imports, is slightly positive for Spain (0.07 p.p. per year). The contribution of exports is much lower than that of Germany (0.15 versus 0.34 p.p. per year). At the same time, the import effect plays a significant role in the decline of manufacturing value-added share (-0.08 p.p. per year). This can be attributed to China’s accession to the WTO in 2000 and the reorientation of the European production chains towards the new member states in the East (Cadarso et al., 2008; Simonazzi et al., 2013). Furthermore, the size of this effect is principally due to the high domestic demand growth of the Spanish debt-led model, which impacts the current account balance due to the increase in consumption of foreign final products (see Figure A1, Appendix 2).

5.2. The post-crisis expansionary period

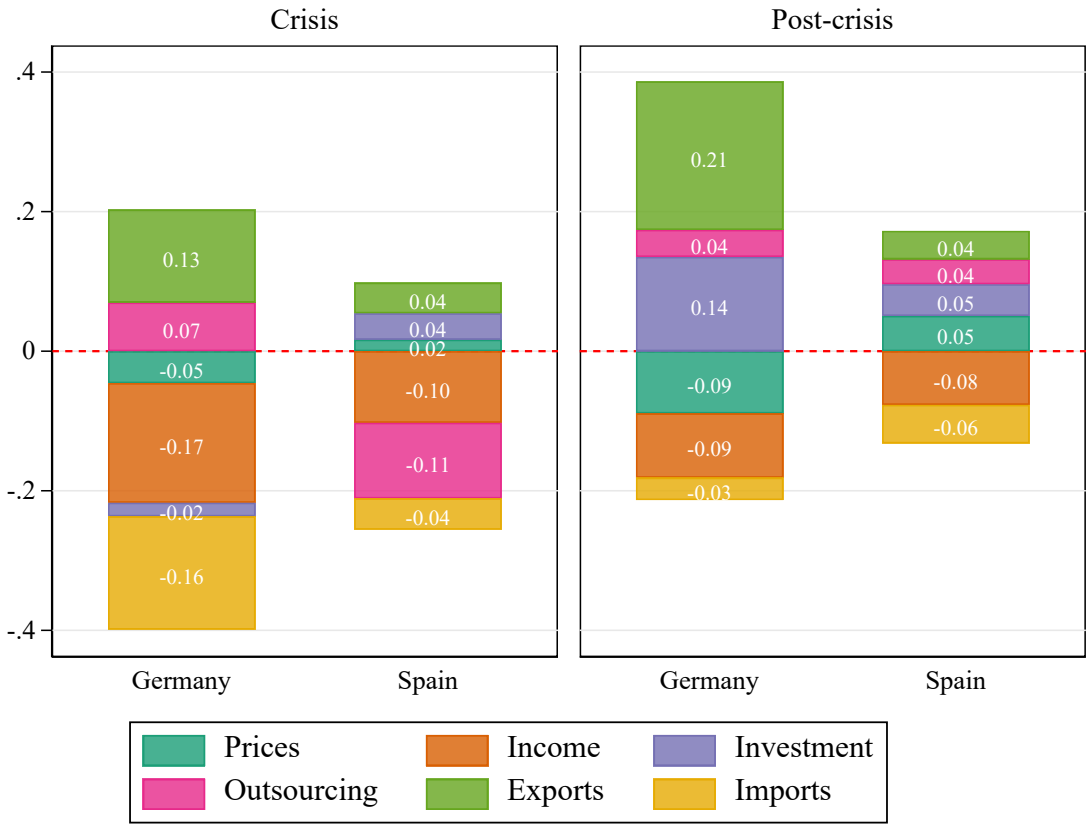
The post-crisis expansionary period starts in 2011 in Germany and in 2014 in Spain. Whereas the former economy rapidly recovered from the 2008-crisis thanks to an expansionary fiscal policy and the reorientation of its exports markets (e.g., China became the main commercial partner), the latter suffered a much longer recession due to the implementation of fiscal austerity and wage

devaluation policies, which further restrained domestic demand growth and pushed unemployment up.

This period is characterized by similar trends in deindustrialization. Both economies manage to contain the process: in Germany, the value-added share of manufacturing decreases by -0.16 p.p., and in Spain, it increases by 0.03 p.p. This is partially explained by the economic policies on which growth models are underpinned.

In Germany, this period is characterized by a more balanced export-led growth, in which domestic demand becomes more relevant thanks to a slight increase in real wages.

Figure 5. *Average contributions to deindustrialization during the crisis and post-crisis expansionary period*



Source: OECD STAN database, authors' calculations.

In this country, the *price effect* contributes 0.37 p.p. to deindustrialization, although from 2016 onwards a sharp decrease is observed. On average, relative prices account for -0.09 p.p. (Figure 5). During these years, the unequal wage restraint process implemented in the past is slightly reverted due to the partial re-regulation of the periphery of the labor market (Eichhorst, 2015; Marx & Starke, 2017). In fact, hourly wages in services grow more than in the manufacturing sector (Table A.2., Appendix 2).

In this sense, several milestones can be highlighted. First, industrial trade unions -especially IG Metall- have negotiated better working conditions for agency workers, and, among other things, minimum wages have been passed in some of these industries (Benassi & Dorigatti, 2018). Second, the introduction of a statutory minimum wage in 2015 -raised in 2017- naturally affects less protected workers, including mini-job holders.

Furthermore, along the re-regulation of the periphery, the country has been close to full employment, resulting in a slight recovery of the bargaining of both peripheral and core workers. All this influenced the recovery of the wage share after its sharp decline in the previous expansionary period.

Regarding the *income effect*, it displays an average contribution of -0.09 p.p., a similar value to the previous expansionary period. This value does not fully reflect the abovementioned re-regulation policies. However, it should be noted that the goal of budgetary stability is still at the center of the fiscal policy stance of the federal government and that public spending plays an even smaller role in economic growth in this period, during which Germany displays very low growth rates (similar to that the previous one; see Figure 2). Besides, the *investment effect* strongly boosts industrialization by 0.14 p.p. due to the dynamism of manufacturing, which continuously being the core sector in Germany.

Then, the *outsourcing effect* also seems to contain deindustrialization (0.04 p.p.). After the huge increase in the externalization of service activities undertaken by manufacturing companies before the 2008-crisis, this period is characterized by the fact that this process slows down. Essentially, as happens with offshoring, German companies implemented most of their restructurings in the past.

Lastly, the *globalization effect* is still positive during this period (0.18 p.p. each year), but the contribution of exports is lower and the one of imports is slightly higher. Germany continues to be the main European trading power, although the slight rebalancing of the economy by means of higher real wages impacts a bit on final consumption goods imports and probably in the lower contribution of exports. The role of investment and, especially, intermediate imports in deindustrialization is much lower (Figure A1, Appendix 2).

When focusing on Spain, the trend in deindustrialization substantially changes with respect to the previous period, and three out of six effects yield negative contributions. From an institutionalist point of view, this has to do with the economic policies implemented to rebalance the economy and lift away from debt-led growth, i.e., due to wage devaluation and fiscal austerity measures.

First, the *price effect* contributes to an increase in the share of manufacturing in value-added (0.5 p.p. per year). The 2008-crisis implied the reconfiguration of the Spanish sectoral structure since the relative weight of construction, real estate and low-level tourism services in the economy declined. Additionally, high productivity services increased their share in value-added. Then, the wage devaluation and the high structural unemployment implied a slump in wages not only during the crisis period, but also in the subsequent years (Table A.2., Appendix 2), which constrained labor costs throughout the entire economy.

Regarding institutional changes, two labor market reforms were passed in Spain in 2010 and 2012 with the aim of both increasing internal flexibility and decentralizing wage bargaining to the firm-level, although they essentially dropped labor costs and the purchasing power of wages by reducing workers' bargaining power. They included the extension of the trial period -with no dismissal costs- of labor contracts for small firms (the so-called entrepreneurial contract), the reduction of the compensation for unfair dismissal, and the expansion of the assumptions for fair dismissals (Cárdenas & Villanueva, 2021). According to the Spanish government and some scholars, these specific measures had the potential to reverse insider-outsider inequalities that stem from a very rigid labor market framework, especially the share of temporary contracts and the unemployment rate. However, they affected none of these variables, and precariousness was extended to the entire labor market.

Regarding the decentralization of wage-setting, the reforms facilitated the application of opt-out clauses and unilateral decisions by companies in collective bargaining. Additionally, another

centerpiece for wage restraint was the substantial reduction of the criteria for the extension of collective bargaining.

Second, the *income effect* exhibits a lower value (0.08 p.p. per year). Again, the transition towards a more balanced growth model is behind the weakening of this effect.

Wage devaluation policies provoked a slump in real wages that constrained domestic demand growth. However, this time the financial system does not compensate for low wages. Since the financial turmoil of the 2008-crisis, capital inflows from Northern to Southern Europe halted, and, along with the reduction of external savings supply, financial conditions tightened. Furthermore, the wealth effect no longer exists due to the financial bubble burst.

In addition, fiscal austerity further contributed to the slowdown of domestic demand. Although the main contraction in public spending took place during the crisis, the contributions of this variable to growth is still very low in this expansionary period (see Figure 2). Moreover, the significant welfare state reduction- especially in social transfers and retirement pensions- and public employment have not yet been reversed.

Furthermore, these reforms are reflected in the *outsourcing effect*, which became one of the most important drivers of deindustrialization after the first expansionary period. Concretely, Spanish firms outsourced service activities to face the slump in domestic demand due to the crisis. Consequently, the yearly contribution to deindustrialization of this effect is -0.11 p.p. Then, this effect is partially reverted in the subsequent period.

In Spain, the two labor market reforms passed in 2010 and 2012 included the priority of firm-level over sectoral-level agreements. They also facilitated the spread of multiservice firm, which pay low wages because a very weak sectoral agreement covers them. These measures, along with the sclerotic macroeconomic situation, encouraged firms to adopt outsourcing strategies (Cárdenas & Villanueva, 2021).

On the other hand, the *investment effect* became, after the price effect, the most important factor containing the deindustrialization process. Although there were cuts in public investment, private investment was the leading variable of the new business cycle. As Cárdenas et al. (2020) show, investment, in particular in equipment, had a major role in driving the economic recovery, and this was not due to the recovery of profitability but to the "accelerator effect" (a rise in the aggregate demand led to a larger increase in capital investment) mainly because of the evolution of the exports.

Simultaneously, within *globalization effect,* the *import effect* has become the other main driver towards the end of the period. As we can see in Figure A1 (Appendix 2), import substitution of intermediate inputs has advanced mostly after the crisis. This process has been evidenced by some authors that study the growing *backward participation* of Spain in GVC after crisis (Prades & Villanueva,2017).[6]

Regarding the *export effect*, it shows a positive contribution. The aforementioned adjustment measures attempted to transform and rebalance the growth model. However, these measures are not reflected in this driver, because its value is rather low. The literature suggests that this is because adjustment measures were inefficient in fostering price competitiveness (Villanueva et al., 2020). On the contrary, export growth is reflecting the *venting-out* effect by which the collapse of the domestic market forces companies to guide their sales to foreign markets (Almunia et al., 2021).

[6] Among the participation indicators in GVCs we find the *backward participation,* import content in the exports of the domestic country and the *forward participation*, which measures the domestic value-added of an economy incorporated in the exports of another (Wang et al., 2017).

In brief, Spanish deindustrialization has slowed down after the crisis largely due to adjustment policies and the collapse of domestic demand and wages. A careful examination of the drivers reveals that these policies have principally affected the value of internal drivers. Furthermore, the export effect shows a very low contribution, thus pointing to the effectiveness of structural reforms for industrialization by improving cost-competitiveness.

6. Concluding Remarks

In this paper, we linked the literature on deindustrialization drivers with the growth model perspective to empirically explore the divergent evolution of the deindustrialization paths in Germany and Spain. The study of these two opposite cases helped us to disentangle how economic policies behind growth models affect the evolution of the manufacturing GVA share.

We have used the OECD IO Tables and have applied a Hierarchical Structural Decomposition Analysis (HSDA) to distinguish five deindustrialization drivers (income, investment, relative prices, outsourcing and globalization) and account for the evolution of the manufacturing GVA share.

Then, we have developed an analytical framework to interpret the relationship between the economic policies and deindustrialization drivers. The framework delineates the expected effects of economic policies on the manufacturing GVA share by capturing their impact on each deindustrialization driver. Concretely, the main policies considered, along with industrial policy, were labor market liberalization, external indebtedness/housing prices boom, conservative fiscal policy, coordinated industrial relations, and non-price factors.

Our results suggest that, in Germany, the ability to control the decrease of the manufacturing GVA share, compared to Spain, goes beyond particular industrial policies or export competitiveness factors (export effect). During the pre-crisis expansionary period, we found that, in Germany, coordinated wage bargaining along with the labor market dualization and its traditional fiscal conservatism have contained the income, price and import effects. Furthermore, investment presented very positive contributions to GVA trends. In addition, the restructuring of the manufacturing sector through offshoring is well captured by the HSDA and appeared as the main deindustrialization driver. Conversely, Spain's deindustrialization has been driven by a substantial price effect and the income effect linked to the speculative bubble in construction and real estate, a principal feature of its pre-crisis debt-led growth model.

In the post-crisis period, both economies have exhibited a containment of deindustrialization. Germany's export-led growth model has undergone a more balanced phase with increased real wages, contributing to a change in the direction of relative prices effect due to a timid labor market re-regulation and the introduction of a statutory minimum wage. Furthermore, the investment effect has promoted industrialization, the outsourcing effect has diminished, and the globalization effect has moderated (due to lower export contributions). In contrast, Spain's deindustrialization trend drastically changed due to policies focused on rebalancing the economy. However, deindustrialization has been contained not because of an improvement in the globalization effect related to the rise of exports but because of the change in the relative prices effect and the containment of the income effect due to labor market reforms and fiscal austerity.

We believe that this comprehensive analysis of industrial and macroeconomic policies enriches our understanding of deindustrialization. Our framework might have some policy implications as well, as it is clear that manufacturing GVA (and employment) is (are) not only affected by industrial policy. In this sense, it seems that policies focused on restraining domestic demand and stimulating exports through the improvement of price and non-price elements are the principal and easiest avenue to contain deindustrialization. However, this would imply the alteration of the income distribution between labor and capital and low growth rates (particularly for countries

specialized in producing technologically unsophisticated goods). Furthermore, a growth strategy principally focused on exports has many limitations as it cannot be pursued by all the countries simultaneously and implies a heavy dependence on external factors. Therefore, high-income economies might be facing an important dilemma between two hardly compatible goals: on the one hand, the achievement of high output growth rates and low unemployment, and the containment of deindustrialization trends, on the other hand. In the case of EU countries, implementing active and vertical industrial policies targeted at strategic sectors, accompanied by a coordinated macroeconomic policy between EU members, is probably the main way out of such a dilemma.

7. References

Acemoglu, D., & Guerrieri, V. (2008). Capital deepening and nonbalanced economic growth. *Journal of political Economy*, *116*(3), 467-498.

Almunia, M., Antràs, P., Lopez-Rodriguez, D., & Morales, E. (2021). Venting out: Exports during a domestic slump. *American Economic Review*, *111*(11), 3611-3662.

Álvarez-Cuadrado, F., Van Long, N., & Poschke, M. (2017). Capital–labor substitution, structural change, and growth. *Theoretical Economics*, *12*(3), 1229-1266.

Álvarez-Cuadrado, F., & Poschke, M. (2011). Structural change out of agriculture: Labor push versus labor pull. *American Economic Journal: Macroeconomics*, *3*(3), 127-58.

Andreoni, A., & Chang, H. J. (2019). The political economy of industrial policy: Structural interdependencies, policy alignment and conflict management. *Structural Change and Economic Dynamics*, *48*, 136-150.

Baccaro, L., & Benassi, C. (2017). Throwing out the ballast: growth models and the liberalization of German industrial relations. *Socio-Economic Review*, 15(1), 85-115.

Baccaro, L., Blyth, M., & Pontusson, J. (2022). *Diminishing returns: The new politics of growth and stagnation*. Oxford University Press.

Baccaro, L., & Pontusson, J. (2016). Rethinking comparative political economy: the growth model perspective. *Politics & society*, *44*(2), 175-207.

Baccaro, L., & Pontusson, J. (2022). The politics of growth models. *Review of Keynesian Economics*, 10(2), 204-221.

Baumol, W. J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *The American economic review*, *57*(3), 415-426.

Bentolila, S., Cahuc, P., Dolado, J. J., & Le Barbanchon, T. (2012). Two-tier labour markets in the great recession: France Versus Spain. *The Economic Journal*, *122*(562), F155-F187.

Betts, C., Giri, R., & Verma, R. (2017). Trade, reform, and structural transformation in South Korea. *IMF Economic Review*, *65*(4), 745-791.

Buendía, L. (2020). A perfect storm in a sunny economy: a political economy approach to the crisis in Spain. *Socio-Economic Review*, *18*(2), 419-438.

Bulfone, F. (2023). Industrial policy and comparative political economy: a literature review and research agenda. *Competition & Change*, *27*(1), 22-43.

Bulfone, F. (2020). New forms of industrial policy in the age of regulation: A comparison of electricity and telecommunications in Italy and Spain. *Governance*, *33*(1), 93-108.

Bürgisser, R., & Di Carlo, D. (2023). Blessing or Curse? The Rise of Tourism-Led Growth in Europe's Southern Periphery. *JCMS: Journal of Common Market Studies*, *61*(1), 236-258.

Cadarso, M. Á., Gómez, N., López, L. A., & Tobarra, M. Á. (2008). The EU enlargement and the impact of outsourcing on industrial employment in Spain, 1993–2003. *Structural Change and Economic Dynamics*, *19*(1), 95-108.

Caloghirou, Y., Voulgaris, Y., & Zambarloukos, S. (2000). The political economy of industrial restructuring: comparing Greece and Spain. *South European Society and Politics*, *5*(1), 73-96.

Cárdenas, L. & Fernández, R. (2020). The Spanish paradox: demand growth with productivity stagnation. *Journal of Economic Studies, 48*(4), 786-803.

Cárdenas, L., & Herrero, D. (2021). Distribución funcional de la renta y capacidad negociadora de los trabajadores en España. *Papers: Revista de Sociología*, 106(3), 0441-466.

Cárdenas, L., Villanueva, P., Álvarez, I., & Uxó, J. (2021). In the Eye of the Storm: The "success" of the Spanish growth model. In Cárdenas & Arribas (Eds.). *Institutional Change after the Great Recession* (pp. 202-245). Routledge.

Cárdenas, L., Villanueva, P., Álvarez, I., & Uxó, J. (2020). Peripheral Europe beyond the Troika: assessing the 'success' of structural reforms in driving the Spanish recovery. *Review of Keynesian Economics*, *8*(4), 560-588.

Celi, G., Ginzburg, A., Guarascio, D., & Simonazzi, A. (2018). *Crisis in the European Monetary Union: A Core-Periphery Perspective*. Routledge.

Ciriaci, D., & Palma, D. (2016). Structural change and blurred sectoral boundaries: assessing the extent to which knowledge-intensive business services satisfy manufacturing final demand in Western countries. *Economic Systems Research*, *28*(1), 55-77.

Clark, C. (1940). *The Conditions of Economic Progress*. London: Macmillan.

Comin, D., Lashkari, D., & Mestieri, M. (2021). Structural change with long-run income and price effects. *Econometrica*, *89*(1), 311-374.

Cuadrado-Roura, J., & Maroto, A. (2016). Unbalanced regional resilience to the economic crisis in Spain: a tale of specialisation and productivity. *Cambridge Journal of Regions, Economy and Society*, *9*(1), 153-178.

Deeg, R. (1999). *Finance capitalism unveiled: Banks and the German political economy*. Ann Arbor, MI: University of Michigan Press.

Dietzenbacher, E., & Los, B. (1998). Structural decomposition techniques: sense and sensitivity. *Economic Systems Research*, *10*(4), 307-324.

Doellgast, V., & Greer, I. (2007). Vertical disintegration and the disorganization of German Industrial Relations. *British Journal of Industrial Relations*, 45(1), 55-76.

Dullien, S., Jürgens, E., & Watzka, S. (2020). Public Investment in Germany: The Need for. In Cerniglia, F. & Saraceno, F. *A European Public Investment Outlook*, 49.

Ergen, T., and Kohl, S., 2019. Varieties of economization in competition policy: institutional change in German and American antitrust, 1960–2000. *Review of International Political Economy*, 26 (2), 256–286

Fernández, R., & Palazuelos, E. (2018). Measuring the role of manufacturing in the productivity growth of the European economies (1993–2007). *Structural Change and Economic Dynamics*, 46, 1-12.

Fernández-Vázquez, E., Los, B., & Ramos-Carvajal, C. (2008). Using additional information in structural decomposition analysis: the path-based approach. *Economic Systems Research*, *20*(4), 367-394.

García-Santana, M., Pijoan-Mas, J., & Villacorta, L. (2021). Investment demand and structural change. *Econometrica*, *89*(6), 2751-2785.

Gräbner, C., Heimberger, P., Kapeller, J., & Schütz, B. (2020a). Is the Eurozone disintegrating? Macroeconomic divergence, structural polarisation, trade and f/ragility. *Cambridge Journal of Economics*, *44*(3), 647-669.

Gräbner, C., Heimberger, P., Kapeller, J., & Schütz, B. (2020b). Structural change in times of increasing openness: assessing path dependency in European economic integration. *Journal of Evolutionary Economics*, *30*, 1467-1495.

Goldschmidt, D., & Schmieder, J. F. (2017). The rise of domestic outsourcing and the evolution of the German wage structure. *The Quarterly Journal of Economics*, 132(3), 1165-1217.

Hassel, A. (2014). The Paradox of Liberalization—Understanding Dualism and the Recovery of the G erman Political Economy. *British Journal of Industrial Relations*, 52(1), 57-81.

Hein, E., Meloni, W. P., & Tridico, P. (2021). Welfare models and demand-led growth regimes before and after the financial and economic crisis. *Review of International Political Economy*, 28(5), 1196-1223.

Herrendorf, B., Rogerson, R., & Valentinyi, A. (2021). Structural change in investment and consumption—a unified analysis. *The Review of Economic Studies*, *88*(3), 1311-1346.

Herrendorf, B., Rogerson, R., & Valentinyi, A. (2013). Two perspectives on preferences and structural transformation. *American Economic Review*, *103*(7), 2752-89.

Herrero, D. (2022). Disentangling the transformation of the German model: The role of firms' strategic decisions and structural change. *Competition & Change*, 26(3-4), 357-383.

Herrero, D., & Rial, A. (2023a). Labor costs, KIBS, and export performance: A comparative analysis of Germany and Mediterranean economies. *Structural Change and Economic Dynamics*, *65*, 184-198.

Herrero, D., & Rial, A. (2023b). Productive linkages in a segmented economy: the role of services in the export performance of German manufacturing. *Economic Systems Research*, 35(2), 183-210.

Katzenstein, P.J. (1985). *Small States in World Markets: Industrial Policy in Europe*. Ithaca and New York: Cornell University Press.

Kattel, R., Mazzucato, M., Haverkamp, K., & Ryan-Collins, J. (2020). Challenge-driven economic policy: A new framework for Germany. *Forum New Economy Working Papers (Vol. 5)*. Berlin: Forum for a New Economy.

Köhler, K., & Stockhammer, E. (2022). Growing differently? Financial cycles, austerity, and competitiveness in growth models since the Global Financial Crisis. *Review of International Political Economy*, *29*(4), 1314-1341.

Krugman, P. R. (1996). *Domestic distortions and the deindustrialization hypothesis*. Working Paper 5473, NBER.

Liboreiro, P. R., Fernández, R., & García, C. (2021). The drivers of deindustrialization in advanced economies: A hierarchical structural decomposition analysis. *Structural Change and Economic Dynamics*, *58*, 138-152.

Martínez, J., & Zubiri, I. (2014). Los multiplicadores de la política fiscal en España. *Papeles de Economía Española*, *139*, 174-198.

Marx, P., & Starke, P. (2017). Dualization as destiny? The political economy of the German minimum wage reform. *Politics & Society*, 45(4), 559-584.

Matsuyama, K. (2019). Engel's law in the global economy: Demand-induced patterns of structural change, innovation, and trade. *Econometrica*, *87*(2), 497-528.

Milberg, W., & Winkler, D. (2013). *Outsourcing economics: global value chains in capitalist development*. Cambridge University Press.

Ministerio de Industria, Comercio y Turismo (2010). Plan Integral de Política Industrial 2020. Disponible en: https://www.mincotur.gob.es/es-es/gabineteprensa/notasprensa/documents/planintegralpoliticaindustrial2020.pdf

Montresor, S., & Marzetti, G. (2011). The deindustrialisation/tertiarisation hypothesis reconsidered: a subsystem application to the OECD7. *Cambridge journal of economics*, *35*(2), 401-421.

Naqvi, N., Henow, A., & Chang, H. J. (2018). Kicking away the financial ladder? German development banking under economic globalisation. *Review of International Political Economy*, 25(5), 672-698.

Ngai, L. R., & Pissarides, C. A. (2007). Structural change in a multisector model of growth. *American economic review*, *97*(1), 429-443.

Prades, E. & Villanueva, P. (2017). Spain in the global value chains. *Banco de España, Economic Bulletin*, *3*, 2017.

Rowthorn, R., & Coutts, K. (2004). De-industrialisation and the balance of payments in advanced economies. *Cambridge Journal of Economics*, *28*(5), 767-790.

Sánchez Chóliz, J., Duarte, R., & Jiménez, S. (2021). Structural components of income growth: an application to the evolution of the Spanish economy, 1980–2014. *Economic Systems Research*, 1-16.

Šćepanović, V. (2020). Transnational integration in Europe and the reinvention of industrial policy in Spain. *Review of International Political Economy*, *27*(5), 1083-1103.

Schneider, E. (2023). Germany's Industrial strategy 2030, EU competition policy and the Crisis of New Constitutionalism. (Geo-)political economy of a contested paradigm shift. *New Political Economy*, 28(2), 241-258.

Sebastián, M. (2019). La política industrial del siglo XXI. In García-Ruiz, J. L. (Ed.). *Políticas industriales en España: pasado, presente y futuro*. Paraninfo, pp. 117-155.

Simonazzi, A., Ginzburg, A., & Nocella, G. (2013). Economic relations between Germany and southern Europe. *Cambridge Journal of Economics*, *37*(3), 653-675.

Sola, J., Alonso, L. E., Rodríguez, C. J. F., & Rojo, R. I. (2013). The expansion of temporary employment in Spain (1984–2010): neither socially fair nor economically productive. In *Non-Standard Employment in Europe: paradigms, prevalence and policy responses* (pp. 67-83). London: Palgrave Macmillan UK.

Stockhammer, E. (2015). Rising Inequality as a Cause of the Present Crisis. *Cambridge Journal of Economics,* 39 (3), 935–58.

Storm, S., & Naastepad, C. W. M. (2015). Crisis and recovery in the German economy: The real lessons. *Structural Change and Economic Dynamics*, 32, 11-24.

Tregenna F. (2016) Deindustrialisation and premature deindustrialization. In: Ghosh J, Kattel R, Reinert E, (Eds). *Elgar handbook of alternative theories of economic development*. Cheltenham: Edward Elgar; pp. 710–28.

Tregenna, F. (2009). Characterising deindustrialisation: An analysis of changes in manufacturing employment and output internationally. *Cambridge journal of economics*, *33*(3), 433-466.

Van Neuss, L. (2018). Globalization and deindustrialization in advanced countries. *Structural Change and Economic Dynamics*, *45*, 49-63.

Van Neuss, L. (2019). The drivers of structural change. *Journal of Economic Surveys*, *33*(1), 309-349.

Villanueva, P., Cárdenas, L., Uxó, J., & Álvarez, I. (2020). The role of internal devaluation in correcting external deficits: The case of Spain. *Structural Change and Economic Dynamics*, *54*, 282–296.

Wang, Z., Wei, S. J., Yu, X., & Zhu, K. (2017). *Measures of participation in global value chains and global business cycles* (No. w23222). National Bureau of Economic Research.

Warwick K (2013) Beyond Industrial Policy: Emerging Issues and New Trends. *OECD Science, Technology and Industry Policy Papers.*

Appendix 1

Given a vector of value-added per output unit $\mathbf{v}$:

$$\mathbf{Y} = \mathbf{v}'(\mathbf{I} - \mathbf{A} + \mathbf{N})^{-1}(\mathbf{c} + \mathbf{i} + \mathbf{e} - \mathbf{m})$$

Where $\mathbf{x}$ is the vector of gross production, $\mathbf{A}$ is the matrix the technical coefficients (total intermediate consumption), $\mathbf{N}$ is the matrix of coefficients of imported intermediate consumption, $\mathbf{c}$ is the final consumption vector, $\mathbf{i}$ the final investment vector, $\mathbf{e}$ the export demand vector, and $\mathbf{m}$ the final import demand vector.

Given a vector of value-added per unit of output $\mathbf{v}$, the total GVA express as:

$$\mathbf{v}' = \mathbf{g}'(\mathbf{I} - \mathbf{A} - \hat{\mathbf{t}})$$

Where $\mathbf{t}$ is the vector of taxes less subsidies on products per unit of output.

The relationship between import and national consumption is:

$$\mathbf{c} - \mathbf{m} = \hat{\mathbf{n}}\mathbf{c}$$

Where $\mathbf{n}$ is the consumption coverage rate vector. Analogously for investments:

$$\mathbf{i} - \mathbf{im} = \hat{\mathbf{o}}\mathbf{c}$$

Where $\mathbf{o}$ is the investment coverage rate vector.

Given a price vector $\mathbf{p}$ it is possible to obtain a matrix of coefficient of total intermediate consumption at constant prices $\widetilde{\mathbf{A}}$, a matrix of coefficients of imported intermediate consumption at constant prices $\widetilde{\mathbf{N}}$, and a vector of final consumption, final investment and external demand at constant prices $\tilde{\mathbf{c}}$, $\tilde{\mathbf{o}}$ and $\tilde{\mathbf{e}}$:

$$\mathbf{Y} = \mathbf{g}'\left(\mathbf{I} - \hat{\mathbf{p}}\widetilde{\mathbf{A}}\hat{\mathbf{p}}^{-1} - \hat{\mathbf{t}}\right)\left(\mathbf{I} - \hat{\mathbf{p}}\widetilde{\mathbf{A}}\hat{\mathbf{p}}^{-1} + \hat{\mathbf{p}}\widetilde{\mathbf{N}}\hat{\mathbf{p}}^{-1}\right)^{-1}\hat{\mathbf{p}}(\hat{\mathbf{n}}\tilde{\mathbf{c}} + \hat{\mathbf{o}}\tilde{\mathbf{i}} + \tilde{\mathbf{e}})$$

Analogously, given other vector $\mathbf{v'_i}$ whose elements are identical to $\mathbf{v}$ in those rows that represent the industries that make up the manufacturing sector and zero in the rest, then, the GVA of each industry is:

$$\mathbf{y_i} = \mathbf{v'}_{\mathrm{i}}(\mathbf{I} - \mathbf{A} + \mathbf{N})^{-1}(\mathbf{c} + \mathbf{i} + \mathbf{e} - \mathbf{m})$$

And the transpose vector $\mathbf{v'}_{\mathrm{i}}$ can express as:

$$\mathbf{v'}_{\mathrm{i}} = \mathbf{g}'(\mathbf{J} - \mathbf{AJ} - \hat{\mathbf{t}}\mathbf{J})$$

Where $\mathbf{J}$ is a diagonal matrix, whose elements are one for the manufacturing industries and zero for the rest.

In this way, it can be deduced:

$$\mathbf{y}_{\mathrm{i}} = \mathbf{g}'\left(\mathbf{I} - \hat{\mathbf{p}}\widetilde{\mathbf{A}}\mathbf{J}\hat{\mathbf{p}}^{-1} - \hat{\mathbf{t}}\right)\left(\mathbf{I} - \hat{\mathbf{p}}\widetilde{\mathbf{A}}\hat{\mathbf{p}}^{-1} + \hat{\mathbf{p}}\widetilde{\mathbf{N}}\hat{\mathbf{p}}^{-1}\right)^{-1}\hat{\mathbf{p}}(\hat{\mathbf{n}}\tilde{\mathbf{c}} + \hat{\mathbf{o}}\tilde{\mathbf{i}} + \tilde{\mathbf{e}})$$

Appendix 2

Table A.1. *Manufacturing relative to services prices (1995=100)*

	2000	2007	2012	2018
Austria	99.5	89.9	83.4	75.6
Belgium	89	76.5	71.6	69.9
Denmark	102.3	94.4	87.4	94.5
Estonia	76.7	68.7	60.6	53
Finland	86.3	60.7	51.7	50.3
France	90.5	71.3	67.9	66.6
Germany	100	94.9	95.1	89.9
Greece	89.9	85.3	89.1	94.9
Hungary	77.2	60.6	67.8	70.1
Italy	96.5	87.1	84.8	86.6
Latvia	70.1	62.7	75.2	71.3
Lithuania	83.8	66.9	71.5	57.5
Netherlands	89.4	79.1	73.4	71.8
Poland	104.4	78.7	65.9	64.1
Portugal	88.9	76.7	74.8	75.5
Slovenia	88.3	72.1	70.6	73.5
Spain	95.1	87.3	86.8	87.3
Sweden	78.6	60.9	58.4	59.5
UK	83.8	58.6	62.8	59.8
USA	84.7	68.2	69.6	66.2

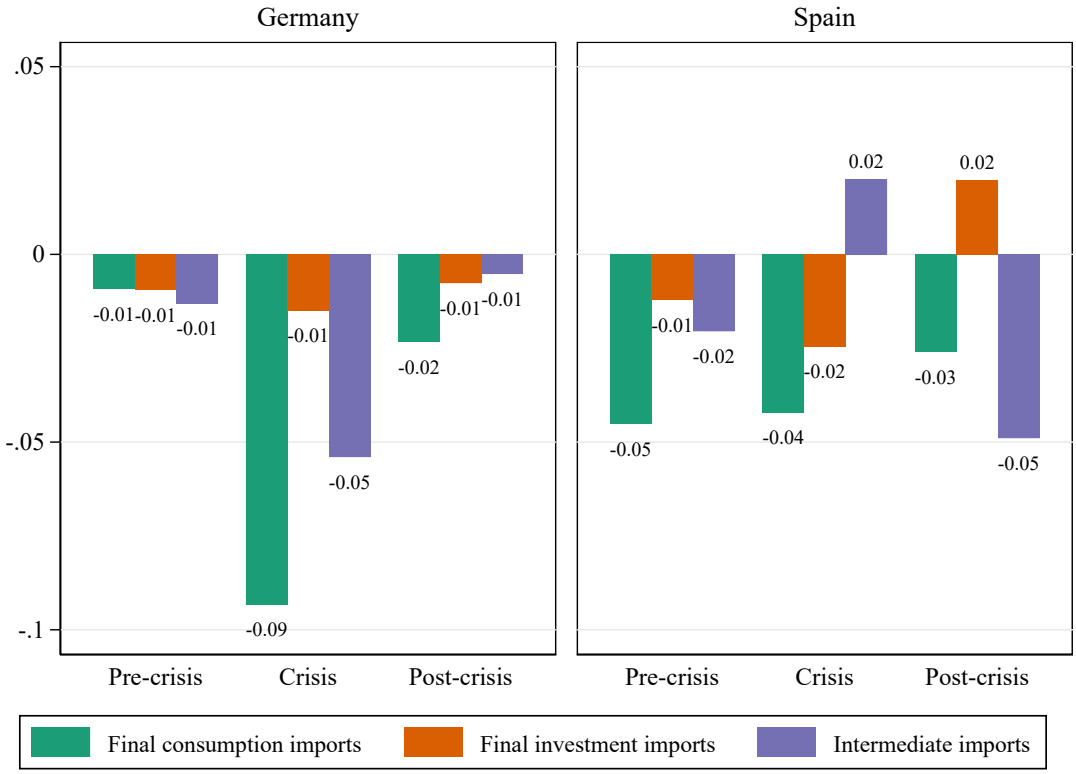
Source: OECD STAN database, authors' calculations.

Table A.2. *Nominal and real hourly wage growth*

	Pre-crisis expansionary period		Post-crisis expansionary period	
	Nominal hourly wage	Real hourly wage	Nominal hourly wage	Real hourly wage
		Germany		
Manufacturing	2.22%	0.64%	2.7%	1.4%
Construction	-0.26%	-1.83%	3.0%	1.7%
Services	1.41%	-0.16%	3.3%	2.0%
Business services	1.64%	0.07%	3.7%	2.3%
Total economy	1.52%	-0.05%	3.2%	1.8%
		Spain		
Manufacturing	3.43%	0.27%	0.5%	0.0%
Construction	3.19%	0.03%	-0.2%	-0.7%
Services	3.77%	0.61%	1.2%	0.6%
Business services	3.75%	0.58%	1.2%	0.7%
Total economy	3.83%	0.67%	1.0%	0.4%

Note: wages are deflated by the consumer price index to obtain real wages. Pre-crisis period: 1995-2008; post-crisis period: 2011-2018 for Germany and 2014-2018 for Spain.
Source: OECD.Stats and OECD STAN database, authors' calculations.

Figure A1. *Average contributions to deindustrialization of final, investment and intermediate imports of goods*



Pre-crisis period: 1995-2008; post-crisis period: 2011-2018 for Germany and 2014-2018 for Spain.
Source: OECD STAN database, authors' calculations.