

UNIVERSIDAD COMPLUTENSE DE MADRID
FACULTAD DE CIENCIAS ECONÓMICAS Y
EMPRESARIALES



TESIS DOCTORAL

**Institutions, Labor Market Segmentation and
Competitiveness in the German Political Economy**

**Instituciones, Segmentación del Mercado de Trabajo y
Competitividad en la Economía Política Alemana**

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

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Director

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Madrid

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A mis padres

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Aunque sólo figure mi nombre en la portada, muchas personas han contribuido a la elaboración de esta tesis doctoral, aportando no sólo conocimientos y buenos consejos, sino también haciendo que su proceso de producción sea un poco menos solitario de lo normal, y mucho más apasionante. Por supuesto, todos los errores y omisiones que hay en este documento son exclusivamente míos.

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Summary

This doctoral dissertation analyzes the evolution of German labor institutions and their effects on the country's economic performance throughout the period 1990-2015. Our theoretical framework draws on a specific strand within the political economy literature: the "Varieties of Capitalism debate" in a broad sense. The PhD thesis is organized in 5 related but independent chapters. Chapter 1 introduces the topic. It provides a historical overview of the German political economy since the early-1970s, and illustrates the theoretical underpinnings of the Varieties of Capitalism debate as well as the goals of each chapter. Chapter 2 explores the transformation of the German employment and industrial relations model. Using a firm-level dataset (a sample size of more than 10,000 observations per year), the evolution of different forms of atypical employment and the coverage of the dual system of industrial relations are analyzed across different groups of firms. Additionally, using a shift-share technique, we estimate the impact of the change in the employment structure on this process of institutional change. The results reveal that once institutional constraints were relaxed, employers across the whole economy increased their use of flexible work and individualized the wage bargaining. Moreover, our findings suggest that structural change played a minor role in the process. Chapter 3 applies the Varieties of Capitalism theory of innovation to Germany. Drawing on the same firm-level dataset, we use logistic models to estimate the joint impact of a set of coordinated institutions on incremental, radical, process innovation and imitations. Furthermore, to properly assess the effect of institutions, the probability to innovate is calculated across industries, export status and firm sizes. The obtained evidence points to the crucial role of the selected group of institutions for all types of innovation, suggesting that the main road to innovation in Germany is a cooperative corporate strategy. Chapter 4 analyzes the causes of the exporting performance of the German manufacturing sector. By applying an input-output methodology, we take into account the interlinkages that exist between manufacturing and services (the most affected sector by liberalization). Particularly, two types of relationships that influence manufacturing competitiveness are considered: the wage squeeze in services due to institutional factors and outsourcing; and the role played by the knowledge-intensive business services as innovation drivers. With manufacturing vertically integrated sectors as observations, an export model is estimated. Overall, our results point to the minor importance of labor costs for international competitiveness. The chapter concludes that non-price factors are the main drivers of German exports and that the relationship between manufacturing and services is not only a matter of cost reduction. Lastly, Chapter 5 details the general conclusions of the dissertation, as well as the main limitations of the analysis and some recommendations for further research.

Resumen

Esta tesis doctoral estudia la evolución de las instituciones laborales alemanas y sus efectos sobre el desempeño económico durante el período 1990-2015. Nuestro marco teórico descansa en una corriente concreta de la economía política comparada: “el debate de las Variedades de Capitalismo” en un sentido amplio. El trabajo se divide en 5 capítulos independientes, pero vinculados entre sí. El Capítulo 1 es introductorio. En él hacemos un repaso histórico de la economía política alemana desde los años 70 hasta la actualidad, y presentamos el debate de las Variedades de Capitalismo junto con los objetivos de cada uno de los siguientes capítulos. El Capítulo 2 analiza el proceso de liberalización del modelo alemán de empleo y relaciones laborales. Para ello, empleamos una base de datos representativa de empresas (con una muestra de más de 10.000 observaciones al año) y exploramos la evolución de varias formas de empleo atípico y de la cobertura del sistema dual de relaciones laborales en diferentes tipos de compañías. Además, utilizamos una técnica de descomposición para estimar el efecto de la evolución de la estructura del empleo en el cambio institucional. Nuestros resultados revelan que, una vez que se relajan los constreñimientos institucionales, todos los tipos de empresa aumentan su demanda de trabajo flexible e individualizan la negociación salarial. Los resultados también apuntan a que el efecto del cambio estructural sobre la evolución de las instituciones ha sido secundario. El Capítulo 3 es un estudio aplicado de los determinantes institucionales de la innovación desde la óptica de las Variedades de Capitalismo. De nuevo, trabajamos con la base de datos de empresas y empleamos regresiones logísticas para estimar el efecto de las instituciones coordinadas alemanas sobre cuatro tipos de innovación (incremental, radical, de proceso e imitaciones). Además, con el objetivo de capturar adecuadamente el impacto de estas instituciones, realizamos estimaciones para empresas de distintas industrias, propensiones exportadoras y tamaños. Nuestros resultados sugieren que las instituciones coordinadas siguen produciendo efectos económicos positivos y que las estrategias cooperativas son la principal vía para innovar en Alemania. El Capítulo 4 analiza las causas del desempeño exportador de la manufactura alemana. En él llevamos a cabo un análisis input-output para capturar los encadenamientos productivos que existen entre la manufactura y los servicios (el sector más afectado por la liberalización). Se tienen en cuenta dos tipos de vínculos entre ambos sectores: la moderación salarial en los servicios, debido a factores institucionales y a la externalización de actividades; y el rol de los servicios intensivos en conocimiento como motores de la innovación. A continuación, utilizando los sectores manufactureros verticalmente integrados como observaciones, estimamos un modelo de exportaciones. Nuestros resultados señalan que el efecto de la contención salarial fue menor. Las exportaciones alemanas son mucho más dependientes de factores distintos a los precios y la relación entre manufactura y servicios no sólo tiene que ver con el ahorro de costes laborales. Por último, el Capítulo 5 recoge las conclusiones generales que se derivan de la tesis doctoral, junto con sus principales limitaciones y algunas sugerencias sobre futuras líneas de investigación.

Chapter 1

Introductory notes on the German political economy and goals of the doctoral dissertation

1. Introduction

This doctoral dissertation analyzes the institutional evolution and economic performance of German capitalism –also known as German model or *Modell Deutschland*- over the last thirty years. Our theoretical framework draws on a particular strand of literature within political economy: the “Varieties of Capitalism debate” in a broad sense. The central reference here is the seminal work by Hall and Soskice (2001), but we also consider some previous contributions that influenced these authors (e.g. Sorge and Streeck, 1987; Streeck, 1991), as well as the subsequent debate resulting from their publication (e.g. Baccaro and Howell, 2011; Thelen, 2014).

Proponents of Varieties of Capitalism (VoC) school are interested in the analysis of the relationship between country specific institutions and macroeconomic performance. Germany is considered as the main representative of what they call “coordinated-market economies”, i.e. economies in which, in opposition to Anglo-Saxon countries, market relations are constrained and embedded into a dense net of social institutions. Far from being a negative factor for economic efficiency, institutional limits on free-market relationships encourage a particular type of economic outcomes, such as price stability, certain innovation patterns or productive specialization in particular manufacturing industries.

Nonetheless, despite the positive effects of this type of institutional architecture, coordinated-market economies have passed through a deep process of institutional change, mainly concentrated on the labor market and the industrial relations (IRR) system. Broadly speaking, such a process is known as liberalization or deregulation, and has consisted of the erosion or removal of the traditional institutions, the weakening of their binding nature and their replacement by market ones (Glyn, 2007).

Regarding Germany, it embarked on the path of institutional transformation in the early-1990s. The coverage of wage agreements dropped, labor relations were increasingly casualized and collective actors lost many affiliates. At present, the traditional “coordinated” institutions described by Hall and Soskice are only present in a small part of the economy, usually identified with the manufacturing sector. These institutional reforms transformed the labor market regulation and led to a profound process of wage devaluation against other competitors. As a consequence, and at a price of greater income inequality, the unemployment rate has been decreasing since 2006, after almost 15 years of steady growth. Furthermore, the country has displayed a remarkable exporting performance from the early-00s onward, when it started to

accumulate large current account surpluses. At the beginning of the 2010s, Germany was praised for its institutional modernization and was mentioned as a successful benchmark of good economic policy-making (Hüfner and Klein, 2012; Dustmann et al, 2014).

With the aim of disentangling the evolution and current situation of the German model, the present dissertation is organized into three empirical contributions. The first one (Chapter 2) seeks to analyze the evolution of labor institutions in different types of firms across the private economy, as well as to capture the effect of the change in the employment structure on the process of institutional change. The latter question is particularly relevant because several authors have pointed out, with little empirical support, that the transition toward a service economy has been a main driver of the overall institutional erosion, since the German model has been traditionally grounded in manufacturing. This chapter's analysis is based on a firm-level dataset, the *IAB Establishment Panel*.

The second contribution (Chapter 3) explores the economic effects of German non-market institutions. The Varieties of Capitalism approach considers innovation as a central economic outcome, and claims that national institutions determine innovation patterns. This chapter focuses on the manufacturing sector, the so-called core of the institutional model, and measures the effect of a set of coordinated institutions on different types of innovation using logistic regressions. We also employ the IAB Establishment Panel for the empirical analysis.

The last contribution is presented in Chapter 4. In it, we analyze the causes of the exporting performance of German manufacturing since 2000. The novelty of this study is that we take into account the productive interlinkages that exist between manufacturing and services using an input-output methodology. This is particularly important for Germany because the process of institutional change and pay moderation have been concentrated on services. The dominant narrative holds that wages in services should grow at a slow rate, in order to supply cheap inputs to manufacturing and help control the evolution of the real exchange rate. We first explore the labor cost structure of domestic manufacturing value chains. Additionally, we hypothesize that, given the high quality of German exports, the relationship among both sectors should not be just a matter of cost reduction. For that reason, we consider the role played by advanced services - which encourage innovation and the deployment of high-quality competitive strategies - in the commercial success of manufacturing. In this chapter, we combine the input-output analysis with panel data regressions, with the aim of capturing the causal effects of the variables of interest on export growth.

Each contribution is related but independent from the other. In order to connect them clearly and to give the reader an overall view of the doctoral dissertation's subject matter, the remainder of this introductory chapter provides a brief historical overview of the German institutional model from the 1970s to the present. Afterward, we illustrate the theoretical underpinnings of the Varieties of Capitalism debate. We end by presenting the goals of the dissertation in a clearer manner.

2. The evolution of the German model

German capitalism has been extensively researched in political economy. During the 1970s and the 1980s, Germany attracted the attention of many observers in this field because of its unique combination of economic institutions promoting social cohesion, high competitiveness in international markets and macroeconomic stability.

Despite this institutional density, Germany has always been an export oriented economy. Wage levels have been traditionally high in comparison with other countries, but the coordinated wage-setting system, in combination with the strict monetary policy of the Bundesbank, contributed to keep prices and unemployment under control (Franzese and Hall, 2000). Collective actors –unions and employers’ associations- were strong but willing to cooperate. They negotiated working conditions considering macroeconomic variables such as exports and prices, and not only the preferences of their affiliates (Soskice, 1990). This institutional ability for macroeconomic stability helped the economy to successfully manage the stagflation crisis in the 1970s. Furthermore, notwithstanding the collapse of the Bretton Woods system of fixed exchange rates and the growing commercial openness since then, the economic performance of manufacturing firms remained quite positive (Lindlar and Holtfrerich, 1997). As a result, the average commercial surplus of the country was above 2% of GDP during the 1970s and above 3% during the 1980s, reaching a maximum value of 5% in 1986 (*OECD.statistics*, own calculations).

Economic relations were rooted into an institutional framework that fostered a certain degree of cooperation and long-term commitment among economic actors. Sorge and Streeck (1987) and Streeck (1991) introduced the concept Diversified Quality Production (DQP) to define the institutional foundations of the German manufacturing production. The main idea is that German firms were embedded into an institutional setting that prevented unilateral or discretionary decisions, so they must focus on long-term strategies, and pursue economic returns in the long run. But, at the same time, these constraints were also beneficial and offered opportunities for strategic upgrading, by encouraging the cooperation between the management and the workforce. They were “the institutional bases of supply-side competitiveness” (Baccaro, 2018). Furthermore, together with cooperative institutions, these authors also highlight the importance of the introduction of new flexible machinery, the so-called modularization of production, which allowed German manufacturers to produce customized high quality goods and, at the same time, to obtain economies of scale.

The main institutional features of the so-called DQP model were:

- Trade unions and employers’ associations bargained wages and working conditions at the industry level. The wage settlement reached in the metalworking and electrical engineering industries set the reference pace for wage growth in the rest of industries (Bispinck and Dribbusch, 2011). This mechanism, called *pattern bargaining*, was useful to achieve the needed price stability for an export-oriented economy, and ensured that the nominal and the real wage would not differ much from one another. At the same time, since the wage growth was quite similar across the whole economy, coordinated bargaining served to transfer income from the faster-growing productivity industries to the slower-growing productivity ones (Jacobi et al., 1992). For instance, wage

differentials between large and small and medium enterprises (SMEs) were remarkably low (the average wage of an employee from SMEs was 90% of an employee's wage from a large firm). Wage scales were comparatively compacted as well; e.g. a CEO in a manufacturing firm used to earn 10 times more than an average worker, while in the UK and the US it was 15 and 25 times more, respectively (Streeck, 1997b).

- Another feature of German capitalism was (and still is) the codetermination right, which entitles workers to veto company's decision-making, forcing employers to negotiate strategic issues with them. This sort of negotiated management is organized on two levels. At plant-level, work councils (*betriebsrat*) must be consulted for the implementation of changes in working time, personal policies (hiring and firing) or organizational decisions (e.g. the introduction of new technologies). They were not allowed to reach agreements on distributive issues agreed upon at the sectoral level, unless otherwise stipulated in the collective agreement. On the other hand, company-level codetermination takes place in supervisory boards (*aufsichtsrat*), where workers are represented (this only applies to firms with 500 or more employees). Their task is to control the board of directors, to exchange information with management and to approve the business policy and firm's strategic decisions¹. This system of consensual decision-making was reinforced by an incentive structure for top management, which, in opposition to Anglo-Saxon countries, depended on the long-term productive performance of the firm, rather than on short-term outcomes.
- DQP also comprised a high degree of job discretion and task rotation, rather than routine and automatization. Multi-skilled workers were necessary to use the new flexible machinery and equipment, which needed to be programmed to produce customized goods for specialized markets (Piore and Sabel, 1984). Therefore, this modern form of craft production required workers with redundant capabilities, which were able to perform complex tasks with a high degree of autonomy. The well-known German dual vocational-training system generated an extensive supply of high-skilled workers (called *facharbeiter*). Furthermore, the industry-specific skills provided by the training system were continuously adapted to the requirements and demands of the business sector. The system was financed by employers along with the public sector. In turn, unions cooperated in the design of the study programs and forced firms to keep investing in it because it constituted an important tool for social inclusion for young people as well as the stepping stone to stable employment (Estevez-Abe et al, 2001).
- Furthermore, some particular relationships among firms were observed in Germany (Soskice, 1999). Although they competed in the market, the degree of product market competition was relatively low. Besides, companies co-operated among themselves to generate technical progress in concrete projects (Soskice, 1997, 1999). These links

¹ The rights of work councils increase with the establishment size. On the other hand, regarding the firm-level co-determination there are three Co-determination Acts (1951, 1976 and 2004), and each of them applies to different types of firms and endow supervisory boards with slightly different rights (for further information, see Page, 2001).

fostered information exchange and allowed companies to detect and define areas of improvement in order to work jointly on them. Therefore they depend upon each other to undertake product and process incremental innovations and remain competitive. These sorts of relationships were in turn fostered by a cross-shareholding network and bank-based financial system, which supplied firms with patient capital and protect them against hostile takeovers so they could focus on productive issues (Vitols, 2001). Additionally, business associations solved potential disputes among companies and set productive standards on a consensual basis (for instance, regarding the introduction of new technologies) to enhance the cooperation among their affiliates (Soskice, 1997).

In this respect, Streeck (1991) highlights as well that particular strategic alliances were undertaken between large multinational firms and SME. A peculiarity of the German corporate sector is the high proportion of family-owned companies, the so-called *mittelstand*. According to data presented by Behringer and van Treeck (2019), nowadays they still account for 65% of total companies, 35% of the total sales and 59% of the employment. This sort of firm has been a main constituency of the German model, because they are usually more committed with long-term productive goals, due to the traditional conflict of interest between them and hired managers not existing (particularly when the ownership is passed from one family generation to the next, as is stressed by Behringer and van Treeck). These firms are characterized by a conservative firm management and by being an important part of the local manufacturing productive ecosystem.

In sum, during the 1970s and the 1980s, German capitalism appeared to be the proof that social partnership and certain collective government of the economy, along with high working condition standards, were compatible with good economic performance in terms of technical progress, competitiveness and unemployment. Ultimately, it proved that there was an alternative approach to the organization of capitalism apart from the Anglo-Saxon one. Nonetheless, this sort of institutional architecture eroded and has been transformed since then.

2.1. The model in crisis: Germany, the sick man of Europe

The 1990s were much more turbulent for Germany. The country faced a profound crisis in 1992 and 1993 (the greatest since World War II), and since then presented low output growth rates and experienced important difficulties to create employment. To illustrative the extent of the problem, hours worked in the economy showed a yearly decrease of -3.5% from 1991 to 1999, while the number of employed persons grew 0.22% over the same period (*OECD.statistics*, own calculations). Naturally, the unemployment rate steadily grew and doubled over the decade (8.4% in 1999; see Figure 1 below). Furthermore, an important part of the business sector started to complain that the institutional framework, and particularly labor institutions, was too rigid and prevented the flexible adjustment to the new conditions and opportunities that international markets were offering (Kinderman, 2005). In addition, the idea that the strict regulation was hampering the development of the main driver of employment creation in advanced economies, the service sector, spread (Möller, 2015). Due to these critiques, along

with the sclerotic macroeconomic performance, the country was considered “the sick man of Europe”² at the end of the decade.

In 1990 the unification between the Western and the Eastern federal states took place. Both regions had quite divergent productive structures. Eastern firms were much less productive, wages were lower and the unemployment level was higher. Additionally, the situation of eastern companies was problematic due to the closure of the COMECON export market. Moreover, they suffered a sudden exposure to national and international competitiveness and also had to operate under a new appreciated exchange rate.

The reunification plan included the transference of the GFR’s labor institutions to the former GDR federal states. It also comprised an agreement in the metalworking sector for a progressive equalization of eastern wages with the levels in the west (*Stufenplan*). *IG Metall* –the main metalworking union - pressed for the rapid equalization of wages to protect their affiliates from low-wage competition, and western employers -organized in the *Gesamtmittel*- also supported the institutional transference because eastern firms were seen as potential low-cost competitors. Likewise, the *Stufenplan* was encouraged by the Government, which committed to subsidize the costs of unification, i.e. the foreseeable increase in unemployment and business failures (French, 2000; Baccaro et al, 2017).

Nonetheless, the Eastern economy rapidly collapsed and unemployment grew sharply. Social agents suspended the application of the *Stufenplan* and renegotiated it. The new agreement set a yearly wage rate of 26%, and planned to reach wage parity in 1996 (Baccaro et al, 2017). However, it also included opening and hardship clauses, which allowed firms that were unable to apply the sectoral agreed working conditions to opt-out from collective bargaining. As is explained in Chapter 2, these exceptional clauses became more and more common, spread across the whole economy, and were a main driver of the decentralization of the IRR.

Apart from these issues, some authors claim that western manufacturing firms had been burdening cost problems since before the reunification. International goods market, in which Germany used to compete through non-price strategies, became more price sensitive due to the entrance of new Asian competitors (Hassel, 2014; Baccaro and Howell, 2016; Baccaro and Benassi, 2017). This way, the high wages and tightness of the DQP model became problematic. Nonetheless, another strand of the literature points out that these market pressures were not so strong. Therefore, the institutional change and productive restructuring process that would be undertaken in the 1990s decade and the early-2000s was caused by the natural aim of firms of widening their profit margins and taking advantage of the new opportunities offered by the progressive trade and financial openness as well as the fall of the Iron curtain (Streeck, 2009). In our view, both factors played a role there, although the latter was more important.

As a consequence, the country embarked on a process of gradual institutional reforms concentrated in the labor market. One of the first signs of the erosion of the model was the loss

² *The Economist* (03/06/1999) <https://www.economist.com/special/1999/06/03/the-sick-man-of-the-euro>

of members of business associations (Table 1). The companies that remained “loyal” to the model during the 1980s, started to leave employers’ associations to avoid being bound by the sectoral bargaining. Together with the abovementioned problems suffered by eastern firms, this was explained by the implementation of new competitive strategies of large manufacturing firms. They began to put higher pressure on their suppliers, and demanded lower input prices. Thus, by outsourcing cost pressures on their suppliers, large companies could maintain and even increase their profit margins while offering competitive prices. Nonetheless, these tactics damaged sectoral bargaining because large assemblers and suppliers were members of the same employer organization and thus were covered by the same collective agreements, in which the interests of the larger companies prevailed. Consequently, intercompany cooperation was progressively harmed and many firms, particularly SMEs, fled from employer associations and sectoral bargaining (Silvia, 1997; Silvia and Schroeder, 2007).

Furthermore, some parts of the production were offshored to Eastern European countries for cost-saving reasons, along with the domestic outsourcing of low-level service activities. These firms’ strategic tactics contribute to erode the IIRR system, as is widely explained in Chapters 2 and 4.

The increasing unemployment rate and the threats of disinvestment weakened the bargaining power of manufacturing trade unions, which adopted a defensive attitude with the goal of defending their core affiliates, i.e. skilled workers in advanced manufacturing industries. Unions accepted the decentralization of the wage bargaining and the deregulation of the margins of the labor market. On the one hand, plant-level bargaining gained importance in manufacturing firms, and the role of work councils became even more important than before because they started getting involved in distributive issues too. They conceded wage moderation and increased working time flexibility in exchange for job protection. Moreover, they did not oppose to labor segmentation strategies within firms through the expansion of agency work, which has mainly affected low-skilled workers. On the other hand, a large share of the labor force was excluded from the IIRR system, particularly service workers. In this sector, collective bargaining coverage decreased considerably, and union strength as well as the work council presence were much lower. Furthermore, the legal facilities to use atypical contracts were progressively expanded, leading to a rapid increase of non-standard work in this sector.

In those years of progressive decentralization of labor relations, the social partnership played a central role, and the state intervention was relatively low. In fact, several authors praised the process and underlined that the traditional cooperative orientation of the German collective actors was behind it (Carlin and Soskice, 2009). In other words, unlike other countries in which the driver of institutional reforms was state intervention, in Germany, the “coordinated nature” of the model made it possible to implement these flexibility measures more or less peacefully, thanks to the close collaboration between unions, work councils and management (Massa-Wirth, 2005). This “coordinated decentralization” process has been called Pacts for Employment and Competitiveness (*Bündnisse für Arbeit und Wettbewerbsfähigkeit*).

Despite decentralization, unemployment continued at high levels. It steadily rose to 11.2% in 2005 (an historical record), of which more than a half was structural unemployment (see Figure 1 below). Then, in 2003, the coalition government of SPD and the Green Party decided to intervene in the labor market with a package of far-reaching reforms, known as Hartz reforms. They comprise the full liberalization of agency work (Hartz I), the abolition of the maximum limit of hours of marginal employment (that is, the well-known minijobs, with limited social contributions; Hartz II). Hartz III involved the reorganization of the Federal Employment Agency and reinforced active labor market policies. Lastly, the controversial Hartz IV reduced the maximum length of unemployment benefit and introduced means-tested social assistance for the long-term unemployed, with the aim of reducing the reservation wage. The condition for precarious workers to receive this aid is to take any job offered to them, thus proving their willingness to work. Hence, the German state was *de facto* fostering the reduction of unemployment by promoting low-wage employment.

This way, wage and working condition differentials among workers amplified, particularly between those in manufacturing firms and those in low-level services. The main distributional consequences of such process of institutional erosion were the drop of the wage share, as well as the sharp increase in low-end inequality (Table 1). Actually, the German low-wage sector (workers earning two thirds or less of the median wage) is nowadays one of the largest among advanced economies (18% according OECD data –Table 1-, but above 22% according to calculations by Gräbka and Schöder, 2019).

Table 1. Evolution of wage inequality, the wage share, collective bargaining coverage and trade union density (average)

	1995-2000		2001-2005		2006-2009		2010-2017	
	Germany	OECD	Germany	OECD	Germany	OECD	Germany	OECD
Decile 5/Decile 1	1.66	1.71	1.77	1.72	1.84	1.71	1.84	1.68
Decile 9/Decile 1	2.92	3.44	3.06	3.51	3.28	3.50	3.38	3.39
Decile 9/Decile 5	1.76	2.01	1.73	2.04	1.78	2.05	1.84	2.02
Low Pay Incidence	14.68%	18.05%	17.36%	17.48%	18.04%	16.91%	18.70%	16.22%
High Pay Incidence	16.31%	21.24%	15.99%	20.90%	17.24%	20.87%	18.46%	20.45%
Adj. Wage share	71.32%	-	69.46%	-	65.45%	-	67.64%	-
Coll. bargaining cov.	73.90%	-	66.98%	-	62.03%	-	57.89%	-
Trade union density	27.17%	-	22.78%	-	19.55%	-	17.83%	-
Employers' org. density	67.60%	-	63.00%	-	-	-	43.00%	-

*Share of full-time workers earning less than two-thirds of gross median earnings of all full-time workers

**Share of full-time workers earning more than one-and-half time gross median earnings of all full-time workers

***Employers organization density represents the number of workers and salaried employees in private sector firms organized in employers' association as a share of total workforce in the private sector. Data available for years 1995, 1997, 2002 and 2013

Source: *OECD.statistics* and *ICTWSS* (version 6.1.), own calculations

It is worth mentioning here that, according to Behringer et al (2020), income and wealth inequality in Germany are underestimated. The unequal distribution of the rising profits due to

the wage restraint and the export-led growth are only partially captured by inequality indicators. This is because of what they call the “corporate veil” hypothesis, i.e. companies are retaining a significant portion of their profits, instead of passing them onto private households in the form of higher salaries for top management. This behavior is explained by institutional factors: on the one hand, shareholder orientation strategies are less common in Germany than in Anglo-Saxon countries. Moreover, family-owned companies or *middlestand* constitute a large portion of the firms in the economy. These companies have less incentives for profit-sharing since the owner and the manager is frequently the same person and the firm property is passed from one family generation to the next. On the other hand, taxes on retained profits are comparatively low in relation to taxes on distributed profits, thus encouraging the increase in corporate savings rather than profit-sharing. In the case of the *mittelstand*, the law incentivizes the use of corporations as piggybanks (Ruscher and Wolff, 2012; cited in Behringer and van Treeck, 2019: 15). These particularities contribute to the explanation of why the wage share has fallen sharply while high-end inequality and top incomes have increased very little in comparison with other advanced economies.

All in all, the combination of “coordinated decentralization” and in-depth reforms led by the state has resulted in a segmented model. Overall, what remains of the traditional German institutional model –standard labor relation, coordinated wage bargaining, cooperation between workforce and management, workers’ participation in the firms’ decision-taking- is encapsulated in a small part of the economy, the manufacturing sector. In the rest of the economy, traditional institutions are hardly present, resulting in lower wages and higher employment instability.

2.2. *The new German model*

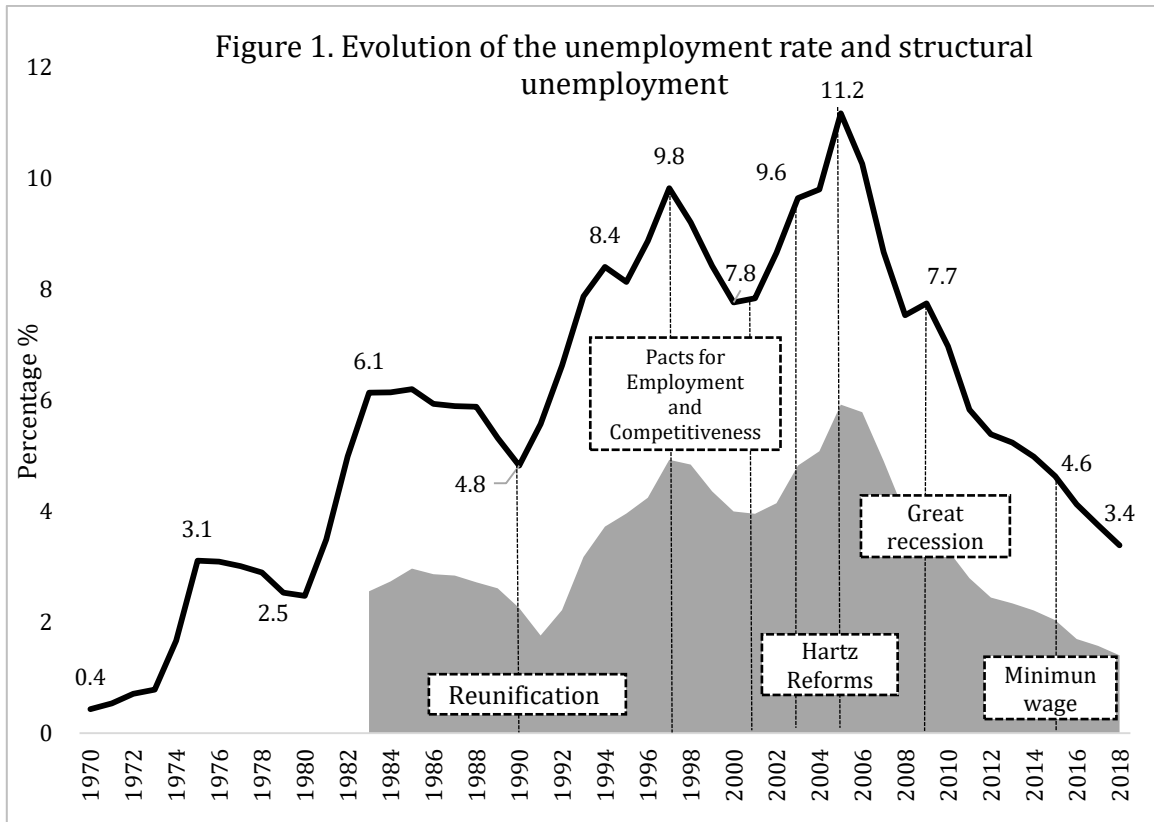
At the price of higher inequality, the process of institutional reform solved the problem of unemployment, and, in turn, provoked a significant wage devaluation against other competitors that drove net exports up³. On the one hand, the margins of the labor market are currently less regulated and industrial relations are weaker. But, on the other hand, coordinated strategies led both by private actors and the Government are still observed, such as the macroeconomic management of the 2009 crisis or the relatively persistent positive economic outcomes of traditional institutions in terms of innovation and competitiveness.

Regarding unemployment, it decreased rapidly from 2006 onward, reaching values below 5%. Furthermore, the share of long-term unemployment also decreased from 53% to 40% of total unemployment (Figure 1). The drivers of employment growth were the service industries, and particularly low-level ones, such as retail, catering or personal services, which are also the branches in which non-standard employment has grown more (Eichhorst, 2015; Möller, 2015).

³ Wren and Iversen (1998) and Wren et al (2013) suggest that modern economies face a trilemma between the policy goals of employment creation, low inequality levels and budgetary stability. It could be said that the policy choice made by Germany is both employment growth and fiscal equilibrium, thus opting for higher inequality to incentivize the development of low-level services.

Apart from the recovery of unemployment, the economy managed the 2009 crisis quite successfully, particularly in comparison with the performance of other advanced economies (Leschke and Watt, 2010). Like in the rest of Europe, Germany was hit by the global economic downturn. Domestic demand decreased -1.5% in 2009 (*OECD.statistics*, own calculations). Besides, exporting firms were particularly affected due to the collapse in demand of their export markets (particularly the European ones). As a consequence, exports of goods declined -18.3% (*OECD.statistics*, own calculations). Despite this shock, the unemployment growth was insignificant (0.7 percentage points between the fourth quarter of 2008 and the third quarter of 2009; Figure 1) and since 2010 it continue decreasing at a similar rate as previous years. This remarkable performance was explained by the implementation of a large fiscal stimulus package (3% of the GDP plus 4% of automatic stabilizers, according to Armingeon, 2012), and by the application of some typical institutional tools of the German coordinated model, which were available much before Hartz reforms, that allowed to reduce working hours (Leschke and Watt, 2010; Reisenbichler and Morgan, 2012; Herzog-Stein et al, 2018). One of these tools is the well-known short-time work scheme (*kurzarbeit*). The German government reacted rapidly to the economic shock by encouraging firms to use short-time work instead of massive layoffs. The regulation regarding the use of this tool was modified several times in order to allow easier access. Furthermore, the time allowed was expanded (up to 24 months for 2009, 18 months for 2010), and it covered broader groups of workers (mainly fixed-term employees). Nonetheless, other internal flexibility measures were undertaken within firms in a context of social partnership at the micro level. These measures were not established in the labor legislation, but informally agreed at the firm level between the workforce and management (they were paid overtime hours, working-time accounts and temporary deviation from regular working hours through opening clauses). According to Herzog-Stein et al (2018) estimations, all of these instruments were used in a similar proportion and altogether saved 1.27 million jobs during the recession.

Naturally, insider-outsider dynamics were perceived in the crisis management. The aforementioned programs focused on standard workers, while atypical employees were more affected by external flexibility measures, i.e. by dismissals. For instance, standard employment (workers with open-ended and full-time contract) decreased -0.23% in 2009 and increased 1.04% in 2010, whereas non-standard work (fixed-term, part-time, marginal and temporary employees) decreased -1.88% in 2009 and increased 3.15% in 2010 (Destatis, own calculations). Overall, the economy handled the crisis successfully compared to other European economies and German firms avoid the dismissals of their skilled workforce, and rapidly hooked into global demand in subsequent years. Concretely, they capitalized the recovery of China as well as the UK and the US and expanded their exports.



*Note: the grey area represents the structural unemployment
Source: *OECD.statistics*, own elaboration

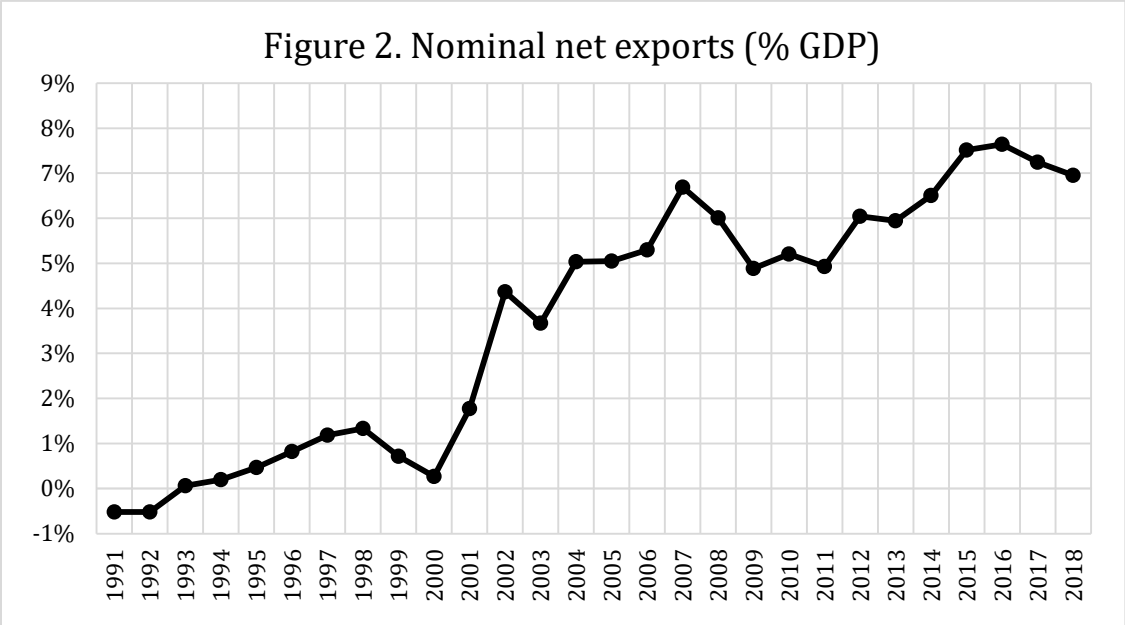
At the same time, several economists linked to the VoC school keep highlighting that, despite the retrenchment of coordinated institutions to certain parts of the economy, they still produce positive economic outcomes regarding innovation, exports and productive specialization in advanced industries (Carlin and Soskice, 2009; Hall and Gingerich, 2009; Schneider and Paunescu, 2012). In Chapter 3, we explore the effect of these institutional agreements on firms' innovation practices⁴. We find that their impact on innovation is indeed quite positive, although the institutional configuration that best promotes innovation is rarely found in our sample.

On the other hand, the weakening of labor institutions and the decentralization of IIRR were the vehicle for a generalized and unequal wage restraint, which drove unit labor costs (ULC) down (Table 1). This policy, accompanied by a conservative fiscal stance, has generated an extreme export-led growth pattern. Although the country has been historically characterized by its exporting strength and has tended to accumulate commercial surpluses (Lindlar and Holtfrerich, 1997; Höpner, 2019), their size and duration have never been as large as they are now.

As we explain in Chapter 4, the wage devaluation contributed decisively to the expansion of net exports, and was the centerpiece of the German growth strategy since 2000 (Figure 2). It had a

⁴ Innovation patterns are considered a main economic outcome of national institutional configurations, thus it is a good variable to evaluate their effect.

great impact on income distribution, and negatively affected domestic demand and imports growth (Stockhammer et al, 2011). Nonetheless, there are wide discrepancies in the literature about the effects of the wage moderation on the different components of aggregate demand. Some authors claim that the impact of ULC on exports was strong, and the lower rate of inflation thanks to the wage moderation allowed the economy to take advantage of a depreciated real exchange rate vis-à-vis other competitors. In this sense, the sharper wage restraint in services relative to manufacturing was particularly functional not only to promote price stability, but also to supply cheaper inputs to manufacturing (Dustmann et al, 2014; Hassel, 2014; Thelen, 2014; Baccaro and Benassi, 2017).



Source: OECD.Statistics, own calculations

On the other hand, another part of the literature considers that wage dynamics were of secondary importance to explain the growth of exports, since German manufacturing is specialized in high-technology industries and in the production of complex goods (Danninger and Joutz, 2008; Felipe and Kumar, 2014). The exporting performance of the country thus rely on its technological advantages, which in turn are related with the institutional foundations of German capitalism (Cesaratto and Stiratti, 2010; Storm and Naastepad, 2015). Therefore, the extreme wage moderation of the country and the restructuring of the manufacturing sector were much more related with the goals of maximizing the profit margins and taking advantage of the new opportunities that the increasing trade and financial integration offered.

We agree with the latter position and we research the links between the wage dynamics in the manufacturing and service sector and the exporting performance of the former. As will be shown in Chapter 4, we find evidence that non-price factors were the main drivers of export growth and that the effect of labor costs on export prices and export volumes is negligible.

Of course, the other great process of institutional change occurred during this period was the onset of the euro. Although we will not go into detail, it is worth noting that some authors have pointed out that Germany has benefited from the monetary union, as it has exploited an undervalued exchange rate regime, thus boosting net export growth (e.g. Cesaratto and Stirati, 2010; Paternessi Meloni, 2017; Höpner, 2019).

All in all, Germany was praised by several authors and multilateral institutions for its ability to overcome the Great depression of 2009, as well as for its impressive exporting performance. Actually, commentators across the academic and political spectrum designated it as an “economic superstar” or “a miracle economy” (e.g. Reisenbichler and Morgan, 2012; Dustmann et al, 2014; along with several newspaper articles⁵).

Nevertheless, it should be pointed out that, in face of the persistent current account surpluses and the extreme wage moderation, more and more observers are starting to consider that Germany’s growth strategy has been as imbalanced and poorly sustainable (IMF, 2019). Furthermore, it makes little sense for the prosperity of the European Union as a whole and it has been especially harmful for the South European partners. Therefore, this combination of wage restraint and conservative fiscal policy during periods of economic growth has not only been a burden for the recovery of the Eurozone during the last crisis, but have damaged the German output growth too (Horn et al, 2017).

3. Theory of institutions and institutional change: the Varieties of Capitalism debate

To analyze the German model, the theoretical backbone of this PhD thesis is the varieties of capitalism debate. It comprises the original contribution by Hall and Soskice (2001), which stems from the DQP argument presented above, as well as the subsequent discussion after its publication in relation to institutional change and economic outcomes. In this section we present the main theoretical arguments of this camp of political economy, along with two further developments of it: the dualization and the liberalization theses.

3.1. The Varieties of Capitalism school

This school of thought is based on Hall and Soskice’s (2001) seminal work. It challenges the view that globalization pressures (i.e. the development of financial markets and higher capital mobility, increasing trade openness or the weakening of unions) would drive advanced economies toward a single model of capitalism, with the same type of labor market organization or financial system (i.e. with decentralized industrial relations and low employment protection, along with developed stock markets or high household indebtedness).

The VoC approach considers that economic efficiency can be achieved within different types of institutional configurations, and therefore market deregulation is not the only road to

⁵ See for instance the opinion article by Paul Krugman (12/11/2009) <https://www.nytimes.com/2009/11/13/opinion/13krugman.html>

accomplish the goals of economic growth, competitiveness in international markets or low unemployment levels.

Building on Douglas North's (1990) work, VoC scholars conceptualize national institutions as formal and informal agreements among economic agents that make interactions more predictable. Institutions are micro-founded, i.e. they are based on the economic behavior and preferences of individual agents. Furthermore, the VoC approach is firm-centered, in the sense that it identifies companies as key players in political economies. Firms are coalitions of economic actors - shareholders, managers, workers, financiers- with relational and dynamic capabilities. It is only by a coordinated interaction among these actors that firms' capabilities can be developed and exploited (Jackson and Deeg, 2008). To that end, actors draw on economic institutions, which are resources for coordination and solve collective action problems.

The concept of institutional complementarity is central: the type of coordination of each institutional field (e.g. industrial relations, the financial system or the style of corporate governance) should be the same to maximize the overall economic performance. Coherent institutions mutually reinforce each other and altogether foster comparative advantages in certain economic activities and encourage particular patterns of innovation. VoC theorizes two major types of institutional configurations (or complementarities): the Liberal Market Economies (LMEs) and the Coordinated Market Economies (CMEs), represented respectively by the US and Germany. While LMEs are characterized by fluid labor and capital markets, an education system that provides general skills and competitive inter-firm relationships; CMEs combine cooperative industrial relations and a tight labor market, patient bank-based financial system, industry-specific education and collaborative inter-firm relations. LMEs have the ability to reallocate assets quickly, and perform well in low-cost services and sectors characterized by radical innovation, whereas CMEs specialize in sectors for which incremental innovation is the key.

Regarding the specific case of Germany, VoC proponents fully embrace the DQP argument. German firms are embedded into an institutional setting composed of strong and corporatist collective actors that encourage forms of coordination in which the market plays a secondary role. This framework provides mechanisms for exchanging information, and monitoring and sanctioning others' behavior, so agents are able to make credible long-term commitments among themselves. Non-market coordination practices support investments in non-transferable or co-specific assets, which are those whose returns depend upon long-term cooperation among agents. These institutional arrangements generate competitive advantages in medium-high technology manufacturing industries, which are predominantly based on high-quality production and on the ongoing improvement and development of the existing produced goods through incremental innovation (e.g. vehicles, other transports or machinery and equipment; for further details, see Chapter 3).

It is worth noting that this approach is a rationalist one, in the sense that institutions are conceived as function of actors' preferences. They are chosen by economic agents, rather than politically imposed. Hence, the German Model is understood as an institutional equilibrium, product of these coordination preferences. This framework leads to an interesting (and

somewhat naïve) corollary. Namely, the German model is above all the result of business interests (Thelen, 2001). Hence, VoC theory predicts that manufacturing employers would support the existence of strong unions and tight labor regulation and would also agree with the codetermination system because they produce positive economic outcomes.

VoC theory focuses on the causes of the continuity of institutional frameworks, and perceives institutional change in a very restrictive way. It is quite deterministic and only conceives exogenous institutional change. Actors' preferences are pre-strategic and are continuously reinforced by the existing institutional architecture, so they cannot change (Allen, 2004). Basically, once a certain type of economic relations are set in motion, complementarities among institutional arenas become stronger and stronger, because they generate increasing returns. Economic agents are locked into a circular process of positive feedback effects, and they have no incentives to stop it, because it would be very costly for them. This way, the institutional structure determines the individual behavior of private actors, but, at the same time, the latter reinforces the former in a process of path dependence. Furthermore, the VoC approach predicts that, in face of an exogenous shock, economic agents would try to preserve and stabilize the core logic of the institutional model, because the returns of the assets in which they have invested depend upon the institutional continuity (Hancké et al, 2007). For instance, the returns on investment in the vocational training system depend on the existence of a tight labor market regulation to prevent poaching, as well as on the institutional mechanisms that foster the cooperation between management and labor force within firms (Hall and Gringerich, 2009).

This conception of institutions and institutional change gives the German model a high degree of stability, because employers would preserve it independently from the unions' bargaining power. As long as coordinated institutions keep enhancing a positive economic performance, economic agents will support them. Nonetheless, it is clear that there are multiple sources of endogenous change, and there is no reason to think that employers would have pre-strategic preferences for a type of institutional organization that constraints their decision-making capacity. In the case of Germany, these endogenous factors have played an important role. For instance, as abovementioned, firms have been pressuring against the formation of work councils, and they restructured their productive strategies through outsourcing in order to avoid wage agreements and gain cost-competitiveness and increase their profit margins.

On the other hand, the VoC approach stresses the cooperation and institutional coherence, while the distributive conflict within and between social classes is absent in the analysis. This deficiency has been criticized by many positions within political economy, which has traditionally highlighted the conflictual and contradictory relations that inherently exist in capitalist economies (Goldthorpe, 1984; Amable, 2003; Amable and Palombarini, 2009). Authors that focus on Germany as a case study have pointed out as well the importance of conflict for the analysis of institutions (Kinderman, 2005; Streeck, 2009). In this sense, the DQP argument itself is built on the concept of "institutional constraints", i.e. limits on the employers' rational voluntarism that generate positive economic outcomes. Therefore, Streeck (1991, 1997b) recognizes that the German model is a "political equilibrium", and its continuity depends upon a strict regulation, as well as on a powerful organized labor movement plus the employers' associations' capacity of uniting and representing the interests of their affiliates. In

absence of such constraints and powerful collective actors, it would be expected that individual employers would try to avoid rigid long-term compromises and flexibilize institutions, regardless of their economic outcomes.

Furthermore, the predominant focus on private agents at the micro level, leads VoC scholars to omit from the analysis a main actor in political economies: the state. It is seen as a passive agent, rather than an actor with its own goals and strategic abilities to undertake economic policies. This is of course an important limit in general, and especially for the analysis of Germany, where the State actively participated in the wage devaluation process by implementing far-reaching reforms of the labor market and the welfare state, and took part in the macroeconomic management of the 2009 crisis, among other things (Eichhorst, 2015). In this sense, it is worth mentioning that the recent work by Behringer and van Treeck (2019) constitutes a promising research line for this school, because it offers a rather convincing institutional explanation for the trends in income distribution and inequality, while introducing in the analysis the role of the government along with the household sector.

Another interesting critique to the VoC school is the lack of typologies of capitalism (only two in the original proposal). This limit is particularly important for those that perform comparative analysis. Other approaches to comparative political economy that study cross-national variation of capitalist organization have developed richer categorizations (Whitley, 1999; Amable, 2003; Howell, 2003; Boyer, 2005; Hein et al, 2020). Later works within the VoC debate have expanded the number of categories. For instance, Hancké et al (2007) introduce the concept of mixed market economy, or Carlin and Soskice (2016) and Hall (2018) acknowledge the existence of different types of CMEs.

All in all, the focus on continuity rather than change, as well as the absence of any conflict and the role of the state in the analysis, impede the VoC school from satisfactorily explaining the institutional evolution of CMEs. In light of such undeniable transformation, this theory has been progressively renovated.

3.2. The dualization thesis

Some VoC scholars realized that since the early-1990s most CMEs have been displaying strong signs of institutional change, and that their view of institutions was excessively focused on continuity and path dependence. Thus, the approach was renovated, and institutions started to be conceived as political outcomes, which are a function of both employer preferences and the balance of power between businesses and workers. They not only are competitive resources for firms, but also regulate conflict among economic agents. In this sense, more attention has been paid to institutional change and social conflict, and existence of groups of interest was incorporated into the analysis.

These scholars have detailed the transformation of the German model as a process of dualization. Far-reaching reforms are difficult to accomplish in corporatist economies like Germany, where several actors have high bargaining power. For that reason, institutional change was not caused by a frontal attack to the central features of the model. On the contrary, it consisted of the introduction of new rules and gradual reforms at the margins of the labor

market and the IRR system, which amended certain aspects of the original ones. However, the sum of a set of small changes have led to an in-depth transformation of the model (Streeck and Thelen, 2005).

This approach highlights the role of organized interests in shaping the process of institutional change. As is explained in detail in Chapter 2, the fringe of the labor market was gradually deregulated. The coverage of collective agreements experienced a sharp decrease and the wage bargaining was decentralized to plant-level. Furthermore, some sectors within the employers' associations started to complain about the excessive rights of the work councils, and pressured to avoid their formation. In Germany, this transformation is shaped by the dominant social bloc formed by manufacturing employers and their skilled workforce, which have "defended" the traditional features of the German model for themselves, while promoting liberalization for the rest of the economy.

On the one hand, the core of the German model has remained resilient and strongly coordinated. Manufacturing firms and their workforce have even intensified their cooperation, although they have left an important part of the economy outside of their arrangements. Manufacturing employers still find traditional institutions useful to accomplish their goals. Nevertheless, trade unions, which are strong in these industries yet, are not powerful enough to extend the coverage of these agreements to the whole economy, and even collaborated with employers' segmentation strategies with the aim of protecting the working conditions of their core affiliates. For instance, they did not oppose to the increase in the facilities to use temporary agency work, which have mainly affected low-skilled workers (Palier and Thelen, 2010).

On the other hand, the "deregulated" periphery is mainly composed of low-level services, which have been the main source of employment creation. Here, atypical employment has risen considerably and coordinated industrial relations are hardly present. The periphery has served to stabilize the core, by providing flexibility and low labor costs for manufacturing in order to control export prices and recover profit margins. As Thelen (2014) claims, core and periphery are the two sides of the same coin. The social bloc formed by core employees, management and employers has endorsed the liberalization of the fringe of the economy, so they could preserve traditional labor institutions for them. Hassel (2014) formulates the issue as a paradox: thanks to the deregulation of services and the segmentation of the labor force within manufacturing firms, the coordination among manufacturing employers and their core workforce is stronger than ever. This way, manufacturing gained competitiveness while preserving employment protection and good working conditions for core workers, which in turn guarantees the necessary cooperation to undertake its high-quality production.

Nevertheless, although the core manufacturing sector remains fundamentally coordinated, its size is shrinking due to the transformation of the employment structure, i.e. the deindustrialization and the emergence of a new service economy.

In sum, although the German model has changed since the 1970s, coordinated institutions are still well grounded in some parts of the manufacturing sector and strongly supported by employers. Therefore, Germany is still a CME variety of capitalism, very different from the Anglo-Saxon economies.

3.3. *The liberalization thesis*

This strand of literature holds that employers' interests are rarely linked with non-market institutions, and that they overwhelmingly prefer market coordination mechanisms (i.e. relative prices and individual formal contracts) that do not limit their capacity to take discretionary decisions. Institutions regulate the inherent conflict that inevitably arises in capitalist economies, and are product of the existing equilibrium of interests among social groups. Therefore, the only guarantee for the survival of the traditional German model is the strength of organized labor, and, when it is weakened, an increase in casualization of labor relations and a decrease of the IRR coverage would be expected. While the dualization camp stresses the prevailing differences between LMEs and CMEs, the liberalization position underlines the common market pressures on advanced economies toward deregulation. In short, they focus on the *commonalities of capitalism*, rather than varieties (Streeck, 2011).

Institutions act as constraints on employers, forcing them to comply with minimum labor standards. The German model is a result of the Fordist postwar pact, characterized by strong unions and a highly regulated labor market, which encouraged a balanced distribution of income between capital and labor. Liberalization comprises the erosion of these constraints and the expansion of the employer discretion thanks to economic globalization, which empowers capital against labor and the state due to its greater mobility (Baccaro and Howell, 2011). Thus, the German model has gone through a process of liberalization, meaning that the erosion of labor institutions is not only circumscribed to the periphery, but to the whole economy. Although this process has advanced much more in low-level services and suppliers firms, it has affected the manufacturing sector too. A central outcome of this process is a dramatic change in income distribution trends and inequality.

As well as dualization scholars, liberalization proponents acknowledge the existence of a sort of coalition of manufacturing firms and their core workforce –a dominant social bloc- that shapes the process of institutional transformation. Manufacturing firms still coordinate with their core employees through some of the traditional institutions, but at the same time workforce segmentation strategies and the use of subcontractors, along with individualized bargaining, are becoming more and more frequent. They underline that high-quality production strategies can be undertaken now under less strict institutional agreements, so employers have less incentives to defend traditional institutions. Nonetheless, as already pointed out, the main limit to this process is the ability of organized labor to contain employer discretion, along with the implementation of public policies. They also interpret the greater deregulation of the margins of the labor market as a way to stabilize the core manufacturing activities, but by no means has the process stopped here, since liberalization is a secular process.

Overall, Germany has moved away from its coordinated model. This outcome is partly explained by the very nature of capitalism as a social order, which tends to break non-market institutions and expand market relations across society. But another explanatory factor is the fact that export markets became more price sensitive and German manufacturers needed to reorganize their productive strategies to be able to compete (Baccaro and Benassi, 2017) while protecting their profit margins (Streeck, 2009).

In this sense, Baccaro and Pontusson (2016) inaugurated an interesting new research line, “the growth models perspective”. The traditional supply-side orientation of VoC is abandoned to focus on the demand-side. Concretely, it aims to investigate the institutional underpinnings of demand-led growth, by combining institutional comparative analysis with post-Keynesian insights on the relationship between income distribution and economic growth (Bhaduri and Marglin, 1990). Their conclusion on the German growth model is that there is a trade-off between consumption demand and exports. Due to the fact that German exports are price-sensitive, manufacturing firms have been less willing to concede wage increases to their workforce. The deregulation of the labor market and the low wage growth in manufacturing have kept domestic labor costs down. Moreover, the exacerbated pay moderation in domestic services was functional to maintain or even increase the real wages of manufacturing workers, despite the moderate evolution of their nominal compensation. Therefore, according to these authors the fall of the wage share and the increase in wage inequality served to repress domestic consumption, which in turn is a necessary condition for export-led growth.

However, the main critique to this approach is that they take for granted the functionality of the export-led growth. First, they assume that the wage moderation is an essential requirement for German competitiveness (while previous empirical evidence casts serious doubts on that issue, as we show in Chapter 4); and, second, they confuse the concept of growth model with the concept of demand regime. The former alludes to the issue of which components of the aggregate demand drive the economic growth (the net exports, in the German case). The latter makes reference to the effect of a change in the functional income distribution (the wage share) on the aggregate demand. If the effect is positive, the economy is wage-led. If it is negative, the demand regime is profit-led. In short, the sources of growth might have change in Germany, but this does not automatically lead to the conclusion that the demand regime has changed as well. In fact, according to many works, it still remains wage-led (among others Naastepad and Storm, 2007; Hein and Vogel, 2008; Stockhammer et al, 2011; Horn et al, 2017). Therefore, this type of extreme export-led growth could have been dysfunctional for the economy. Indeed, although we do not directly estimate the demand regime of the country, our results on the price elasticity of German exports support this thesis.

3.4. Dualization or liberalization?

The truth is that it is difficult to evaluate which of both theses describes the evolution and current situation of the German model better. This is partly due to the fact that some discussions are circumscribed to the theoretical rather than the empirical dimension. Besides, the unit of analysis is sometimes different. While empirical studies in the dualization camp usually examine the whole economy, liberalization scholars are more interested in firm or industry-case studies.

A recent work by Thelen (2014) seeks to synthesize both approaches. She holds that each thesis deals with different aspects of institutions. While dualization proponents are more interested in economic efficiency –that is to say, competitiveness, technical progress, unemployment or economic growth-, liberalization ones are mainly focused on distributive outcomes –i.e. the

evolution of the wage share, income inequality or the redistributive capacity of the welfare state-. Thus, both perspectives would be perfectly congruent: while cooperation between capital and labor has even intensified in the manufacturing sector, the scope and coverage of non-market institutions has decreased, resulting in a much less egalitarian but still coordinated German model.

We consider that, indeed, both approaches have slightly different research interests, but the lack of empirical evidence in some discussions of the Varieties of Capitalism debate is problematic to properly understand the relationships between institutions and economic performance, as well as to discern whether employers are truly interested or not in coordinated institutions.

The motivation of this doctoral dissertation is to fill some of these gaps and to contribute to a better understanding of the German puzzle from an empirical point of view. Therefore, the main interest and contribution of the present work is that it is firmly empirically grounded, and from this position we will be able to make some theoretical assessments. Our investigation lines are the following:

- First, we seek to analyze the extent to which the traditional German model of labor market and IRR is widespread in the private economy, and to capture the effect that the transformation of the employment structure has had on the process of institutional change.
- Second, we investigate whether coordinated institutions still foster positive outcomes in manufacturing industries. To that end, we explore the effects of these institutions on innovation patterns drawing on the Varieties of Capitalism theory of innovation.
- Third, we research the causes of the remarkable exporting performance of German manufacturing. In this sense, we explore the existing productive linkages between manufacturing and services. We will determine to what extent the wage squeeze in the former contributed to improve the price competitiveness of the latter. On the other hand, since Germany is specialized in the production of highly complex manufacturing goods, we explore other causes through which services (the sector most affected by liberalization) might encourage manufacturing competitiveness.

Through the completion of these three empirical studies, we will obtain a more complex view of Germany.

Some conclusions can be advanced at this point. At the beginning of the analysis, we expected to find a picture of the economy closer to the dualization interpretation. However, data reveal that traditional institutions have been eroded across the whole economy, even in the manufacturing sector. There is a small core manufacturing, which accounts for the 9% of the workforce, where coordinated institutions are still present. Nevertheless, we detect labor segmentation dynamics there too. The fact that heterogeneous firms across the entire economy strategically decide to abandon traditional institutional arrangements, explains why the effect of the change in the employment structure is of secondary importance to account for the

transformation of the German model. These empirical results are therefore closer to the liberalization thesis: once institutional constraints are removed, it is likely that employers will casualize labor relations. However, regarding the economic outcomes of coordinated institutions, we find that they are indeed main drivers of innovation in the country. Therefore, although the German model is in marked retreat, coordinated institutions still endow firms with competitive advantages and abilities to innovate. Lastly, we discover that the exporting performance of Germany is not explained by labor cost factors. On the contrary, variables such as the evolution of world demand or the productive linkages with advanced services are much better predictors of manufacturing exports. Therefore the functionality between the two segments of the German model is brought into question, as well as the efficiency of wage restraint policies to regain competitiveness.

4. Goals and structure of the PhD dissertation

Having illustrated the evolution of the German model and the main interpretations of its trajectory of institutional change, we present the structure of this doctoral thesis and the goals of each chapter in more detail, as well as the relevance of each research problem.

As abovementioned, this dissertation is structured in three contributions that address particular aspects of the German model, related with specific debates within political economy. Hence, although built on the varieties of capitalism debate, each chapter has its own literature and methodology. Moreover, conclusions go far beyond this debate, and engage in other discussions in the fields of labor economics, the determinants of innovation or the drivers of international competitiveness.

In the end, it will be possible for the reader to better understand some aspects of the transformation of German capitalism and its economic performance. Nonetheless, it is not our aim to provide a holistic understanding of the model. Following is a summary of each chapter.

In Chapter 2, we explore the evolution of labor institutions of the German model. Although VoC literature on Germany is prolific in theoretical terms, we have detected a lack of empirical evidence regarding how extended the “traditional” German model is. Nor is it clear which parts of the economy belong to the so-called core of the model; for instance, some papers state that only large exporting firms belong to it, others refer to particular industries, while most of them refer to the whole manufacturing sector. Besides, scholars like Traxler (1996) or Thelen (2014) highlight the importance of the transition toward a service economy to explain transformation of labor institutions in most advanced economies, including Germany. Since standard work and labor strength are historically grounded in this sector, the compositional effect resulting from its loss of employment share should have played a role in the evolution of institutions. Nevertheless, here again we detect little empirical evidence for this claim.

With the aim of filling these gaps in the literature, this chapter uses a representative firm-level dataset, the IAB Establishment Panel, and descriptively analyzes the development and current status of labor institutions in several types of firms, according to three variables: the industry, the size and the location. In addition, we apply a shift-share technique (Sharpe, 2009) to estimate the effect of the transformation of the employment structure on the institutional

change. The evidence obtained is discussed in light of the theories of dualization and liberalization.

Our results provide a good panoramic of the German model. Interestingly, they reveal that the size of what has been called the core manufacturing sector is really small, accounting for only 9% of the workforce, and that the casualization of work relations is widely spread across the economy, while the coverage of IIRR is really low in most types of firms. Moreover, our findings suggest that structural change played a minor role in the process. Overall, the situation of the model is better illustrated by the liberalization thesis.

Chapter 3 applies the VoC theory of innovation to Germany. VoC literature has highlighted innovation as a central economic outcome of national institutional frameworks. Hall and Soskice (2001) claim that, in comparative terms, liberal economies are more efficient in undertaking radical innovations, while coordinated economies are more prone to perform incremental innovations. This theory has been very controversial because it attaches great importance to national institutions instead of individual corporate strategies, and also considers that those institutions that are helpful to incrementally innovate, discourage radical innovation and *vice versa*. Furthermore, the evidence obtained by previous empirical analyses is mixed.

Drawing again on the *IAB Establishment Panel*, this chapter's goals are: (1) to measure the joint impact of the four institutional arenas highlighted by VoC on the abovementioned four types of innovation; and (2) to capture whether the innovation performance varies when taking into account some structural variables of the firm -the industry, its exporting activity or its size- that also determine the propensity to innovate. Additionally, we focus on the most advanced manufacturing firms and estimate the effect of coordinated institutions on their innovative activity. In this way, potential biases are controlled and the role of coordinated institutions is better assessed. Our methodology consists of logistic modelling.

Our findings point to the crucial role of coordinated institutions to perform innovations, when a firm undertakes a "non-market corporate strategy" -when it makes full use of all coordinated institutions-, the probability to innovate is maximized. This effect is particularly large for incremental and process innovation, but is also significant for radical innovations. Furthermore, when controlled by the structural features of the firm, the outcome of coordinated institutions still remain the same. Thus, our results suggest that, despite the trajectory of institutional change, the main road to innovation in Germany is still a non-market corporate strategy.

Chapter 4 addresses the causes of the manufacture exporting performance since 2000, and the existing channels through which services could have contributed to the export boom. A large strand of literature considers that the main driver of exports was the process of wage devaluation, concentrated in service industries. Nonetheless, we find that price elasticities captured so far by previous empirical works are quite different. In addition, the productive specialization and high quality of German exports suggest that non-price factors should have played a central role there.

Concretely, this chapter applies a subsystem approach to the input-output analysis (Pasinetti, 1973) to take into account the existing interlinkages between manufacturing and services. With manufacturing subsystems as units of analysis, we perform an export model. Our goals are: (1) estimate the extent to which labor costs contributed to drive exports up; (2) capture the effect of the wage squeeze in services due to institutional factors and outsourcing; (3) estimate the role played by advanced services in it, and concretely the impact of knowledge-intensive business services as innovation drivers. The employed dataset is the *World Input-Output Database* (WIOD).

Overall, despite the pay moderation, our results point to minor importance of labor costs for international competitiveness. We also capture a significant but small effect of service suppliers' labor costs on manufacturing exports. We find that KIBS have helped manufacturing gain international competitiveness. The chapter concludes that non-price factors are the main drivers of German exports and that the relationship between manufacturing and services is not only a matter of cost reduction.

Lastly, in Chapter 5 the main conclusions of the doctoral dissertation are presented.

Chapter 2

Disentangling the transformation of the German Model: the role of firms' strategic decisions and structural change

1. Introduction

Since the early 1990s, the German employment and industrial relations (IIRR) model (*Modell Deutschland*, MD) has been under heavy pressure associated with globalization and deindustrialization (Streeck, 1997b; Hassel, 1999). As a consequence, some of its traditional features –such as high levels of standard employment, encompassing sectoral agreements or employees' plant-level representation in work councils-, along with its capacity to promote social cohesion have been eroded.

Although similar liberalization trends have been registered in other European economies (Koch and Fritz, 2013; Visser, 2013), Germany is a striking case because it has been considered a type of nonliberal capitalism (Streeck, 1997a) or a coordinated-market economy (Hall and Soskice, 2001), distinguished by a solid partnership between capital and labor and cooperative relations among firms. The model was grounded in manufacturing industries (the so-called diversified quality production; Streeck, 1991), but these features could be found across the whole economy. Additionally, strong macroeconomic results, i.e., high productivity and competitiveness in dynamic industries, a balanced current account and low levels of wage dispersion and wealth inequality, were achieved within this institutional framework during the 1970s and 1980s.

Despite the large amount of research that has been produced, the debate on the current state of the MD remains unresolved. Two theories dispute the interpretation of the process of institutional change.

First, scholars linked to the Varieties of Capitalism School have stated that the MD has been involved in a process of dualization, which is the form that liberalization has taken in Germany (Thelen, 2014). They point out that the economy is composed of two economic segments. On the one hand, there is a coordinated and stable core, formed by manufacturing firms in advanced industries and its workforce. Here, traditional labor institutions remain important competitive tools for the former, and ensure good working conditions for the latter. On the other hand, there is a growing periphery of service activities that rely on market-based coordination, leading to the expansion of atypical employment and the erosion of the IIRR system. Here, in the periphery, real wages have experienced a negative growth and working conditions have deteriorated. Furthermore, the model is increasingly encapsulated due to the change in the employment structure, i.e. deindustrialization and the emergence of new service

companies. In summary, according to these authors, the MD is still strong in advanced manufacturing industries, but it is less encompassing or solidaristic, and it is located in a diminishing proportion of the economy (Carlin and Soskice, 2009; Palier and Thelen, 2010; Hassel, 2014; Thelen, 2014; Möller, 2015; Eichhorst, 2015).

Second, IIRR literature has held that the expansion of non-standard work, the decline of sectoral agreements coverage and the dwindling presence of work councils in establishments are signs of exhaustion of the MD in the globalization era, during which most advanced economies have suffered from similar pressures that have shifted them in a common direction (Baccaro and Howell, 2011). Although the MD has not been converging toward an ideal Anglo-Saxon model, it has experienced an “internal softening” or a re-institutionalization process characterized by the substitution of the former obligatory institutions and the dominance of social agents by voluntary pacts between individual actors (Streeck, 2009). According to these authors, once institutional constraints disappear, employers tend to casualize labor relations even in core leading industries. This outcome is partly explained by the very nature of capitalism as a social order, which tends to break non-market institutions (Streeck, 2010), and by the shift in an extreme export-led growth regime experienced by Germany, in which price competitiveness is a central concern that cannot be addressed under the former institutional agreements (Baccaro and Benassi, 2017). Therefore, the entire economy has gone through a process of liberalization, and, for this reason, the transformation of the employment structure is less important in explaining the institutional change.

The comparison of both theories is difficult, although some attempts have been made (Prosser, 2016). This is partly due to empirical studies of IIRR scholars being predominantly focused on firm or industry-case studies, while dualization proponents usually examine the whole economy in international perspective. In addition, there is a lack of empirical evidence regarding how extended is the “traditional” German model and in which industries or firm types it is concretely located. For instance, the definition of core manufacturing is not clear: some authors refer to the whole manufacturing sector (Thelen, 2014), others to particular industries (Palier and Thelen, 2010), while others allude to concrete exporting firms (Hassel, 2014). The same lack of empirical accuracy is detected regarding the extent to which the structural change influenced the process.

It is more or less a consensus that the erosion of the MD has been concentrated in low-level services. Less productive industries are more likely to use flexible forms of employment and seek wage setting practices on the sidelines of collective agreements. Nonetheless, once institutional constraints disappeared, what happened to firms in other industries? And, particularly, how did the German core manufacturing react to the liberalization of the employment legislation and to the new possibilities to decentralize collective bargaining? Furthermore, which role did the transformation of the employment structure (structural change) play on the process of institutional change?

Using data from the *IAB Establishment Panel* two objectives are addressed in this chapter. The first one is to chart the presence and development of the MD across the private economy throughout the period of 1996-2014. To this end, the evolution of four types of atypical

employment (fixed-term, part-time, agency work and marginal) and the trajectory of the IIRR system coverage are explored in several groups of establishments. The second goal is to determine the role of structural change in the erosion of the MD. This is addressed by adapting Sharpe's (2009) shift-share technique. This way, it would be possible to discuss the results in light of the theories of dualization and liberalization.

The remainder of the chapter is organized as follows. Section 2 provides an overview of the main features of the "original" MD. The employed dataset is presented in Section 3. Section 4 offers evidence about the process of institutional transformation. Section 5 analyzes the effects of structural change. Section 6 concludes.

2. Institutional background: the "original" *Modell Deutschland*

Until the late 1980s, Germany was characterized as a solidaristic and coordinated economy. It was considered coordinated because labor institutions fostered strategic interactions among economic agents, in which the market played a secondary role. This form of coordination is efficient to compete in international markets because it generates competitive advantages in certain industries, particularly in the manufacturing ones (Hall and Soskice, 2001). Besides, the MD was solidaristic in the sense that labor institutions "*were relatively encompassing in scope and relatively uniform in content*" (Thelen, 2009: 480).

The main features of the German capitalism were the existence of corporatist social actors and a strict labor law that kept salaries and working conditions away from competition. Advanced manufacturing industries were the heart of the model and acted as pace-setters for the entire economy, defining working conditions and the average wage growth rate. Union density was low (34.4% between 1970 and 1990, *OECD.statistics*) but was concentrated in these industries (automotive, machine tools or metalworking) and the public sector. In general, the trade union movement was centralized and non-competitive, and it pursued inclusive labor policies under the principle of "*equal pay for equal work*" (Benassi and Dorigatti, 2015: 536). Membership rates in employer associations were much higher: two thirds of firms were affiliated, in which 80% of the workforce in the private sector was employed (Bunn, 1984; cited in Sylvia, 1997: 189). These associations negotiated with unions considering the average economic situation of their members (the so-called convoy principle). The combination between encompassing actors and tight labor regulation fostered the presence of "non-market" institutions across the whole economy.

Concerning labor relations, coordination in the core manufacturing industries was achieved by a union strategy that sought low atypical employment levels. Long-term and stable contracts were promoted by industrial firms too because they relied on employees with hard to replace sector- and firm-specific skills (Hall and Soskice, 2001). At the same time, work councils controlled the abusive use of atypical contracts by personnel departments. This institutional environment encouraged mutual trust relationships between management and employees, dominated by a cooperative approach and relative social peace at the workplace level. In this way, in moments of economic slowdowns or structural change (like during the 1980s), institutional rigidities were compensated for by agreements regarding internal flexibility and

distribution of working times (Thelen, 2001). It was also a solidaristic labor market because the regulation was logically extended across the entire economy, assuring high employment protection and great limitations on the use of atypical employment in all industries.

The German system of IIRR was (and still is) “dual”, with two formally independent levels of interest representation – industry and workplace – with separated but complementary functions.

At the upper level, trade unions and employers’ associations set wages and working conditions in industry-wide collective agreements (*flächentarifverträge*). The main determinant of the coverage rate was the density of the employers’ associations because sectoral agreements were legally binding on all of their members. Although sectoral agreements were only compulsory for union members, in practice, companies did not differentiate between affiliated and non-affiliated workers when applying it. Distributive conflict was mainly organized at this level and thus shifted away from plants. Departures from collectively agreed norms at the workplace level could only be concluded in the employees’ favor (the so-called favorability principle, *günstigkeitsprinzip*). The State did not interfere in collective bargaining, in which the principle of autonomy was (and still is) constitutionally guaranteed (*tarifautonomie*).

At the lower level, work councils and firm management were the main actors. Work councils were (and still are) endowed with information, consultation and co-determination rights on social matters (these rights increase with establishment size) by the Work Constitution Act (*Betriebsverfassungsgesetz*). This Act has not changed very much (the modifications introduced in 2001 did not have important effects in terms of rights and coverage), so the formal features detailed below still apply today.

Work councils were mandatory in plants with five or more permanent employees, but they were not automatic and must be proactively formed by the workforce. The number of members of the work council was determined by the number of employees with voting rights (BetrVG §9). The law required them to work in a “spirit of mutual trust” together with managers (BetrVG §2) and prohibited them from calling strikes or any type of industrial action (BetrVG §74). Furthermore, they were not allowed to reach agreements with managers on matters agreed upon at the sectoral level by collective actors, unless otherwise stipulated in the collective agreement (by means of derogation clauses, which are detailed below).

It has long been recognized that this division of functions, by which distributional issues were settled away from workplaces, while work councils mainly focused on organizational and productive matters, has favored a climate of cooperation between workers and managers at the plant level and has led firms to positive economic performance (Jacobi et al, 1992; Freeman and Lazear, 1995).

The MD was solidaristic apart from being coordinated because, along with the favorability principle, advanced manufacturing industries established benchmarks for other economic sectors in terms of wages and working conditions. Consensual wage bargaining was accomplished by corporatist collective actors, which overcome the individual interests of their

members in pursuit of macroeconomic goals (like economic growth, exports or unemployment) (Maier, 1984). Wages were set by *pattern bargaining*: the collective agreement in electrical and metalworking engineering between IG Metall and Gesamtmetall in Baden-Württemberg set the pace for other economic branches and regions. Thus, wage growth was coordinated among industries. In this way, the needed price stability for an export-oriented economy was achieved. Besides, this mechanism, along with the favorability principle, transferred the benefits of productivity growth from the faster-growing productivity sectors to the slower-growing productivity ones (Jacobi et al., 1992: 248)⁶. As a consequence of this institutional density, wage and income inequality were relatively low.

Finally, sectoral agreements could be extended to an entire industry or region by the labor ministry if at least 50% of the employees were already covered, and the extension was considered a matter of public interest (Schulten, 2018).

3. The dataset

The analysis on the institutional transformation of the MD is based on the *IAB Establishment Panel*, a representative dataset of the Institute for Employment and Research (IAB) of the Federal Employment Agency (BA). It annually surveys establishments (not firms) from all sectors and sizes using a stratified random sample of all plants that employ at least one worker covered by social insurance on 30 June of a year. Information about labor contracts and IIRR (among other topics) is collected from personal interviews with the owners or the managers of the establishments. The first survey was conducted in 1993 only for the former West Germany and was extended in 1996 to eastern establishments. The sample size has steadily grown, increasing from 4,265 establishments in 1993 to more than 15,000 from 2001 onward (for more detail, see Fischer et al, 2009; Ellguth et al, 2014). Each cross-section (year) could be combined to form a panel data structure (Umkehrer, 2017). The relevant variables to this chapter are:

- a. The four main forms of *atypical work* in Germany, which are defined by opposition to standard work (open-ended full-time contract). They are fixed-term, part-time, agency work and marginal employment (also known as mini-jobs and midi-jobs) (Keller and Seifert, 2013). All of them entail, to a greater or lesser extent, labor instability, low wages, reduced legal and union protection and scarce opportunities for promotion. Part-time is included here although the share of involuntary part-timers in Germany is low (particularly in comparison with Mediterranean economies). Nonetheless wage, protection and skill gaps associated with it do not depend on the will of the worker.
- b. The coverage of the *dual system of IIRR*, defined as the joint presence of the two pillars of the German IIRR: sectoral agreement and work council. We also consider a broad

⁶ In an international comparative study, Traxler and Brandl (2012) find that this type of wage bargaining coordination is also the most efficient in controlling the Balassa-Samuelson effect and the negative externalities that might arise from the pay setting between the international exposed and the non-trading sector in terms of labor supply.

definition of it by analyzing the evolution of the coverage of collective bargaining (at both sectoral and firm-level) and work council. As aforementioned, the dual system has historically promoted cooperation between labor and capital at macro and micro level, resulting in a positive economic performance in terms of competitiveness and income inequality.

Three variables are taken into account to map the evolution of the model, due to previous literature highlighting them as important vectors of the process of institutional change. With them we build establishment groups:

- c. *Industry*: the analysis is centered on the German private sector⁷. Economic activities are grouped into five categories: advanced manufacturing, other manufacturing, business services, supplies, consumer and personal services, and construction, agriculture and extractive industries. The OECD taxonomy of economic activities based on R&D is employed for clustering manufacturing industries (Galindo-Rueda and Verger, 2016). Advanced manufacturing (for which non-market institutions has been historically crucial) is composed of high and medium high R&D intensity industries, and are identified as the core of the German productive structure. Other manufacturing includes medium-low and low R&D intensity industries. The business services category contains those services activities connected with manufacturing industries (Franke and Kalmbach, 2005). Another category comprises supplies, consumer and personal services, i.e. services that are usually considered as “low-level”. Lastly, construction, extractive industries and agriculture are grouped into a single category. This classification is detailed in the Appendix (Table A.8). The dataset provides a time-consistent industry classification, so the results in 1996 and 2014 are perfectly comparable, which is not the case in other similar works (Addison et al, 2017c; Oberfichtner and Schnabel, 2019).
- d. *Size*: We distinguish between large establishments (200 or more employees) and small and medium ones (less than 200 employees).
- e. *Region*: Establishments located in eastern *Länder* are separated from those located in the West.

With these three variables, it will be possible to identify the German core manufacturing, along with other establishment types, and analyze their behavior regarding the variables of interest. The dataset does not allow any calculations based on less than 20 observations. This restriction compels us to group western and eastern large establishments in construction, extractive industries and agriculture into one category. Therefore we analyze nineteen types of establishments instead of twenty.

The analysis excludes all establishments with fewer than five employees since it is the employment threshold for works council formation. Because the investigation goal is to capture

⁷ Oberfichtner and Schnabel (2019) showed that the dual system of industrial relations was almost perfectly preserved in the public sector between 1996 and 2015.

a process of institutional change, we sought the longest period possible: 1996-2014. For this purpose, 18 cross-sections are used to chart yearly atypical employment incidence and coverage rates. The results are cross-section weighted. The final sample is 161,423 observations (approximately 6,000 for the first four years and between 8,500 and 10,000 in subsequent years). Empirical analysis is focused on the proportion of employees by establishment type.

4. Institutional change in the *Modell Deutschland*

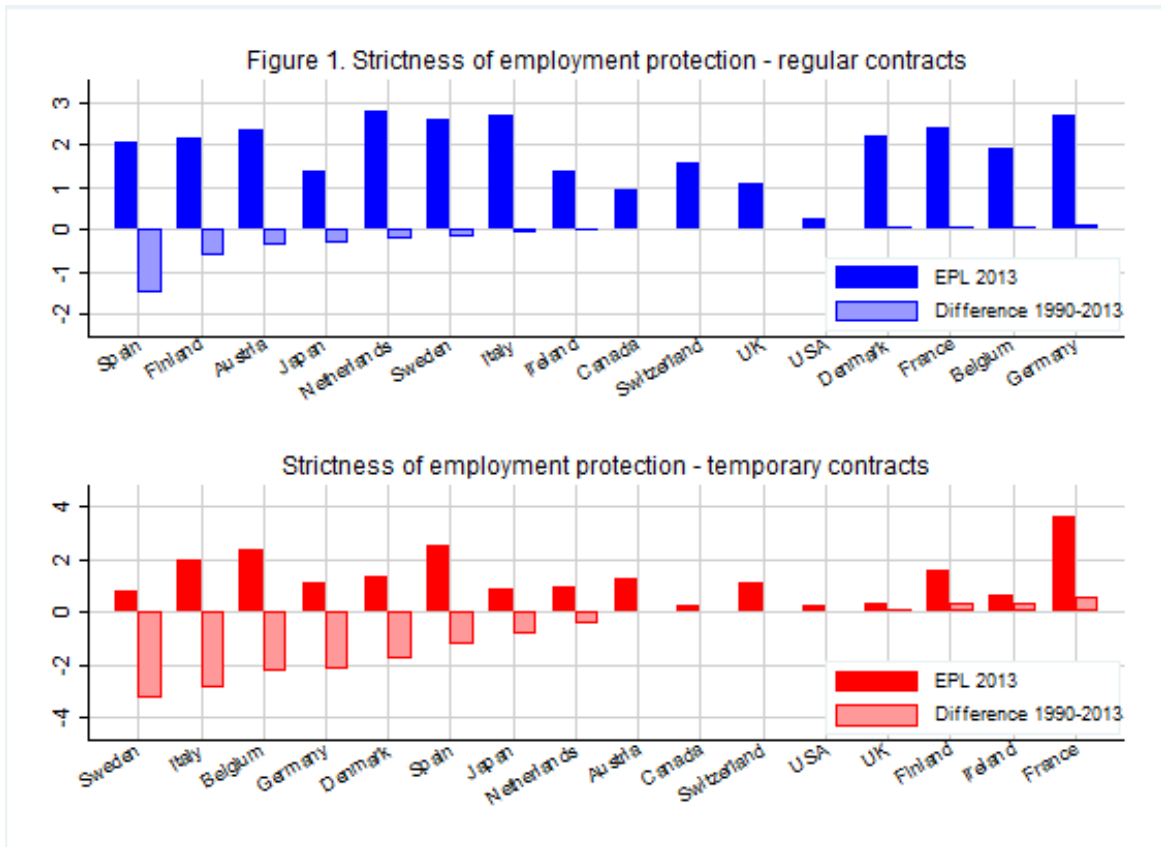
Having presented the features of the original MD, this section addresses the first goal of the chapter and explores its transformation over time.

4.1. The evolution of the model

Since the early 1990s, the institutional organization of the labor market came under criticism, particularly by the business sector (Vitols, 2004; Kinderman, 2005). The economy faced high levels of structural unemployment, weak economic growth and certain lack of cost competitiveness. In response to these problems, the labor market was deregulated and atypical employment expanded. Furthermore, sectoral bargaining and work council coverage suffered a sharp drop and wage negotiations were decentralized to the firm level. As a consequence, the problem of unemployment was solved over the years, but the system lost its capacity to promote social cohesion (Möller, 2015). For instance, Germany currently displays high levels of wage inequality, which are particularly severe at the lower-end of the distribution (Dustmann et al, 2009, Gräbka and Schöder, 2019).

In general, far-reaching reforms are difficult to accomplish in corporatist economies like Germany, where several actors have high bargaining power. Institutional change was not caused by a frontal attack to the central features of the model. It consisted in partial reforms, i.e. the creation of new institutions that amended certain aspects of the original ones. In the end, these new institutions assumed a more prominent role, changing the overall system logic. Concerning labor institutions, employers started to claim that the standard labor relation was too rigid and costly, and discouraged investment and employment creation. Instead of reforming it directly, this problem was addressed by the progressive inclusion of legal facilities to use non-standard contracts and by the decentralization of the wage bargaining. Over the years, through the action of economic agents at the micro level, the reformed margins end up being larger than the “solid” core. This type of institutional change has been characterized as a layering process (Streeck and Thelen, 2005).

The transformation of German employment relations is a textbook case of this type of institutional change. The margin of the labor market was flexibilized and protection against dismissals was deeply reduced for non-standard contracts, while it even increased for regular contracts. Seen in comparative perspective, Germany, together with Belgium, is the country in which the OECD index for standard employment protection grew the most and where peripheral workers suffered from the sharpest decline in it (Figure 1).



Source: OECD statistics, own calculations

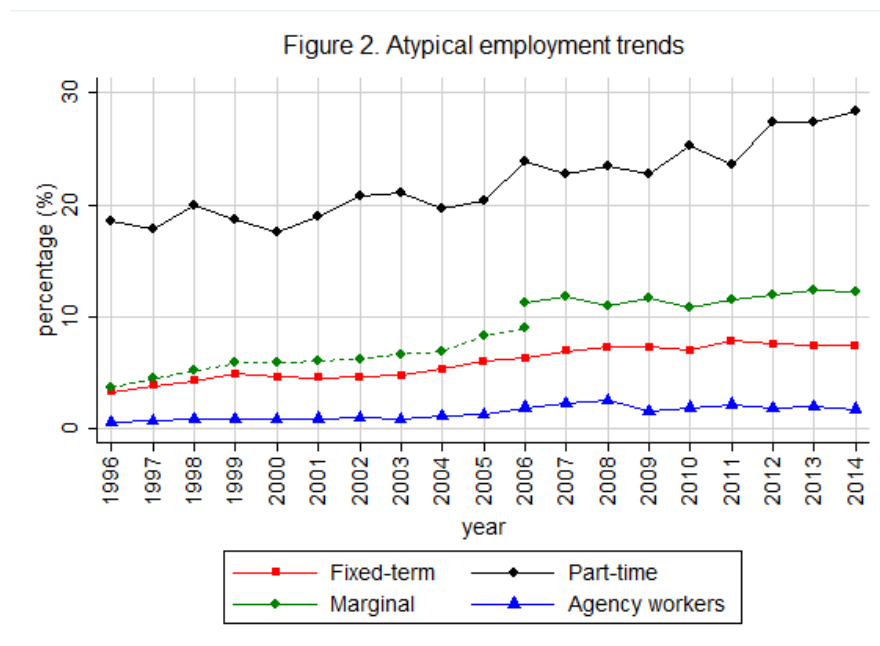
Deregulation at the margin of the labor market also included the increase in the legal facilities to use atypical contracts. This process was the precondition for the rise of non-standard employment (Keller and Seifert, 2013). The starting point was the approval of the Employment Promotion Act (*Beschäftigungsförderungsgesetz*) in 1985, which extended the maximum duration of fixed-term contracts (until 18 months) and temporary agency work (from 3 to 6 months) without objective reasons. Since then, further reforms have been passed. Quite relevant were the reforms affecting part-time employment (*Teilzeit- und Befristungsgesetz*, 2001), fixed-term employment (1997) and progressive liberalization of temporary agencies (1997 and 2002).

Despite this reforms, the unemployment rate kept growing and the coalition government between the SPD and the Green party passed the well-known Hartz reforms (2003-2005), which were the last step of the deregulation process. These reforms introduced far-reaching changes in the labor regulation and constituted a shift in the non-interventionist attitude of the German state in labor relations. They fully liberalized agency work, removing the maximum length of this type of contract (Hartz I). At the same time, they contributed to the expansion of marginal employment by the reform of *mini-jobs* and *midi-jobs*, with limited social contributions (the maximum of 15 hours per week was abolished under Hartz II). In turn, Hartz III promoted the reorganization of the Federal Employment Agency and reinforced active labor market policies; and the controversial Hartz IV reduced the duration of the unemployment

benefit and introduced means-tested social assistance for the long-term unemployed, with the aim of reducing the reservation wage.

Nonetheless, deregulation is only a precondition for non-standard employment growth. Once it is permitted by law, its expansion is led by labor demand. Therefore, deregulation is normally selective, because, *de facto*, it tends to affect more less-skilled workforce, particularly in those industries and firms in which employees have less control over the production process and diminished labor strength, as will be exposed in the next subsection (Eichhorst and Tosch, 2015).

As shown in Figure 2, the four non-standard employment forms have increased to a greater or lesser degree over the period 1996-2014. Part-time work has been the fastest growing type during the reporting years (9.9 percentage points, pp), reaching an employment share of 28.4% in 2014. Temporary agency work incidence is the lowest one (1.8%), but it has tripled in size since 1996. Marginal employment is more than one tenth of total employment (12.2%), and grew rapidly until 2006. Fixed-term (7.5% in 2014) has grown 4.2 pp.



* Data cannot be totaled because the groups overlap | Data on marginal employment are not available from 1996 to 2005 | Data on agency workers from 1999 to 2001 are authors' own calculations | Marginal employment series between 1996 and 2005 (green dashed line) is obtained from Destatis (the IAB Establishment Panel does not provide data for these years).

* Source: IAB Establishment Panel, own calculations

Concerning the IRR system, three main factors have led its erosion. The first one is the shrinking coverage of sectoral level agreements and work councils, as well as the decrease in employer's associations and union density. Many companies abandoned sectoral bargaining due to their departure from employers' organizations or because they became special members (*ohne tarifbindung*), so they could avoid the wage agreement signed by the association.

During the 1990s, the relationship between suppliers and large producers or assemblers was hampered because of the aggressive tactics of the latter. Powerful large companies faced increasing competition in foreign markets by intensifying cost pressures on suppliers, with which they successfully negotiated price cuts. These practices damaged sectoral bargaining because large assemblers and suppliers were members of the same employer associations and thus were covered by the same collective agreements, in which the interests of the larger companies prevailed. Agreed-upon wages were too high for suppliers, and small medium firms were affected especially badly. As a result, intercompany solidarity was hurt, and a majority of SMEs flew from employer associations and sectoral bargaining (Silvia, 1997; Silvia and Schroeder, 2007). Furthermore, the outsourcing strategies of manufacturing firms have also contributed to the emergence of a segment of employees outside IRR institutions. The fragmentation of previously integrated production processes undermined coordinated bargaining by moving workforce from core to peripheral firms, in which different wage settlements (if any) are reached (Doellgast and Greer, 2007; Goldschmidt and Schmieder, 2017). Additionally, an important decline in work council coverage is registered. The falling share of employees without codetermination rights is mainly related to the growing pressures of the employers' associations, which had been pointing out that work councils enjoy "excessive rights" (Müller and Stegmaier, 2017) and the lack of union structure in these sectors.

The second cause of erosion was the decentralization of collective bargaining. New possibilities for firms to deviate from sectoral agreements and to implement local adjustments were designed. After the unification, the institutional structure was transferred from western to eastern *Länder*, where the economic structure was weaker, and the firms were less productive. At the same time, the environment in which eastern firms used to operate radically changed due to the privatization of the Kombinat (industrial production cores of the GDR) and the demise of the commercial partners of the former COMECON, which led to an increase in input prices and the closure of export markets. Furthermore the sudden exposure to national and international market and rapid exchange rate appreciation, resulted in a sharp crisis in 1992-93.

Furthermore, the first agreement in the metalworking sector for a progressive equalization of wages failed (*Stufenplan*). In the second agreement, social agents included hardship clauses (*härtefallklauseln*) and opening clauses (*öffnungsklauseln*) for eastern firms that could not comply with the sectoral one. This way, actors at the firm level were able to reach agreements on matters normally addressed at higher levels, eluding the favorability principle. Although, these clauses were created to avoid the abandonment of sectoral bargaining of eastern companies, they were ineffective for that purpose and a rapid steady decline in coverage was observed in the East during the mid-90s (Silvia, 1997; French, 2000).

Initially these clauses were designed for eastern companies with economic difficulties, but, in practice, they were (and still are) employed by healthy firms to implement internal flexibility measures regarding working time, compensation or organizational issues in exchange for

investment compromises and employment security⁸. In fact, they were the centerpiece of the process of “coordinated decentralization” (Seifert and Massa-Wirth, 2005) known as Pacts for Employment and Competitiveness, *Bündnisse für Arbeit und Wettbewerbsfähigkeit*, which helped some firms to regain competitive capacity (for a case study of the automotive industry, see Kädtler and Sperling, 2002). During the last crisis, these clauses, together with short-time work schemes (*kurzarbeit*), were mostly employed by manufacturing and construction firms to preserve their skilled workforces (Leschke and Watt, 2010; Reisenbichler and Morgan, 2012; Herzog-Stein et al, 2018).

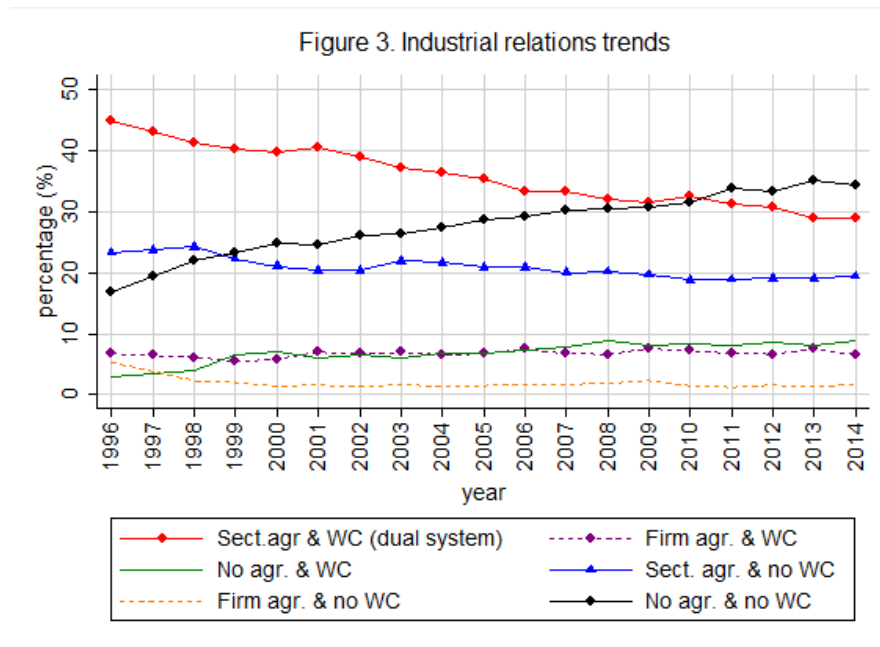
Third, some scholars stress the importance of the change in the employment structure. According to them, the decline in IIRR coverage is driven by the relative growth of employment in service industries (Thelen, 2014) or in small newly founded firms (Silvia, 1997; Addison et al, 2017c), in which unions are weak and the presence of the dual system is lower.

Naturally, this whole process of erosion has damaged the capacity of the system to promote social solidarity. Although pattern bargaining continue being effective to control wage growth across industries, it lost its redistributive capacity, causing a qualitative transformation of peak-level coordination. In the original MD, sectoral agreements imposed minimum standards over local actors, but now they are only a simple reference for individual bargainers at the firm level. For instance, the wage drift has been negative since 1995, which is the first year for which data are available (*WSI-Tarifarchiv*, 2019).

Trends of the IIRR system are plotted in Figure 3, which charts the six possible combinations between collective bargaining and work council presence⁹. In 1996, the coverage rate of the dual system of IIRR was 48.9%, but it decreased to 34.6% in 2014. A broader definition of it might include the employees covered by firm agreements and work councils. This particular type of coverage is low (7.4% in 2014), but has not change much over the period. Altogether, the proportion of employees covered by work councils and any type of collective agreement was 41.3% in 2014, indicating that the dual system is in marked retreat. Conversely, the segment without either bargaining or work councils has grown from 15.7% to 30.7%; thus, it has almost the same incidence than the dual system.

⁸ In 2003, 44% of establishments that concluded a company-level pact were in a profit situation rated as good or very good by their work councils. Furthermore, the economic situation of establishments that concluded company-level pacts in this year was only slightly worse than that of those that did not (Work Council Survey, in Seifert and Massa-Wirth, 2005: 224).

⁹ It is assumed that, if one establishment was covered by a collective agreement, all of its employees would be covered too.



Source: IAB Establishment Panel, own calculations

It is worth mentioning that the fall in the sectoral coverage has been partially compensated by an increase in the number of uncovered establishments (around 30% of total establishments in 2015), which orient their wage policy toward sectoral agreements, although bargaining individually with their workforce. Nonetheless, wage growth in these establishments has been lower than in the covered ones (Addison et al, 2016). Therefore voluntary orientation is not a perfect substitute of sectoral bargaining.

Overall, the erosion of the MD has had consequences on wage growth and income distribution. Labor institutions are determinants of working conditions and its weakening has been a main driver of the wage moderation experienced by the economy. Non-standard work, particularly marginal employment, is associated with higher levels of precariousness and instability (Eichhorst, 2015). Furthermore, the lack of collective agreements and union coverage impacted on wages too. For instance, Dustman et al (2009) find that the 28% of the increase in wage inequality at the lower-end of the distribution is explained by de-unionization. Moreover, Addison and coauthors show that wages paid by firms covered by collective agreements are significantly higher than those paid by non-covered ones (Addison et al, 2016). At the same time, the existence of a work council is positively related with higher wages (Addison et al, 2011). Regarding primary income distribution, the weakening of labor relations is directly related with the evolution of the wage share (Baccaro and Benassi, 2017). This variable decreased 8 percentage points between 1995 and 2007, registering one of the steepest fall among advanced economies (AMECO, own calculations).

In summary, aggregate data shows a general decomposition of the MD. Although there is a consensus about these general transformation, their dimension and location are not accurately measured. The following empirical analysis attempts to partly overcome this gap.

4.2. Mapping the evolution of the Modell Deutschland: establishments' trajectories

The interpretation and incidence of the above described layering process in the economy is unclear. Regarding the theoretical interpretation, the main issue lies on which are the employers' strategic interests.

On the one hand, scholars linked to VoC school highlight that manufacturing employers are interested in protecting the standard labor relationship and the dual system of IRR, because it promotes cooperation with the workforce, and helps to retain their skilled workers. Therefore, although more possibilities to hire atypical workers or to abandon centralized bargaining are available, it is expected that they would "remain loyal" to the traditional institutions for strategic reasons (Palier and Thelen, 2010; Hassel, 2014; Thelen, 2014).

They sustain that the process of institutional change has taken the form of dualization. They point out that the economy is composed of two segments: a coordinated core formed by manufacturing employers and their skilled workforce (the so-called manufacturing coalition), in which traditional institutions remain strong because they contribute to the employer's competitive advantage while promoting good working conditions; and a periphery of low-level services, in which the incidence of non-standard employment is particularly high, the dual system of IRR is hardly present and wages have dramatically fallen. Both segments are not self-contained areas, but "*the two sides of the same coin*" (Thelen, 2014: 51). The manufacturing producer coalition from which the MD spread across the whole economy has promoted dualization as a strategy to provide the needed labor flexibility while protecting the real wages of the core workers. Thus, they have sustained – or at least have not opposed – deregulation of the margins of the labor market and decentralization of collective bargaining, resulting in a segmented and less egalitarian but still coordinated economy (Thelen, 2009).

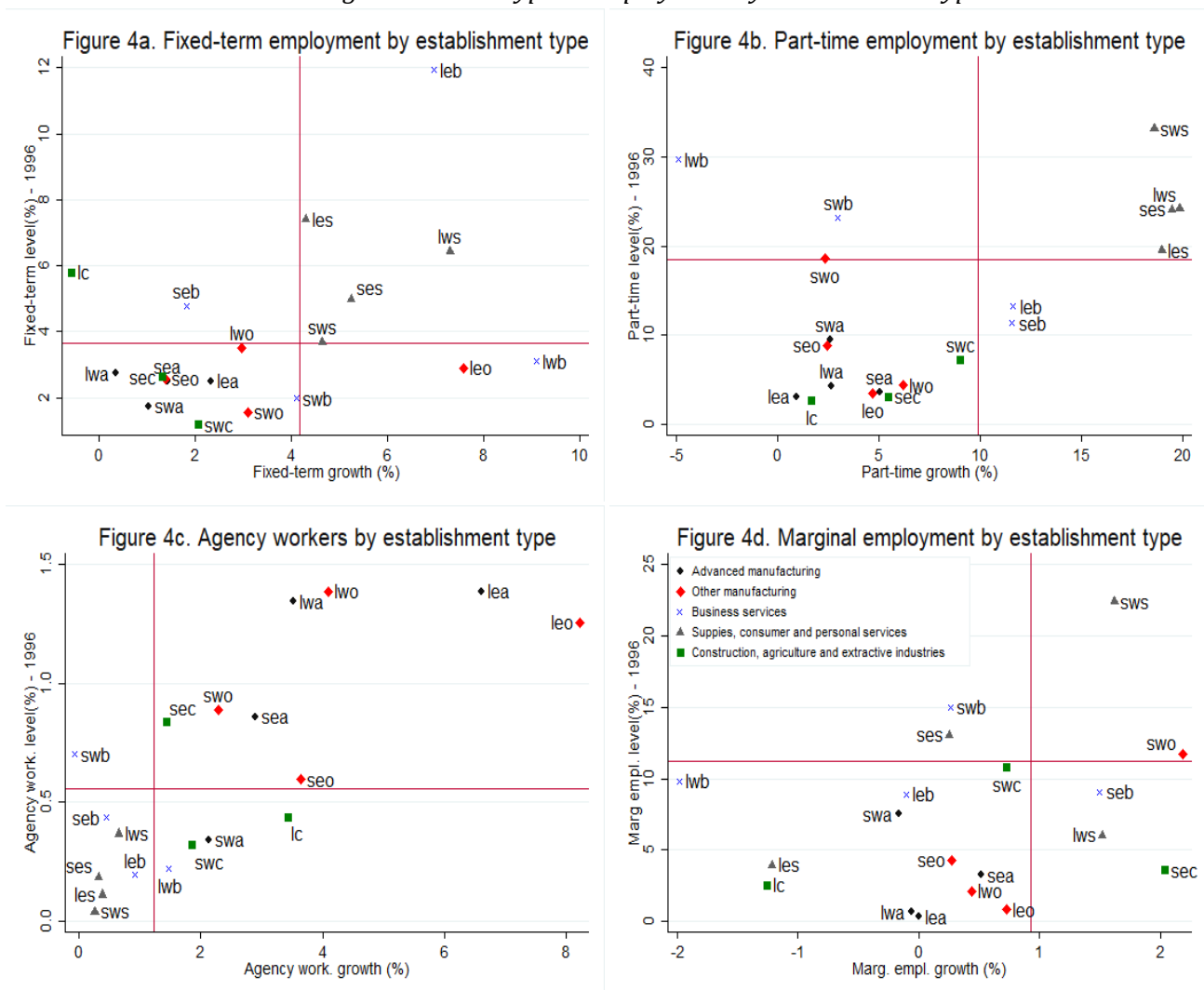
Other strand of literature holds that the economy has passed through a liberalization process, and that employers are rarely interested in institutions that limit their capacity to take discretionary decisions. Contrary to dualization scholars, these authors stress that institutions act as constraints on employers, forcing them to comply with minimum labor standards. Therefore, when they are weakened, an increase in atypical work and a reduction of IRR institutions coverage across the whole economy would be expected. In a nutshell, liberalization comprises the expansion of employer discretion thanks to globalization of economic relations, resulting in a wide reduction of job security and deterioration of IRR (Baccaro and Howell, 2011). This process has been sharpest in low-wage services, where skill levels and worker's bargaining power are low. Nonetheless, it has affected manufacturing industries as well, where firms attacked IRR institutions, implemented workforce segmentation strategies and used a higher share of atypical employment in order to face a growing price-elastic international demand (Baccaro and Benassi, 2017) and increase their profit margins (Streeck, 2009).

With this in mind, data is presented. Scatter plots are used to show the establishments that led to the erosion of the MD and those that preserved it. The cumulative growth (1996-2014) of each form of employment and the coverage of the dual system of IRR (horizontal axis) are plotted against the level of the same variables in 1996 (vertical axis). Lines represent the

growth and level of each variable for the whole sample. Acronyms are used to represent the establishment types.

Figures 4a-4d show the evolution of non-standard employment (Table A.4. in the Appendix). In this case, establishments that drove atypical employment growth are located in the upper-right sector, and those that contained it are in the bottom left sector. A rather weak association between both variables can be seen for fixed term, part-time and marginal employment. This means that these types of non-standard work have grown not only in those establishments in which they were already important, but across the whole sample. Agency work presents a strong positive correlation, i.e. it grew more in those establishments in which the initial level was higher.

Figures 4a-4d. Atypical employment by establishment type



1st letter = size ("l" large, "s" small and medium); 2nd letter = region ("w" west, "e" east); 3rd letter = industry ("a" advanced manufacturing, "o" other manufacturing, "b" business services, "s" supplies and consumer services, "c" construction, agriculture and extractive industries).

Source: IAB establishment panel, own calculations

Our results show that low-level services indeed drove this process, but other industries were also involved in it. For instance, fixed-term work growth was led by personal and consumer services together with large business service establishments, while the former also drove part-time expansion. Besides, marginal employment was particularly important for SMEs in services and non-advanced manufacturing.

On the other side, segmentation dynamics emerged in large manufacturing firms through agency work. Thus, even the core of the MD drew on deregulation and participated in the erosion process in this particular manner (Benassi, 2016, found that even high-skilled workers in these industries are affected by these dynamics).

IIRR trends are presented in Figures 5a-5b, which show, respectively, a narrow and a broad definition of the German dual system (Table A.5 in the Appendix). Due to the growth rate being negative, establishments located in the bottom left sector of these figures have led to the erosion of the IIRR system, while those located on the upper-right side have contained it.

Despite scholars mainly emphasizing the sectoral axis (e.g. Thelen, 2014), it is clear from these figures that firm size is the main determinant of IIRR coverage: all large establishments are situated above the average coverage level, while all SMEs are below it.

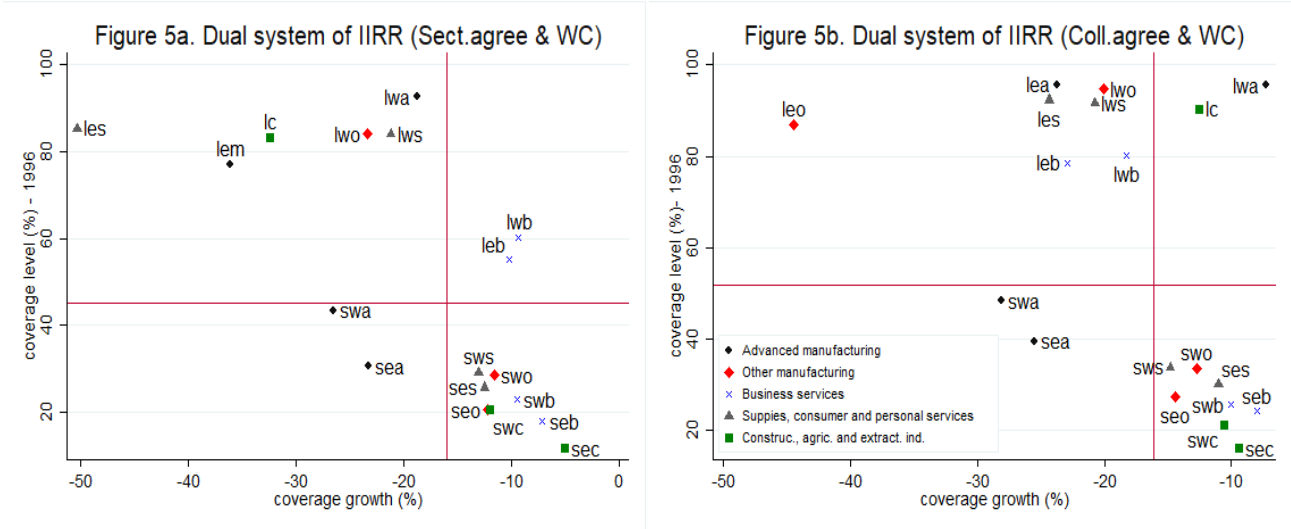
This trend is explained by the fact that workers are usually better organized in large firms, but also because the firm size is proxy for its position in the supply chain. As explained above, many manufacturing SMEs abandoned sectoral bargaining due to the aggressive strategies of the large assemblers. Moreover, many SMEs that are outside the collective bargaining comprise outsourced jobs from manufacturing. Interestingly, despite the dual system presence is very low in SMEs, the erosion process being greater in those establishments in which the dual system used to be stronger, i.e. the larger ones. In general, IIRR trends in non-advanced manufacturing and services were marked by the abandonment of the dual system, although the coverage still remains high in comparative terms. For instance, the coverage rate declined by 20pp in large non-advanced manufacturing establishments located in the west, although it remained comparatively high at the end of the period. Besides, it suffered a more pronounced decrease in eastern manufacturing (36pp), particularly when looking at non-advanced establishments. Large eastern establishments in consumer services present the sharpest decrease (50%)¹⁰, while large business services establishments show a moderate decline (although, if the definition of dual system is relaxed, the decrease almost doubles).

As explained, the region has been a historically critical variable to understand the decentralization trends. For this reason, IIRR institutions tend to be less present in eastern establishments, which are generally located in the left in Figures 5a-5b.

¹⁰ Due to sample restrictions, large eastern manufacturing establishments (*lem*) are grouped in the analysis of the narrow definition of the dual system. This problem does not exist for the broad definition. The results of the broad definition of the dual system lead into thinking that *leo* establishments are much further from the original MD than *lea* establishments (Figure 5b).

Finally, it is worth noting that advanced manufacturing establishments are located in the upper-left sector of the narrow definition of the dual system figure. However, when the definition is relaxed (Figure 5b), it falls in the upper-right sector. Stated differently, German core manufacturing has decentralized collective bargaining, but it has not turned into a “liberal-market” wage-setting system.

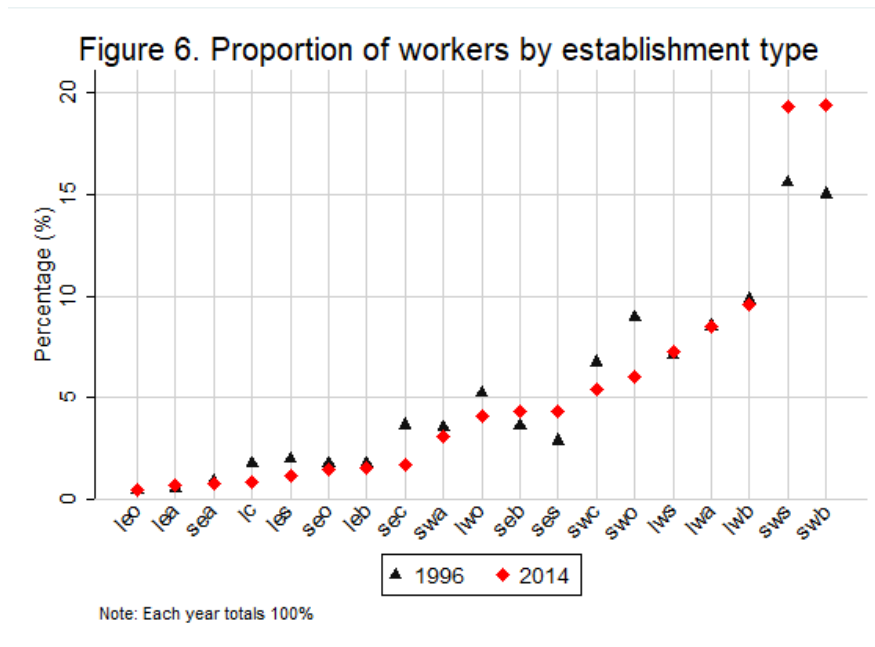
Figures 5a-5b. IIRR by establishment type



1st letter = size (“l” large, “s” small and medium); 2nd letter = region (“w” west, “e” east); 3rd letter = industry (“a” advanced manufacturing, “o” other manufacturing, “b” business services, “s” supplies and consumer services”, “c” construction, agriculture and extractive industries).

Source: IAB establishment panel, own calculations

In sum, over the period 1996-2014, IIRR erosion has been sharper in those establishments in which the MD used to be stronger, as is suggested by the negative relationship between the initial level and the evolution of the dual system coverage. The MD is still well grounded in large advanced manufacturing establishments, but they have been involved in the institutional change by increasing the share of agency workers in their workforces and by moving toward a more relaxed notion of the dual system, in which firm agreements have become more important. Nonetheless, a small share of the workforce is located in these establishments (around 9%; Figure 6). At the same time, enormous heterogeneity is found across the remaining establishment types (91% of the economy; Figure 6), indicating that several protagonists were involved in the erosion of the MD and that by no means has it only been only concentrated either in services, small firms, or eastern *Länder*. It seems that once institutional constraints were relaxed, the use of flexible forms employment and the individualization of wage bargaining increased throughout the whole economy.



Source: IAB Establishment Panel, own calculations

5. The role of individual strategic decisions and the structural change in the erosion of the *Modell Deutschland*

This section explores the influence of the structural change on institutional dynamics. The employment structure has deeply changed in advanced economies since the 1970s, as it did in Germany. In general, employment growth has been concentrated in industries and firms in which unions are weak, workers have less control over production processes and labor protection is low.

Previous works considered deindustrialization as a driver of institutional change (Lash and Urry, 1987; Traxler, 1996). Given that the original MD was grounded in manufacturing industries, the transition toward a service economy might have played a role in explaining the process. As stated above, this composition effect is mostly stressed by the dualization thesis, although without measuring it directly (Thelen, 2014). Moreover, structural change also comprises employment reallocation among firm types. We showed that employment in small firms increased (Figure 6), and the dual system is less grounded in them (Figures 5a-5b).

Taking into account the three variables considered so far (industry, establishment size and location), we seek to quantify the contributions made by establishments' strategic decision and by the structural change to the evolution of labor institutions.

To this end, Sharpe's (2009) decomposition formula is used. The advantages of this formula over other options are that it successfully controls reallocation effects, in contrast with the Traditional Decomposition Formula (De Avillez, 2012: 114), and that, against Fernández and Palazuelos' (2012) option, it distinguishes between two reallocation effects (level and growth), and it is perfectly additive.

This approach is formalized in Equation (1), which breaks down the absolute change in atypical employment share (IIRR dual system) (Δv_t) into three effects throughout the period (t) 1996-2014. In the formula, k is each establishment type. f is the share of each k group over total employment. A represents the number of atypical jobs (number of employees covered by the dual system of IIRR). E is total employment.

$$\Delta v_t = \underbrace{\sum_k [\Delta v_t^k * f_{t1}^k]}_{(1) \text{ WGE}} + \underbrace{\sum_k \left[\left(\frac{A_{t1}^k}{E_{t1}^k} - \frac{A_{t1}}{E_{t1}} \right) * \Delta f_t^k \right]}_{(2) \text{ RLE}} + \underbrace{\sum_k \left[\left(\Delta \frac{A_t^k}{E_t^k} - \Delta \frac{A_t}{E_t} \right) * \Delta f_t^k \right]}_{(3) \text{ RGE}} \quad (1)$$

In the Equation, three effects are measured.

- (1) *Within Group Effect* (WGE) captures the contributions to non-standard employment growth due exclusively to changes in demand growth undergone by individual establishments, weighted by its employment share in t1. In the case of IIRR, this term captures the contributions to the decrease in dual system coverage.
- (2) *Reallocation Level Effect* (RLE) measures the contributions caused by labor shifts to establishments with levels of atypical employment or IIRR coverage below – or above – average levels in t1, weighted by its employment share growth. This effect is positive in two situations: when a group above-average nonstandard employment (below average dual system coverage, due to it has been negative) level experiences an increase in its labor input share¹¹; or when an establishment with below-average non-standard employment (above average IIRR-core coverage) level experiences a reduction in its labor input share¹². It is also known as static effect.
- (3) *Reallocation Growth Effect* (RGE) captures the contributions caused by labor moves to establishments below – or above – average atypical employment (dual system coverage) growth, weighted by its employment share growth. RGE is positive either when an establishment above-average growth gains relative weight¹³ or when an establishment below atypical employment growth loses relative weight (below average and above average dual system coverage, respectively)¹⁴. It is also known as dynamic effect.

¹¹ When $\left(\frac{A_{t1}^k}{E_{t1}^k} > \frac{A_{t1}}{E_{t1}} \right)$ and $(f_{2014}^k > f_{1996}^k)$ for atypical employment; when $\left(\frac{A_{t1}^k}{E_{t1}^k} < \frac{A_{t1}}{E_{t1}} \right)$ and $(f_{2014}^k > f_{1996}^k)$ for IIRR.

¹² When $\left(\frac{A_{t1}^k}{E_{t1}^k} < \frac{A_{t1}}{E_{t1}} \right)$ and $(f_{2014}^k < f_{1996}^k)$ for atypical employment; when $\left(\frac{A_{t1}^k}{E_{t1}^k} > \frac{A_{t1}}{E_{t1}} \right)$ and $(f_{2014}^k < f_{1996}^k)$ for IIRR.

¹³ When $\left(\Delta \frac{A_t^k}{E_t^k} > \Delta \frac{A_t}{E_t} \right)$ and $(f_{2014}^k > f_{1996}^k)$ for atypical employment; when $\left(\Delta \frac{A_t^k}{E_t^k} < \Delta \frac{A_t}{E_t} \right)$ and $(f_{2014}^k > f_{1996}^k)$ for IIRR.

¹⁴ When $\left(\Delta \frac{A_t^k}{E_t^k} < \Delta \frac{A_t}{E_t} \right)$ and $(f_{2014}^k < f_{1996}^k)$ for atypical employment; when $\left(\Delta \frac{A_t^k}{E_t^k} > \Delta \frac{A_t}{E_t} \right)$ and $(f_{2014}^k < f_{1996}^k)$ for IIRR.

Therefore, structural change is captured by labor moves between groups (RLE and RGE components), while strategic or behavioral decisions are quantified by the WGE effect. The total contribution of each group (k) is equal to the sum of its components WGE, RLE and RGE. The formula is perfectly additive and contributions are expressed in relative terms. Results are presented after aggregating establishment types by either industry, size or location. They are offered in a disaggregated way in the Appendix (Tables A6 and A7).

5.1. Results: contributions to the erosion of the model

As shown in Figure 6, relative weights in employment of the selected establishments are quite distinct. For instance, eastern establishments account for less than 17% of employment altogether, so their contributions to institutional change will be rather moderated. Around 65% of the workforce is located in SMEs, while when looking at industry aggregates, the largest ones are business and supplies, personal and consumer services (35% and 32%, respectively). Each gained 4.5pp in the employment structure over the period. These structural features will be reflected in the formula's components.

Aggregated results show the importance of structural change when looking at atypical employment. Its contribution is positive for fixed-term, part-time and, particularly, marginal employment growth. In the case of agency work, structural transformations acted as a barrier to its expansion. Despite that, the WGE explains the greater part of non-standard work growth, i.e. strategic decision undertaken by firms, were the main driver of the process of institutional change in the labor market.

Results at industry level point to the leading role of consumer and personal services. These industries increased their share in total employment, and drove up fixed-term, part-time and marginal work through the WGE. Business services were important for fixed-term and part-time employment, whereas non-advanced manufacturing led agency work growth and, surprisingly, played an important role in the expansion of marginal employment. Contributions made by advanced manufacturing were high for agency work (it accounts –via WGE– for more than one third of its growth) and low for the rest of employment types.

Regarding establishment size, SMEs were the protagonist in the expansion of atypical employment. Their internal requirements (WGE) of fixed-term, part-time and marginal employment increased throughout the period. When looking at marginal employment, it is clear that they were the main benefited from its liberalization under Hartz II. Besides, due to their gained share in total employment, their contribution through RLE (33%) is notable. On the other side, large firms made, in general, smaller contributions to the process. It is worth mentioning that they even contained marginal employment growth. On the other side, their demand of agency workers (WGE) led the expansion of this type of employment.

Lastly, as expected, when taking into account the location, western establishments dominated the process, due to accounting for more than 80% of the workforce.

Table 1. Results of the decomposition formula

	WGE	RLE	RGE	TOTAL	WGE	RLE	RGE	TOTAL
	Fixed-term ($\Delta 4.17\%$)				Part-time ($\Delta 9.89\%$)			
Adv. manufacturing	2.2%	0.2%	0.4%	2.8%	3.7%	0.4%	0.3%	4.5%
Other manufacturing	13.9%	0.7%	1.1%	15.8%	7.9%	2.0%	2.8%	12.8%
Business services	38.8%	-1.1%	-0.8%	36.9%	4.1%	1.3%	-2.5%	2.8%
Supp., personal & consumer serv.	35.6%	0.2%	0.9%	36.7%	53.2%	6.3%	4.1%	63.6%
Constr., agric. & extr. industries	4.3%	0.5%	3.1%	7.8%	8.5%	6.1%	1.8%	16.4%
SME	50.4%	2.2%	3.7%	56.4%	56.0%	13.4%	5.6%	74.9%
Large	44.4%	-1.8%	1.0%	43.6%	21.4%	2.8%	0.9%	25.1%
West	81.4%	0.5%	3.3%	85.2%	58.4%	12.5%	4.6%	75.5%
East	13.4%	0.0%	1.4%	14.8%	19.0%	3.7%	1.8%	24.5%
<i>Total</i>	<i>94.8%</i>	<i>0.5%</i>	<i>4.7%</i>	<i>100.0%</i>	<i>77.4%</i>	<i>16.2%</i>	<i>6.4%</i>	<i>100.0%</i>
	Agency work ($\Delta 1.23\%$)				Marginal employment ($\Delta 0.93\%$)			
Adv. manufacturing	35.7%	0.1%	0.0%	35.8%	-0.8%	0.4%	0.7%	0.3%
Other manufacturing	40.7%	-1.5%	-5.7%	33.4%	20.9%	10.5%	-1.3%	30.1%
Business services	15.6%	0.5%	-5.2%	10.9%	-7.1%	1.5%	-2.1%	-7.7%
Supp., personal & consumer serv.	8.5%	-1.7%	-3.5%	3.2%	41.2%	26.4%	1.6%	69.2%
Constr., agric. & extr. industries	19.4%	-0.1%	-2.7%	16.7%	7.5%	1.0%	-0.4%	8.1%
SME	49.2%	-2.5%	-13.7%	33.0%	70.2%	33.4%	-0.5%	103.0%
Large	70.6%	-0.2%	-3.4%	67.0%	-8.4%	6.5%	-1.0%	-3.0%
West	98.1%	-2.1%	-15.7%	80.3%	50.9%	31.5%	-2.2%	80.3%
East	21.8%	-0.6%	-1.5%	19.7%	10.8%	8.3%	0.6%	19.7%
<i>Total</i>	<i>119.9%</i>	<i>-2.7%</i>	<i>-17.1%</i>	<i>100.0%</i>	<i>61.7%</i>	<i>39.9%</i>	<i>-1.6%</i>	<i>100.0%</i>
	Dual system - narrow definition ($\Delta -15.96\%$)				Dual system - Broad definition ($\Delta -16.13\%$)			
Adv. manufacturing	17.2%	0.0%	-0.4%	16.8%	12.3%	-0.4%	-0.3%	11.6%
Other manufacturing	17.7%	-0.9%	0.5%	17.4%	17.7%	-0.3%	0.3%	17.6%
Business services	17.3%	7.8%	-2.0%	23.1%	23.6%	8.8%	-2.1%	30.4%
Supp., personal & consumer serv.	31.6%	7.2%	-2.5%	36.3%	29.1%	7.7%	-1.0%	35.8%
Constr., agric. & extr. industries	9.8%	-4.1%	0.8%	6.5%	7.9%	-4.8%	1.5%	4.6%
SME	47.5%	3.0%	-0.7%	49.7%	50.8%	3.5%	-1.1%	53.2%
Large	46.1%	7.0%	-2.8%	50.3%	39.7%	7.6%	-0.5%	46.8%
West	74.0%	10.8%	-1.1%	83.7%	76.3%	9.8%	-2.7%	83.3%
East	16.5%	0.3%	-0.5%	16.3%	17.3%	0.2%	-0.8%	16.7%
<i>Total</i>	<i>93.6%</i>	<i>10.0%</i>	<i>-3.6%</i>	<i>100.0%</i>	<i>90.5%</i>	<i>11.1%</i>	<i>-1.6%</i>	<i>100.0%</i>

Source: IAB Establishment Panel, own calculation

Contrary to expectations, the erosion of the IIRR system was strongly driven by firm's strategic decisions, and the effect of structural change was of secondary importance (less than 10%).

The results reveal that more than 57% of the decrease of the dual system coverage (narrow definition) is caused by business services and by personal and consumer services. When using the broad definition, the contribution is even larger (66%). This is explained by behavioral factors (WGE) and also because labor has moved toward these industries, where coverage levels were below average (RLE). Advanced manufacturing industries did participate in the erosion of the IIRR. Their contribution was slightly alleviated by structural change and it is greater when considering the narrow definition of the dual system. This is partially reflecting what was pointed out in Section 4.2: large advanced establishments have been moving toward a more individualized wage-setting process without abandoning collective bargaining and work council representation.

The abandoning of sectoral bargaining in favor of firm-level negotiations is also captured in the firm size results. For instance, when looking at the narrow definition of the dual system, the WGE in large establishments is much higher. One should bear in mind that large establishments account for a small proportion of the workforce (only 35%), so the size of their contributions is quite high. Therefore, although coverage levels were lower in small establishments, the larger ones where the main drivers of its fall.

Regarding the influence of the location, western establishment made the most relevant contribution to the erosion of the IIRR system, doing so via WGE.

In sum, structural change influencing the process of institutional change in the MD, but it was not the main explanatory factor. Behavioral decisions carried out by individual firms were the drivers of this transformation.

5.2. *Discussion: dualization or liberalization?*

Our results illustrate that the erosion of the MD is a process in which all establishment types were involved in one way or another, and several trends were found.

First, the principal driver of the process of institutional change was the individual decisions within establishments across the whole private economy. We showed that traditional labor institutions are weaker in SMEs and service firms, nonetheless they have also been weakened in all other firm types. As a consequence, the effect of structural change, captured by RLE and RGE, is minimized.

The erosion of the MD is a case of layering in which the margins end up being larger than the core. At the beginning, the erosion of the MD was a typical case of dual legislation, by which deregulation was concentrated on the periphery of the labor market: protection against dismissals was only reduced for outsiders and the legal facilities to hire atypical workers were expanded. Nonetheless, although non-standard work was first consolidated in those firm types in which workers have less control over production processes and less bargaining power, it eventually grew across the whole economy. The same occurred when looking at the coverage of the dual system of IIRR: it first decreased in SMEs, where it was already low, and declined the most across large firms, especially in the service ones but also in manufacturing.

Second, the evolution of the model is not only shaped by a simple manufacturing against services logic. Western manufacturing has actively participated in the erosion of the MD, contributing to a greater or lesser degree to the expansion of the four forms of non-standard employment and accounting for approximately 30% of the fall in coverage of the dual system of IIRR in a narrow sense. Eastern manufacturing establishments have moved away from the original model too, but their contributions are comparatively small due to the labor input share. Therefore, the results suggest that without institutional constraints, employers would casualize employment relations. The weakening of labor institutions implied an overall deterioration of working conditions and the rapid individualization of wage bargaining.

In this respect, it is worth highlighting that large advanced manufacturing establishments, the core of the MD, did contribute to its erosion, but in a particular manner. Segmentation dynamics were detected within them in the form of agency work. At the same time, despite them still coordinating with their employees through the dual system of IIRR, some of them have moved from sectoral to firm agreements, contributing to the decentralization of collective bargaining. In sum, we detected an underlying process of re-institutionalization by which the former obligatory character of institutions is being relaxed. The core of the MD has remained neither stable nor aside from the process of institutional change. Furthermore, its size is relatively small.

As expected, the main drivers of institutional change were consumer and personal service establishments, particularly the smaller ones. They have led the expansion of three forms of atypical employment (fixed-term, part-time and marginal) and the drop of the dual system coverage through the WGE combined with the increase in its relative share in employment. On the other hand, business services were less involved in the expansion of atypical employment (only large establishments were determinant for fixed-term work growth), but they strongly influenced the drop of the coverage of the dual system of IIRR.

In summary, this chapter's findings suggest that the transformation of the MD, rather than being located in a concrete portion of the economy, is a general and comprehensive process. Hence, the overall situation of the model is better illustrated by the liberalization thesis (Streeck, 2009; Baccaro and Howell, 2011; Baccaro and Benassi, 2017). Nonetheless, we also show that liberalization has advanced more rapidly in some areas of the economy, which can be separated in a core, a heterogeneous periphery and a semiperiphery:

- The core is made up of core manufacturing establishments (9% of the workforce), which have increased the share of temporary workers and, although they still coordinate with their workforce through the dual system of IIRR, have moved toward a more individualized bargaining style.
- The periphery is formed by SMEs in non-advanced manufacturing and business services, and all establishments in consumer and personal services. They have departed from the dual system (the incidence of which was testimonial in 2014) and, in general, have substantially raised their levels of atypical employment, which vary depending on its form. It accounts for approximately 63% of the workforce.

- In an intermediate or semiperipheral position, large establishments in non-advanced manufacturing industries, business services and construction, agriculture and extractive industries establishments are found. On the one hand, they have decisively contributed to the decomposition of the MD through significant, atypical employment growth. On the other hand, in 2014 they still presented above-average IRR coverage rates. Also, small western and eastern advanced manufacturing establishments are located in this semiperipheral area, in which atypical employment levels and growth are below average, while the dual system of IRR has almost disappeared. Here about 33% of the workers are located.

6. Concluding remarks

This investigation has provided empirical evidence about the recent transformation of the MD in the face of globalization and deindustrialization. Using data from the IAB Establishment Panel, it was possible both to disentangle the performance of different segments of the private economy, and to measure the effect of the structural change on the evolution of labor institutions.

Two goals have been addressed. The first one was to map the evolution and current state of the model. The results showed that even core manufacturing firms increased their demand of non-standard work and have slightly abandoned sectoral agreements in favor of firm-level ones. Although they are still the last stand of the MD, only 9% of the workforce is employed there.

On the other hand, the erosion of the MD was concentrated in a periphery of low-level services and SMEs in business services and non-advanced manufacturing (63% of workers are located there). There, non-standard employment has exponentially expanded, and the joint presence of collective agreements and work councils was rarely found in 2014. Additionally, a semiperipheral area composed of establishments that used certain institutions and not others (33% of the workforce) was found; these are small, advanced manufacturing establishments that have overwhelmingly abandoned the dual system of IRR, but the incidence of atypical employment has remained remarkably low. There are also large establishments in non-advanced manufacturing, business services and construction, agriculture and service industries, in which atypical employment is high, but the two pillars of IRR are still present (although they have decisively contributed to the decrease of the dual system coverage).

The other goal of the article was to estimate the role of the structural change in the transformation of the MD. By adapting Sharpe's (2009) decomposition formula, we found that the effect is rather small, contrary to what dualization proponents suggest. Thus, even though the transition toward a service economy or the increase of SMEs did contribute to the erosion of the model, it was the establishments' preferences regarding its coordination strategies with the workforce which mainly drove the process of institutional change.

All in all, our results indicated that this process of institutional change is better captured by the liberalization theory. The main corollary here is that, once labor institutions are flexibilized, causal work relations and individualized wage bargaining spread across the entire economy.

Nonetheless, this landscape appears not to be an arrival point for the MD. Liberalization's potential to advance is still high, although the process is not linear. For instance, Benassi and Dorigatti (2015) showed that the strategies of German unions regarding marginal workers have changed since 2006, and now it is a priority for them to regulate and include the working conditions of these employees in collective bargaining. In this sense, Haipeter stated that collective actors "*have been sent to retirement too early*" by some scholars (2013: 116), and they are still powerful (and creative) in renewing some of the eroded institutions. Although liberalization seems to be a secular process, there are stages of economic deregulation that alternate with stages of *re-regulation* (Eichhorst and Marx, 2011). For instance, the growth of inequality as a consequence of liberalization impacted on the public opinion and trade unions attitudes toward the political intervention of the labor market. They, after years of reluctance, supported the introduction of the statutory national minimum wage in 2015 (Marx and Starke, 2017). At the same time, the legal preconditions for the extension of sectoral agreements were extended by an additional reform.

The final results of these trends remain open to question, and will mark the new nature of the MD.

Appendix – Chapter 2

Table A.1. Evolution of atypical employment

	Fixed term	Part-time	Marginal	Agency work	n
1996	3.30%	18.51%	-	0.56%	5,613
1997	3.87%	17.89%	-	0.74%	5,278
1998	4.28%	19.96%	-	0.83%	5,939
1999	4.96%	18.73%	-	0.87%	-
2000	4.66%	17.62%	-	0.91%	-
2001	4.57%	19.01%	-	0.95%	-
2002	4.64%	20.73%	-	0.99%	9,914
2003	4.80%	21.03%	-	0.86%	1,856
2004	5.30%	19.69%	-	1.15%	9,693
2005	6.10%	20.30%	-	1.29%	9,558
2006	6.31%	23.91%	11.24%	1.92%	9,241
2007	6.95%	22.77%	11.87%	2.25%	9,323
2008	7.33%	23.47%	11.00%	2.52%	9,074
2009	7.31%	22.72%	11.63%	1.56%	9,080
2010	7.02%	25.30%	10.89%	1.92%	8,549
2011	7.84%	23.60%	11.56%	2.21%	8,796
2012	7.55%	27.39%	11.94%	1.90%	8,897
2013	7.48%	27.39%	12.33%	1.94%	9,180
2014	7.47%	28.41%	12.16%	1.78%	8,977
Trend	***	***	ns	***	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: IAB establishment panel, own calculations

Table A.2. Evolution of IIRR: collective bargaining and work councils coverage

	Sectoral agreement	n	Firm agreement	n	No agreement	n	Work council	n	No Work council	n
1996	68.28%	3,589	12.06%	780	19.66%	1,244	54.57%	2,972	45.43%	2,641
1997	67.14%	3,203	13.36%	794	19.50%	1,281	52.95%	-	47.05%	-
1998	65.48%	3,493	8.39%	565	26.13%	1,881	51.33%	2,792	48.67%	3,147
1999	62.64%	3,353	7.49%	556	29.88%	2,334	52.45%	2,865	47.55%	3,378
2000	60.91%	4,612	7.23%	704	31.86%	3,457	52.67%	3,875	47.33%	4,898
2001	60.84%	5,042	8.57%	772	30.59%	3,902	53.45%	4,230	46.55%	5,486
2002	59.42%	5,030	7.95%	751	32.64%	4,133	52.27%	4,124	47.73%	5,790
2003	59.02%	4,648	8.62%	740	32.36%	4,191	50.03%	3,614	49.97%	5,965
2004	58.09%	4,717	7.85%	762	34.06%	4,214	49.65%	3,802	50.35%	5,891
2005	56.27%	4,562	8.23%	818	35.50%	4,178	48.83%	3,736	51.17%	5,822
2006	54.32%	4,212	9.20%	821	36.48%	4,208	48.30%	3,496	51.70%	5,745
2007	53.42%	4,077	8.44%	782	38.14%	4,464	48.07%	3,385	51.93%	5,938
2008	52.15%	3,929	8.50%	745	39.35%	4,400	47.34%	3,166	52.66%	5,908
2009	51.31%	3,810	9.86%	797	38.84%	4,473	47.07%	3,114	52.93%	5,966
2010	51.48%	3,347	8.66%	639	39.86%	4,563	48.24%	2,775	51.76%	5,774
2011	50.17%	3,396	8.04%	610	41.79%	4,790	46.12%	2,849	53.88%	5,947
2012	49.96%	3,377	8.19%	640	41.86%	4,880	45.95%	2,899	54.05%	5,998
2013	48.05%	3,416	8.71%	665	43.24%	5,099	44.55%	2,883	55.45%	6,297
2014	48.49%	3,274	8.29%	638	43.22%	5,065	44.51%	2,743	55.49%	6,234
Trend	***		***		***		***		***	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: IAB establishment panel, own calculations

Table A.3. Joint coverage of collective bargaining and work councils

	Dual system	n	Firm agree. & WC	n	No agree. & WC	n	Sect agree. & no WC	n	Firm agree. & no WC	n	No agree. & no WC	n
1996	44.97%	2,386	6.74%	388	2.87%	198	23.31%	1,203	5.32%	392	16.80%	1,046
1997	43.08%	-	6.43%	-	3.45%	-	23.80%	-	3.80%	-	19.45%	-
1998	41.19%	2,143	6.12%	372	4.03%	277	24.29%	1,350	2.27%	193	22.11%	1,604
1999	40.35%	2,066	5.46%	383	6.64%	416	22.29%	1,287	2.02%	173	23.24%	1,918
2000	39.83%	2,767	5.82%	482	7.02%	626	21.07%	1,845	1.42%	222	24.84%	2,831
2001	40.45%	2,979	6.97%	550	6.02%	701	20.39%	2,063	1.60%	222	24.56%	3,201
2002	39.01%	2,891	6.68%	539	6.59%	694	20.40%	2,139	1.27%	212	26.05%	3,439
2003	37.13%	2,507	6.96%	508	5.94%	599	21.89%	2,141	1.66%	232	26.42%	3,592
2004	36.40%	2,585	6.53%	529	6.72%	688	21.69%	2,132	1.32%	233	27.34%	3,526
2005	35.39%	2,490	6.73%	586	6.70%	660	20.87%	2,072	1.50%	232	28.79%	3,518
2006	33.43%	2,247	7.51%	572	7.37%	677	20.89%	1,965	1.69%	249	29.11%	3,531
2007	33.39%	2,131	6.74%	539	7.94%	715	20.03%	1,946	1.70%	243	30.20%	3,749
2008	31.94%	1,965	6.62%	495	8.78%	706	20.21%	1,964	1.88%	250	30.57%	3,694
2009	31.54%	1,895	7.51%	522	8.02%	697	19.77%	1,915	2.35%	275	30.82%	3,776
2010	32.65%	1,669	7.22%	466	8.36%	640	18.83%	1,678	1.44%	173	31.50%	3,923
2011	31.22%	1,723	6.81%	460	8.09%	666	18.95%	1,673	1.23%	150	33.70%	4,124
2012	30.84%	1,676	6.64%	477	8.48%	746	19.12%	1,701	1.55%	163	33.38%	4,134
2013	28.95%	1,658	7.45%	496	8.15%	729	19.10%	1,758	1.26%	169	35.09%	4,370
2014	29.01%	1,558	6.56%	458	8.94%	727	19.48%	1,716	1.72%	180	34.28%	4,338
Trend	***		ns		***		***		***		***	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: IAB establishment panel, own calculations

Table A.4. Evolution of atypical employment by establishment type

	Fixed term			Part time			Marginal			Agency work		
	1996	2014	Trend	1996	2014	Trend	2006	2014	Trend	1996	2014	Trend
swa	1.75%	2.78%	ns	9.50%	12.10%	ns	7.50%	7.33%	ns	0.34%	2.48%	***
sw0	1.57%	4.67%	**	18.58%	20.92%	ns	11.76%	13.94%	ns	0.89%	3.18%	***
swb	1.97%	6.08%	**	23.19%	26.18%	ns	14.99%	15.25%	ns	0.70%	0.63%	ns
sea	2.49%	3.91%	ns	3.65%	8.68%	***	3.23%	3.75%	ns	0.86%	3.75%	***
seo	2.57%	3.95%	ns	8.89%	11.31%	ns	4.31%	4.59%	ns	0.60%	4.23%	***
seb	4.76%	6.57%	ns	11.35%	22.96%	***	9.07%	10.57%	ns	0.43%	0.89%	ns
lwa	2.73%	3.09%	ns	4.25%	6.88%	*	0.65%	0.59%	ns	1.35%	4.86%	***
lwo	3.52%	6.48%	ns	4.42%	10.61%	***	2.10%	2.53%	ns	1.39%	5.48%	***
lwb	3.10%	12.21%	**	29.67%	24.75%	ns	9.82%	7.83%	ns	0.22%	1.70%	***
lea	2.51%	4.84%	*	3.13%	4.05%	*	0.34%	0.34%	ns	1.39%	8.00%	***
leb	2.91%	10.48%	*	3.54%	8.20%	**	0.82%	1.54%	ns	1.26%	9.47%	***
leo	11.94%	18.92%	*	13.25%	24.90%	**	8.89%	8.78%	ns	0.19%	1.12%	**
sws	3.68%	8.33%	**	33.18%	51.79%	***	22.41%	24.03%	ns	0.04%	0.30%	***
swc	1.19%	3.25%	*	7.22%	16.24%	***	10.77%	11.50%	ns	0.32%	2.17%	***
lws	6.45%	13.76%	*	24.20%	44.07%	***	6.03%	7.55%	ns	0.37%	1.02%	ns
lc	5.80%	5.23%	**	2.72%	4.36%	ns	2.52%	1.26%	ns	0.44%	3.87%	***
ses	4.99%	10.23%	*	24.13%	43.61%	***	13.08%	13.33%	ns	0.19%	0.51%	ns
sec	2.63%	3.94%	*	3.14%	8.60%	***	3.59%	5.63%	*	0.84%	2.27%	*
les	7.41%	11.71%	ns	19.53%	38.54%	**	3.96%	2.74%	ns	0.11%	0.50%	*

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: IAB establishment panel, own calculations

Table A.5. Evolution of IIRR by establishment type

<i>Dual system – narrow definition (Sectoral agreement & Work council)</i>				<i>Dual system – Broad definition (Coll. agreement & Work council)</i>			
	1996	2014	Trend		1996	2014	Trend
swa	43.43%	16.93%	***	swa	48.40%	20.27%	***
swo	28.42%	16.91%	***	swo	33.43%	20.68%	***
swb	22.64%	13.22%	***	swb	25.51%	15.47%	***
sea	30.52%	7.31%	***	sea	39.49%	14.03%	***
seo	20.38%	8.23%	***	seo	27.23%	12.84%	***
seb	17.65%	10.61%	***	seb	24.08%	16.13%	***
lwa	92.62%	73.92%	ns	lwa	95.58%	88.27%	ns
lwo	84.11%	60.79%	***	lwo	94.75%	74.66%	***
lwb	60.06%	50.81%	ns	lwb	80.16%	61.91%	**
lem	77.16%	41.07%	***	lea	95.68%	71.96%	**
				leb	86.87%	42.45%	***
leb	55.04%	44.91%	ns	leo	78.53%	55.64%	**
sws	28.96%	15.04%	***	sws	33.83%	18.41%	***
swc	20.47%	8.54%	***	swc	21.10%	10.54%	***
lws	84.12%	62.95%	***	lws	91.64%	70.89%	***
lc	83.24%	50.90%	***	lc	90.29%	77.79%	**
ses	25.65%	13.21%	***	ses	30.08%	19.05%	***
sec	11.59%	6.63%	***	sec	16.07%	6.69%	***
les	85.34%	35.03%	***	les	92.37%	68.05%	**

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: IAB establishment panel, own calculations

Table A.6. Results of the growth contribution formula – non-standard employment

	Fixed-term ($\Delta 4.17\%$)				Part-time ($\Delta 9.89\%$)				Agency work ($\Delta 1.23\%$)				Marginal employment ($\Delta 0.93\%$)			
	WGE	RGE	RLE	TOTAL	WGE	RGE	RLE	TOTAL	WGE	RGE	RLE	TOTAL	WGE	RGE	RLE	TOTAL
swa	0.9%	0.2%	0.3%	1.4%	0.9%	0.4%	0.3%	1.7%	6.2%	0.1%	-0.3%	5.9%	-0.7%	3.4%	1.0%	3.7%
swo	6.7%	1.2%	0.7%	8.6%	2.1%	0.0%	2.2%	4.3%	16.7%	-0.8%	-2.5%	13.4%	18.3%	-1.0%	-2.3%	15.0%
swb	14.8%	-1.4%	-0.1%	13.4%	4.5%	2.1%	-3.1%	3.6%	-0.9%	0.5%	-4.7%	-5.0%	5.3%	2.4%	-0.4%	7.4%
sea	0.3%	0.0%	0.1%	0.4%	0.5%	0.1%	0.0%	0.7%	2.1%	0.0%	-0.1%	2.0%	0.5%	0.6%	0.0%	1.1%
seo	0.6%	0.1%	0.2%	0.8%	0.4%	0.3%	0.2%	1.0%	5.2%	0.0%	-0.6%	4.6%	0.5%	1.8%	0.2%	2.4%
seb	1.6%	0.2%	-0.4%	1.4%	4.2%	-0.5%	0.1%	3.8%	1.3%	-0.1%	-0.4%	0.8%	6.4%	-0.9%	0.2%	5.7%
lwa	0.7%	0.0%	0.0%	0.8%	2.3%	0.1%	0.0%	2.4%	24.5%	0.0%	-0.1%	24.4%	-0.6%	-3.6%	-0.3%	-4.5%
lwo	3.7%	-0.1%	0.3%	4.0%	3.3%	1.6%	0.4%	5.4%	17.4%	-0.8%	-2.7%	13.9%	2.4%	9.0%	0.5%	11.8%
lwb	21.6%	0.0%	-0.3%	21.3%	-4.9%	-0.3%	0.4%	-4.8%	11.9%	0.1%	-0.1%	12.0%	-19.2%	-1.0%	-2.0%	-22.1%
lea	0.3%	0.0%	-0.1%	0.2%	0.1%	-0.2%	-0.1%	-0.2%	2.9%	0.1%	0.5%	3.5%	0.0%	0.0%	0.0%	0.0%
leb	0.9%	0.0%	0.0%	0.9%	0.2%	0.0%	0.0%	0.2%	3.2%	0.0%	0.0%	3.2%	0.4%	1.0%	0.0%	1.4%
leo	3.0%	-0.5%	-0.2%	2.3%	2.1%	0.1%	0.0%	2.2%	1.3%	0.1%	0.1%	1.5%	-0.2%	0.7%	0.3%	0.8%
sws	17.4%	0.3%	0.4%	18.2%	29.4%	5.5%	3.3%	38.1%	3.3%	-1.6%	-2.9%	-1.2%	30.4%	23.8%	1.5%	55.6%
swc	3.3%	0.7%	0.7%	4.7%	6.2%	1.6%	0.1%	7.9%	10.2%	0.3%	-0.7%	9.8%	4.4%	0.1%	0.1%	4.6%
lws	12.5%	0.1%	0.1%	12.7%	14.3%	0.1%	0.1%	14.5%	3.8%	0.0%	-0.1%	3.7%	11.7%	-0.8%	0.1%	11.0%
lc	-0.2%	-0.5%	1.0%	0.2%	0.3%	1.5%	0.8%	2.5%	4.9%	0.1%	-1.6%	3.4%	-1.0%	-0.9%	-0.2%	-2.2%
ses	3.6%	0.6%	0.4%	4.6%	5.7%	0.8%	1.4%	7.9%	0.8%	-0.4%	-1.1%	-0.8%	1.0%	1.4%	-0.5%	1.9%
sec	1.2%	0.3%	1.4%	2.8%	2.0%	3.1%	0.9%	6.0%	4.3%	-0.5%	-0.3%	3.5%	4.1%	1.8%	-0.3%	5.6%
les	2.0%	-0.8%	0.0%	1.2%	3.8%	-0.1%	-0.7%	3.0%	0.6%	0.3%	0.5%	1.5%	-1.9%	2.0%	0.6%	0.7%
	94.8%	0.5%	4.7%	100.0%	77.4%	16.2%	6.4%	100.0%	119.9%	-2.7%	-17.1%	100.0%	61.7%	39.9%	-1.6%	100.0%

Source: IAB Establishment Panel, own calculations

Table A.7. Results of the growth contribution formula – IIRR

Dual system - Sect. agree. & work council (Δ -15.96%)					Dual system - Coll. agree. & work council (Δ -16.13%)				
	WGE	RGE	RLE	TOTAL		WGE	RGE	RLE	TOTAL
swa	5.9%	0.0%	-0.3%	5.5%	swa	6.2%	-0.1%	-0.3%	5.7%
swo	6.4%	-3.0%	0.8%	4.3%	swo	7.1%	-3.3%	0.6%	4.4%
swb	8.9%	6.2%	-1.8%	13.2%	swb	9.4%	7.1%	-1.7%	14.8%
sea	1.3%	-0.1%	0.0%	1.2%	sea	1.4%	-0.1%	-0.1%	1.3%
seo	1.3%	-0.5%	0.1%	0.9%	seo	1.6%	-0.5%	0.0%	1.1%
seb	1.6%	1.2%	-0.4%	2.4%	seb	1.8%	1.2%	-0.4%	2.6%
lwa	10.0%	0.1%	0.0%	10.1%	lwa	3.9%	0.1%	0.0%	4.0%
lwo	7.6%	2.8%	-0.5%	9.9%	lwo	6.5%	3.1%	-0.3%	9.3%
lwb	5.7%	0.3%	0.1%	6.1%	lwb	11.2%	0.5%	0.0%	11.6%
lem	2.3%	-0.2%	0.1%	2.2%	lea	0.8%	-0.3%	0.1%	0.5%
					leo	1.3%	0.0%	0.0%	1.3%
leb	1.1%	0.1%	0.1%	1.3%	leb	2.5%	0.4%	-0.1%	2.8%
sws	13.6%	3.7%	-0.5%	16.9%	sws	14.9%	4.1%	-0.2%	18.9%
swc	5.1%	-2.1%	0.3%	3.3%	swc	4.4%	-2.6%	0.5%	2.3%
lws	9.5%	-0.3%	0.0%	9.2%	lws	9.2%	-0.3%	0.0%	8.9%
lc	3.6%	2.2%	-0.9%	4.8%	lc	1.4%	2.2%	0.2%	3.8%
ses	2.2%	1.8%	-0.3%	3.7%	ses	2.0%	2.0%	-0.5%	3.5%
sec	1.1%	-4.2%	1.4%	-1.7%	sec	2.1%	-4.4%	0.8%	-1.4%
les	6.3%	2.0%	-1.7%	6.6%	les	3.0%	2.0%	-0.4%	4.6%
	93.6%	10.0%	-3.6%	100.0%		90.5%	11.1%	-1.6%	100.0%

Source: IAB establishment panel, own calculations

Table A.8. Classification of economic activities (WZ08)

Advanced Manufacturing	Other manufacturing	Business services
303 Manufacture of air and spacecraft and related machinery	13 Textiles	46 Wholesale trade and commission trade, except of motor vehicles and motorcycles
21 Pharmatheuticals	15 Leather and related products	H Transportation and storage
26 Computer, electronic and optical products	17 Paper and paper products	J Information and communication
254 Manufacture of weapons and ammunition	10 Food products	64 Financial intermediation, except insurance and pension funding
29 Motor, vehicles, trailers and semi-trailers	11 Beverages	66 Activities auxiliary to financial services and insurance activities
325 Manufacture of medical and dental instruments and supplies	12 Tobacco	L Real estate activities
28 Machinery and equipment nec	14 Manufacture of wearing apparel	M Professional, scientific and technical activities
20 Chemicals and chemical products	251 Manufacture of structural metal products	N Administrative and support service activities (except Travel agency, tour operator and other reservation service and related activities (79))
27 Electrical equipment	252 Manufacture of tanks, reservoirs and containers of metal	
302 Manufacture of railway locomotives and rolling stock	253 Manufacture of steam generators, except central heating hot water boilers	
304 Manufacture of military fighting vehicles	255 Forging, pressing, stamping and roll-forming of metal; powder metallurgy	
309 Manufacture of transport equipment n.e.c.	256 Treatment and coating of metals; machining	
22 Manufacture of rubber and plastic products	257 Manufacture of cutlery, tools and general hardware	
301 Building of ships and boats	259 Manufacture of other fabricated metal products	
322 Manufacture of musical instruments	19 Manufacture of coke and refined petroleum products	
323 Manufacture of sports goods	310 Manufacture of furniture	
324 Manufacture of games and toys	161 Sawmilling and planing of wood	
329 Manufacturing n.e.c.	162 Manufacture of products of wood, cork, straw and plaiting materials	
23 Other non-metallic mineral products	181 Printing and service activities related to printing	
24 Basic metals	182 Reproduction of recorded media	
331 Repair of fabricated metal products, machinery and equipment		
332 Installation of industrial machinery and equipment		

Table A.8. Classification of economic activities (WZ08) (continue)

Supplies and consumer services	Construction, agriculture and extractive industries
D Electricity, gas, steam and air conditioning supply	A Agriculture, forestry and fishing
E Water supply, sewerage, waste management and remediation activities	B Mining and quarrying
47 Retail trade, except of motor vehicles and motorcycles	F Construction
I Accommodation and food service activities	
65 Insurance, reinsurance and pension funding, except compulsory social security	
79 Travel agency, tour operator and other reservation service and related activities	

Chapter 3

Institutional determinants of innovation in Germany: an empirical analysis from a Varieties of Capitalism approach

1. Introduction

Innovation has been pointed out as an important determinant of technical progress, which in turn is a main driver of international competitiveness and economic growth in the long run. Thus, the question of how to foster innovation has always been a central concern for policy-makers in order to ensure a good pace of income growth and welfare for the economy.

The varieties of capitalism (VoC) approach has made a great contribution to the topic of the institutional determinants of innovation. Nonetheless, since the publication of the Hall and Soskice's seminal work (2001), a controversial and still unresolved debate was triggered (see e.g. Amable, 2003; Taylor, 2004; Boyer, 2005).

The core argument of the VoC approach is that country-specific institutions not only determine innovation, but also explain the innovation patterns of a country and endow firms with comparative advantages in certain industries. As in other political economy approaches, institutional complementarity and institutional coherence are the key. The former concept embraces the idea that the joint presence or combination of a particular set of institutions improve the efficiency of the whole system or variety of capitalism (Whitley, 1999; Hall and Soskice, 2001; Amable, 2003), while the latter while the latter points to the congruence between the same types of institutions (Kenworthy, 2006). Therefore, the existence of institutional coherence boosts institutional complementarities. Hall and Soskice see two kinds of complementarities, the Liberal Market Economy (LME) type and the Coordinated Market Economy (CME) type – an additional model of capitalism is conceptualized, the Mixed Market Economy (MMEs) (Molina and Rhodes, 2007), but it is defined by its lack of institutional coherence and by underperformance compared to the other two types -. While the LME institutional setting boosts radical innovation due to the mixture of fluid labor and capital markets, general educational system and competitive inter-firm relationships, CMEs encourage incremental innovation, thanks to the combination of cooperative industrial relations and a tight labor market, patient bank-based financial system, industry-specific education and collaborative inter-firm relations. Therefore, liberal institutions support productive specialization in industries characterized by radical innovation, while coordinated institutions encourage specialization in activities where incremental innovation is required to compete.

The discussion on VoC claims is partly explained because a strict interpretation of the theory would lead to three contested corollaries. First, national institutions are the main determinant

of corporate strategies, and firms are mere passive institutional absorbers with little room for manoeuvre to undertake their own policies. Due to corporate strategies varying across countries, if a firm would like to perform well, it needs to be located inside a particular institutional framework. Second, incremental and radical innovation corporate strategies are fully dependent on the institutions of the variety of capitalism, and institutions that are helpful to incrementally innovate, discourage radical innovation and *vice versa*. Third, stemming from the latter idea, the distinction between industries characterized by radical innovation and those more prone to incremental innovation makes sense, but one might think that both types of innovative activity can be found in every industry.

Empirical research shows, at best, partial evidence about these corollaries. For instance, some studies have shown that economic activities that apparently do not fit well in CMEs are indeed well performed in these countries, and, thus, corporate strategies do not fully rely on national institutions but on the firms' own capabilities (Herrmann, 2008; Herrmann and Peine, 2011). At the same time, it is clear that the institutional structure of CMEs like Germany is only present in certain parts of the manufacturing sector, due both to its historical origins (Streeck and Yamamura, 2001) and to the features of the service industries (Thelen, 2014).

Regarding the German case, political economists have detailed the deep process of institutional change experienced by the *Modell Deutschland* and have pointed out that coordinated institutions are mainly employed by the most advanced firms of the economy (Palier and Thelen, 2010; Hassel, 2014). Likewise, the international business literature underlines other structural characteristics of the firm as determinants of innovation, such as the economic branch in which it operates, its exporting activity or its size (Cohen and Kepler, 1996). So, one can ask whether institutions are important for innovation or, on the contrary, if innovation is solely explained by other structural factors. In other words, it might be the case that coordinated institutions are only an option for the most advanced and productive firms, and the link between them and innovation may well be spurious.

Focusing on the German manufacturing sector, this chapter explores the link between coordinated institutions and innovation highlighted by VoC scholars. More precisely, two objectives are addressed. The first one (1) is to measure the joint impact of the abovementioned set of institutions on four types of innovation, namely incremental, radical, process and imitation. It is expected that those firms that make full use of all coordinated institutional arenas –thus expressing coherence- will be more prone to perform incremental and process innovation; on the other side, if the theory is correct, the effect of the same coordinated institutions on radical innovation should be negative. Its effect on imitative innovation is undefined. Our second goal (2) is to capture whether the innovation performance varies when taking into account the structural variables of the firm, i.e. the industry, its exporting activity or its size. Additionally, we focus on the most advanced manufacturing firms and measure the effect of institutions on their innovative activity; hence, potential biases are properly controlled and the role of coordinated institutions is better assessed. We expect that the importance of institutions would be minor for advanced firms because of their specific structural features.

The analysis is based on firm-level data from the IAB Establishment Panel, which offers high quality information about the innovative behaviour of the firm and its business policy. Our methodology consists of logistic modelling.

The structure of the chapter is as follows. Section 2 contains a comprehensive literature review on the nexus between institutions and innovation. Methodological aspects are presented in Section 3. A sample description and a set of preliminary results are reported in Section 4. The fifth section provides the results of the econometric analysis. Section 6 concludes.

2. Theory and findings on the institutional determinants of innovation

2.1. The role of institutions in the innovation process: the VoC approach

The VoC approach (Soskice, 1997; Hall and Soskice, 2001) sustains two interesting theoretical proposals: the firm-centered approach to institutions, which are considered as resources or tools for coordination; and the idea that national institutions, when fully coherent with each other, generate environments where firms develop capabilities to innovate and comparative advantages in some industries. Taking into account both proposals, national economies are clustered into two groups: liberal-market economies (LMEs), exemplified by the US, and coordinated-market economies (CMEs), whose archetype is Germany.

Firms are considered the key players in political economies. They are conceptualized as coalitions of economic actors -shareholders, managers, workers, financiers- with relational and dynamic capabilities (Hall and Soskice, 2001: 6; Jackson and Deeg, 2008: 549). It is only by the interaction among these actors that firms' core competencies can be developed and exploited. Yet, coordination problems in the form of moral hazard constantly emerge, and national institutions are seen as tools or resources to solve them and ensure coordination.

In economies such as the US, companies perform in fluid, deregulated and competitive markets, in which prices and individual formal contracts are the main instruments for coordination. Other standard features of these economies are weak collective actors and hierarchical decision-making processes within the firm. In this manner, national institutions encourage investment in transferable assets, allowing companies to make quick decisions and reconfigure their competitive strategies. On the other hand, in economies such as Germany, firms are embedded into an institutional setting composed of strong and corporatist collective actors that efficiently foster forms of coordination based on strategic interactions, in which the market plays a secondary role. It provides mechanisms for exchanging information, and monitoring and sanctioning others' behaviour, so agents are able to make credible long-term commitments among themselves. These non-market coordination practices support investments in non-transferable or co-specific assets, which are those whose returns depend upon long-term cooperation among agents.

What connects the first with second theoretical proposal is that corporate strategies are shaped by national institutions. Firms are well-disposed to use country-specific institutions because

they endow them with technological capabilities and comparative advantages in certain industries. Those economic activities that require fast –and sometimes risky- adaptations of contractual arrangements are better supported by LME institutions, such as flexible labor markets, general education, short-term oriented company finance and competitive relations among firms. On the other hand, those activities that involve long-term commitment and cooperation among actors benefit from CME institutions, like tight labor market, industry-specific education, long-term bank based finance and inter-firm cooperative relations. In this way, LMEs provide comparative advantages and support productive specialization in industries characterized by radical innovation - the creation of a totally new product or a major change in the production process-, whereas CMEs provide advantages and encourage specialization in industries characterized by incremental innovation –defined as continuous improvements to a product or production process that already exists -.

It is well known that VoC literature highlights four main institutional dimensions in which firms need to coordinate their endeavours with other agents: industrial relations, the financial system and corporate governance, the educational system and inter-firm relationships. However, the whole national institutional framework is more than the sum of its parts. What really matters is the coherence between these four spheres, and not each of them individually. Institutional complementarity is a common concept in political economics (Jackson and Deeg, 2008). It takes up the idea that the returns of an individual institution increase when another institution exists, and that a particular form of coordination in one institutional arena tends to foster analogous types in others. More precisely, the effects of a coordinated institution on economic performance will improve when interacting with other coordinated institutions, i.e. a coherent institutional environment. What provides firms with innovation capabilities and advantages in particular activities is the whole institutional structure of an economy (Whitley, 1999; Amable, 2003; Hall and Gingerich, 2009).

Turning to Germany, those firms in the country that make full use of non-market modes of coordination –a non-market corporate strategy- are expected to efficiently achieve the economic results predicted by Hall and Soskice. Focusing on innovation, the reasoning may be summarized as follows. German institutional framework supports incremental innovation. This innovation type is normally based on a skilled workforce with industrial and firm specific skills that perfectly understands the functioning of production process and the product line in which they work. At the same time, the workforce needs to be sure that technological progress will not affect their job situation, so long-term employment contracts, control and participation mechanisms in firms' decision-taking are necessary for its cooperation. Wages and working conditions are set in sectoral collective agreements. This is because firms are interested in settling the distributional conflict with labor away from workplaces, so cooperation with the workforce is easily achieved. Additionally, by promoting the same labor standards and low wage dispersion for the entire industry, sectoral agreements discourage the poaching of skilled workers by other companies. On the other side, close links between companies, suppliers and research institutions are needed to foster information exchange, and to detect and define areas of improvement in order to work jointly on them. Finally, the German stakeholder model of corporate governance –whose principle is that the company should not be controlled by any of

its constituent parts - encourages incremental innovation too. It discourages high-risk practices that could damage employment security, like the entry into new markets, and focuses on the increase in market share by the ongoing improvement of existing product lines and production processes. This is also helped by a traditional bank-based financial system that supplies firms with patient capital, and a cross-shareholding network, which protect firms against hostile takeovers so they can focus on productive issues (Vitols, 2001).

Nonetheless, business literature has highlighted that some structural features of the firm satisfactorily explain its innovative activity. Three of them are particularly relevant due to their influence on the rate of investment in R&D, namely the industry, the export status and the firm size. In this respect, in some industries firms require higher levels of investment in R&D and innovation than in others to remain competitive (Shefer and Frenkel, 2005). In the same way, exporting firms tend to be more innovative due to the harsh competition in international markets (Rogers, 2004; Pla-Barber and Alegre, 2007). Concerning the effect of firm size, there are two positions (Cohen and Kepler, 1996; Chandy and Tellis, 2000). Arguments in favour of superior large firms' ability to innovate are their greater resource availability, i.e. financing capability, sales volume and productivity –which reduces the fixed costs of innovation-, and the wider range of skills of their workforce. On the other side, advantages of small and medium firms are their flexibility and capacity to make faster decisions, reallocate resources and launch new projects. Although both views have received empirical support, the meta-analytical review made by Damanpour (2010) shows that the former position is more plausible, and innovation is more favoured by large firms.

These insights from business literature present some important challenges for VoC's innovation theory, particularly when looking at the German case. The process of institutional change the economy has gone through has put the Modell Deutschland in marked retreat. Nowadays, coordinated institutions –and mainly the ones related to industrial relations- are primarily employed by the most advanced manufacturing firms. For instance, trade unions and strong work councils are still firmly grounded in large manufacturing companies located in core manufacturing industries, but their influence on other types of firms has been eroded in the last thirty years (Hassel, 2014). However, is this simply because their levels of productivity are high enough to deal with coordinated institutions? Or are coordinated institutions real efficient tools to improve their innovative performance? These queries need to be solved to assess the real impact of institutions on innovation and are dealt with in the present chapter.

2.2. Review of empirical research: indicators of innovation and main empirical findings

Our literature review draws from two types of studies: those which try to test the VoC hypotheses by comparing the economic outcomes of diverse institutional configurations; and those which, focusing on Germany, estimate the effect of country-specific coordinated institutions -mainly those related to the labor market- on different types of innovation. Our aim in this article is connecting both approaches. As a result, it constitutes an empirical country-

case study that uses firm-level data and, at once, takes part in the debate of institutional determinants of innovation.

It is worth pointing out that contributions regarding the impact of institutions on innovativeness are sometimes difficult to compare. On one side, studies on the topic employ different indicators of innovation and select distinct institutional domains as explanatory variables. On the other side, some of them explore the nexus between institutions and innovation in one particular activity -the pharmaceutical industry¹⁵-, others focus on several countries, and others are country-case studies. Table 1 summarizes the most relevant works on the topic so far.

2.2.1. *Indicators of innovation employed by the literature*

A short comment on the indicators of innovation might be appropriate here. Three types of them are used in the literature. Some papers assume that medium-high (MHT) and high technology (HT) industries are inherently characterized, respectively, by incremental and radical innovation strategies (e.g. Schneider and Paunescu, 2012). Thus, a country's productive specialization, export performance or revealed comparative advantage (RCA) in these activities, reflect institutional support for one of these types of innovation. However, the main critique against this assumption is that it is possible to perform radical innovations in low-tech industries, or to imitate an existing product in high-tech industries. So, although one might think that the ability to innovate is a precondition for a firm to compete in an industry, productive specialization is just a second-best indicator of innovation.

Second, most articles employ patents as empirical material and several indexes are built with them. The principal advantages of patents are that they are an objective measure of innovation and patent data are widely available for most countries. On the other hand, its main drawback is that it is difficult to know which type of innovation is contained in the patent. Hall and Soskice (2001) themselves do not realize this, and calculate an index based simply on patent counting as a measure of innovation¹⁶, equating trivial patents with highly innovative ones. This issue is much better addressed by their critics, e.g. Taylor (2004) weights patent counts by the number of times they are cited, and identifies radical innovations as the most cited. Akkermans et al (2009) captures radical innovation by a novel multidimensional index based on (a) the number

¹⁵ There are, at least, two good reasons that explain the interest in this industry. Firstly, it is characterized by high levels of investment in research and development, so technical progress happens at a very fast pace, and both radical and incremental innovations are constantly obtained. Secondly, as Herrmann explains, the competitive strategies based on radical, incremental innovation or imitations are easy to detect because of the notion of NCE. An NCE is a chemical entity which has not been discovered before. Firms in the pharmaceutical industry indicate whether each pharmaceutical product is based on ingredients that are an NCE (radical innovation), on modifications of an NCE (incremental innovation) or on an imitation (2008: 640), so the link between theory and data is straightforward.

¹⁶ The index calculated by Hall and Soskice (2001: 41-43) is the country's patents in a k industry as a share of its total patents divided by the world's patents in the same k industry as a share of total global patents. A positive index score means specialization in innovation in the k industry.

$$Patent\ specialization\ index_{country\ k} = \left(\frac{Patents\ country_k}{Total\ patents\ country} \right) / \left(\frac{Patents\ world_k}{Total\ patents\ world} \right)$$

of citations received by a patent, (b) the number of scientific fields or patent types that are cited into a patent –the generality index-, and (c) the number of different scientific fields or patent classes from which a patent received citations –the originality index-. Those patents in the 10th decile are considered radical. Witt and Jackson (2016) follow this strategy and operationalize radicalness as the number of citation received, while generality and originality indexes are retained for robustness tests. Similarly, they define a patent to be radically innovative if it scores higher than 95th percentile of received citations, whereas an incremental innovation is the opposite (94th percentile or less). On the contrary, this approach has other limitations, namely, propensity to patent strongly varies across industries, not all innovation can be patented –e.g., new software-, some firms might take the decision to not patent a product due to cost or other strategic reasons, and citations are not received immediately, so some bias might exists (Akkermans et al, 2009; Witt and Jackson, 2016). Nonetheless, sector specific studies focused on the pharma industry do not have this problem due to NCE concept (see footnote 14).

Third, firms' innovative activity is also collected by surveys. This is the case of this work and others based on the IAB Establishment Panel (e.g. Addison et al, 2017a), which asks whether any type of innovation has been introduced by the establishment. Nevertheless, this option presents two limitations. There is not an objective measure of innovation, but it is the owner or manager of the establishment who is asked to rank it; therefore this variable might be affected by subjectivity bias. On the other hand, the researcher only knows whether an innovation has been performed over a time period, but not how many times it has been accomplished. Hence, relevant information is lost and methodological options are more restricted -e.g. it is not possible to use count data models, like Kraft et al (2011)-.

2.2.2. The nexus between institutions and innovation: a review of empirical results

Regarding the empirical findings, papers that studied innovation patterns of national economies from a VoC perspective have obtained inconclusive empirical evidence. In one of the most comprehensive studies to date, Schneider and Paunescu (2012) examine the effects of 26 OECD countries' institutional frameworks on the export share and the Balassa index of RCA in MHT and HT industries, and find that LMEs have RCA in HT industries while CMEs have it in MHT industries. Furthermore, they detect signals of liberalization and find that those economies that moved towards the LME type of capitalism increased their export share and RCA in HT activities more than those economies that remained LME since the start of the period¹⁷. Schneider et al (2010) analyse 19 OECD economies and also find empirical support for the hypothesis that, in general, LMEs hold RCA in HT industries, but CMEs do not. Interestingly, they capture that the combination of extensive university training and a large stock market is a sufficient condition to perform well in HT industries, while lax employment protection and low collective bargaining coverage do not appear to be important requirements. Ultimately, this

¹⁷ That is to say, an economy which wants to stimulate HT activities would be benefited from moving to a LME institutional framework.

analysis challenges the complementarity concept, and suggests that hybrid institutional frameworks are able to achieve strong economic performance in these industries.

On the other side, a comprehensive critique against VoC's theory of innovation is in Taylor (2004). He challenges the view that some industries are inherently more prone to radically innovate than others and criticizes the methodology employed by Hall and Soskice to test their claims. He finds that national institutions cannot explain innovation performance and that the results are strongly influenced by the inclusion of the US in the regressions. VoC's innovation thesis is also rejected by Akkermans et al (2009). They address the question whether LMEs innovate more radically than CMEs. To this end, they build a multidimensional index of radicalness based on patents (see Table 1). Although LMEs and CMEs present patterns of specialization similar to those predicted by VoC¹⁸, they find that radical innovations are not more common in LMEs in all industries if we understand radicalness as a multidimensional concept.

Focusing on the pharmaceutical industry, Herrmann and Peine (2011) explore the nexus between skill specificities and the type of innovation and competitive strategies. By comparing the UK, Germany and Italy, they test whether the skills required to perform radical, incremental or imitative innovations result from firms' competitive strategies or from the availability of these qualifications thanks to the country-specific educational and training system. They apply a mixed methodology that combines interviews with the firms' Human Resources managers and econometric analysis. Although evidence for one of the VoC's claims is found -the link between skill types and innovation (general skills boost radical innovation whereas specific skills push incremental innovation) -, their results suggest that the main determinant of firms' innovation patterns are their competitive strategies and not national institutional frameworks, because companies with the same competitive strategy present similar workforce composition and skill profiles, regardless of location. In an earlier study on the pharma industry in the same three countries, Herrmann (2008) obtains similar results: despite any alleged institutional (dis)advantage, firms are able to pursue the same strategy in different countries by using functional equivalents, i.e. by circumventing the economy's typical institutions to secure the required skill specificities for their corporate goals. They might *import from abroad* key employees that cannot be found in the country; or perform *contractual improvisation* by concluding non-standard contracts¹⁹. Thus, Herrmann concludes, there is not a sole competitive strategy in a national economy and firms are not mere institutional-takers, but they have the ability to institutionally innovate with the aim of being competitive in any particular industry.

¹⁸ For instance, LMEs roughly specialize in radical innovations in industries related to chemicals and electronics, while CMEs do so in machinery and transport equipment industries (Akkermans et al, 2009).

¹⁹ For example, firms which pursue incremental innovation strategies in UK may offer long-term labor contracts to their employees or combine specific training with intra-firm promotion schemes. On the other side, radical innovation corporate strategies in Germany and Italy are possible through partnerships with universities or offering researchers the opportunity to undertake a PhD or a postdoc in collaboration with the firm (Herrmann, 2008).

Table 1. Literature review

Authors	Indicator of innovation	Institutional domains considered	Scope and period	Methodology and results
Hall and Soskice (2001)	Number of patents: patent specialization index (PSI)	IIRR, Educational system, corporate governance and financial markets, inter-firm relations	USA and Germany; 1983-84 / 1993-94	- <i>Methodology</i> : descriptive analysis based on the PSI - National institutions determine innovation patterns - CME institutions boost incremental innovation and have CA in MHT industries; LME institutions support radical innovation and have CA in HT - CME institutions hamper radical innovation; LME ones are harmful for incremental innovation
Taylor (2004) (A)	Number of patents, weighted patent counting and scholarly publications	Country, assuming the VoC classification of CMEs, LMEs and MMEs	23 economies; 1975-1999	- <i>Methodology</i> : OLS regression models - National institutions do not explain innovation performance - Results are strongly affected by the inclusion of the US in the analysis
Herrmann (2008) (A)	Patent multidimensional index: (a) NCE = radical; (b) modification of a NCE = incremental	Skill formation system and labor market	Pharma industry in the UK, Germany and Italy; 2004	- <i>Methodology</i> : Multinomial and binary logistic regressions and interviews with firms' HR managers - Firms pursue the same competitive strategy in different institutional frameworks by using functional equivalents
Akkermans et al (2009) (A)	Patents: Multidimensional index formed by (a) number citations, (b) generality index, (c) originality index. Radical patents >= 90 percentile	Country, assuming the VoC classification of CMEs, LMEs and MMEs	22 economies; 1975-1999	- <i>Methodology</i> : Revealed comparative technological advantage, diagrams and chi-square tests - Radical innovation are not more common in LMEs than in CMEs
Schneider et al (2010) (M)	Industry (HT= radical innovation)	LM, Educational system, Financial system, Institutional arbitrage	HT industries in 19 economies; 1990-2003	- <i>Methodology</i> : FSQCA - Combination of university training and large stock market is sufficient condition to perform well in HT industries - The rest of institutions does not appear to be important factors - <i>Methodology</i> : Multinomial and binary logistic regressions and interviews with firms' HR managers
Herrmann and Peine (2011) (A)	Patents: (a) NCE = radical; (b) modification of a NCE = incremental	Skill formation and scientific system	Pharma industry in the UK, Germany and Italy; 2004	- the determinant of firms' innovation patterns is their competitive strategy - companies with the same competitive strategy present similar workforce composition and skill profiles, regardless of location
Schneider and Paunescu (2012) (M)	Industry (MHT= incremental; HT= radical innovation)	LM, IIRR, Educational system, corporate governance and financial markets, inter-firm relations	HT and MHT industries in 26 economies; 1990-2005	- <i>Methodology</i> : Cluster analysis and pooled cross-section regressions at the sector level - LMEs have RCA in HT industries, while CMEs have it in MHT industries - Economies that liberalize its institutional framework increase their export share and RCA in HT industries
Witt and Jackson (2016) (A)	Patents: number of citations. Radical patents >= 95 percentile	Corp. gov., inter-firm relations, hierarchies within firms, employment relations, and education	22 economies and 14 industries; 1995-2003	- <i>Methodology</i> : FSQCA - Radical innovation is boosted by the combination between: o liberal corp. governance and coordinated institutions; o coordinated IIRR and liberal institutions
Allen et al (2011) (G)	Question to the owner / manager of the firm	IIRR	German MHT and HT industries; 2007	- <i>Methodology</i> : Logistic regression model - Neither work councils nor collective agreements have a negative effect on innovation
Kraft et al (2011) (G)	Number of patents	Corporate governance	Germany; 1971-76 / 1981-90	- <i>Methodology</i> : Negative binomial and zero-inflated negative binomial models - Positive effect of codetermination on innovation
Addison et al (2017a) (G)	Question to the owner / manager of the firm	IIRR	Germany; 2007-2012	- <i>Methodology</i> : Probit and dif-in-dif models - German coordinated labor institutions positively impact on innovation
Addison et al (2017b) (G)	Question to the owner / manager of the firm	IIRR	Germany; 2005-2013	- <i>Methodology</i> : dif-in-dif model - Small positive effect of the German coordinated decentralization process on innovation

Notes: (A) evidence against VoC's hypotheses, (M) mixed evidence on VoC's Hypotheses; (G) Centered on Germany; FSQCA: fuzzy-set qualitative comparative analysis; NCE: New chemical entity

One of the most novel contributions to the topic was recently made by Witt and Jackson (2016). They revisit the complementarity concept and develop an alternative theoretical framework to explain why positive effects on radical innovation might arise from the combination between LME unconstrained market-oriented transactions and the beneficial constraints of CME institutions. Therefore, a positive marriage between apparently conflictual institutional logics may be achieved to counterbalance some weaknesses of pure institutional frameworks. In that way, LME institutions are effective to alleviate some rigidities of CME institutions, whereas the latter are useful to prevent some market failures that stem from LME logics. Concretely, coordinated employment relations and liberal institutions in other domains encourage comparative advantages in industries with radical innovation, because they force firms to make and protect investment in core human resources, preventing hyper-rational behaviours that lock actors into potential market failures (pp. 796). Likewise, liberal corporate governance mix well with coordinated institutions in other arenas, thus boosting comparative advantages in industries with radical innovation. This is because a more hierarchical corporate governance and external monitoring by financial markets might remove the lack of incentives to risk taking of highly coordinated actors. Witt and Jackson conclude, indeed, that the combination between beneficial constraints of coordinated institutions and unconstrained market oriented transactions positively impact on radical innovation. Nonetheless, to our knowledge, this investigation line has not been further developed yet.

A second group of papers relevant to our purposes has investigated the link between institutions and innovation patterns of German firms. Most of them are based on the *IAB Establishment Panel* and, interestingly, they all find a positive -or at least non-negative- impact of German coordinated institutions on all types of innovation. Therefore, they implicitly contradict the VoC claim on the harmful effect of non-market institutions on radical innovation.

Addison and his co-authors made two recent contributions to the topic. First, they (Addison et al, 2017a) investigate the nexus between cooperative industrial relations -i.e., the joint presence of collective agreement and work council in an establishment- and the same four types of innovation studied in this chapter -radical, incremental, imitation and process-, with the aim of challenging the studies made in the US that unanimously point to a negative effect. They analyse how innovation is affected by firm transitions towards sectoral agreements and *vice versa* and find that German coordinated institutions positively impact on it. In a second paper, Addison et al (2017b) quantify the effect of the Pacts for Employment and Competitiveness - the so-called opening clauses, a tool for organized decentralization of labor relations- on wages, employment, productivity, innovation and survivability of the establishment. In this case, innovation is a dummy variable that captures whether any process or product innovation was carried out, without differentiating between them. They report a certain positive effect of these clauses on innovativeness.

Focusing on the German pharmaceutical sector, Allen et al (2011) seek to challenge the VoC approach. Germany is highly competitive in the pharma industry, characterized by radical innovation patterns, despite the fact that this does not fit with the coordinated features of its institutional framework. They estimated a logistic regression for the year 2007 in which the

dependent variable is radical innovation and the predictors are 3 HT and 3 MHT industries²⁰, along with sectoral agreements and the presence of work councils. The results suggest that neither collective agreements nor work councils had a negative effect on radical innovation, and, surprisingly, that none of the industries included in the regression were less prone to radically innovate than pharma.

Lastly, Kraft et al (2011) employ a sample of 148 German stock companies to assess the impact of the co-determination law of 1976 (MitbestG) on innovation. The results show that, contrary to what mainstream economics predicts, codetermination does not harm innovativeness (even a small positive effect is found in some regressions).

In sum, although previous research suggests inconclusive evidence on VoC claims, a general positive effect of coordinated institutions on innovation is found in Germany.

3. Dataset and variable definitions

The analysis is based on the *IAB Establishment Panel*, a representative dataset of the Institute for Employment and Research (IAB) of the Federal Employment Agency (BA). It annually surveys establishments (not firms) from all sectors and sizes using a stratified random sample of all plants that employ at least one worker covered by social insurance on 30 June. The first survey was conducted in 1993 only for the former West Germany and was extended in 1996 to eastern establishments. The sample size has steadily grown, increasing from 4,265 establishments in 1993 to more than 15,000 from 2001 onward (for further details, see Fischer et al, 2009; and Ellguth et al, 2014). This dataset collects information about a wide range of topics, such as innovation, labor relations, training and other business policies. Thus an extensive amount of high-quality variables can be used to achieve this chapter's investigation goals.

Three years are selected for the analysis -1998, 2007 and 2013-, since the required variables are only available in these cross-sections.

The relevant variables of the study are measured in the following way (see Table A.1. in the Appendix for more details):

- (a) *Innovation variables*. Establishments can introduce three types of product innovation:
 - (i) *Incremental*, defined as the improvement or further development of a product already manufactured by the establishment;
 - (ii) *Radical*, which involves the introduction of an entirely new product for which a new market was created;
 - (iii) *Imitative*, when an establishment starts to offer a product that was previously available in the market.

²⁰ HT = Pharmaceuticals, Radio, television, and communication equipment, and Scientific instruments; MHT = Motor vehicles, Electrical machinery, and Chemicals (excluding pharmaceuticals).

- (iv) *Process innovation*, the owner or manager of the establishment was asked whether new developed procedures which have improved production processes were introduced;
- (v) Finally, we created a *dummy variable*, coded as 1 when an establishment has performed either incremental, radical or process innovation (imitation is excluded, because it is the less complex form of innovation and might bias the results).

However, it has to be noted that there is a break in the innovation measure from 2008 onward. Prior to 2008 the interviewee was inquired about the innovative activity of the establishment in the last two years, whereas, since 2008, the question references the last year, so the results in 2013 should be interpreted with caution. Despite that, we have decided to compare these three years because it allows coverage of a larger period of time and, when looking at the descriptive statistics and the models by year in the Appendix, the variables do not display strong variations. In addition, information about process innovation is only available from 2007 onward, so only two cross-sections are included in its analysis.

- (b) *Institutional variables*. The four institutional spheres highlighted by VoC literature are operationalized as follows:
 - (i) *Industrial relations*: it is a dummy variable that takes value 1 if the joint presence of collective agreement -either firm or sectoral- and work council is found.
 - (ii) *Cooperation among firms and other institutions*: it is captured by a dummy variable coded as 1 if the establishment declares to carry out research and development (R&D) in cooperation with other establishments, universities, consultants or non-university research institutions.
 - (iii) *Vocational training*: this binary variable takes value 1 if the establishment declares to have offered a permanent position to at least one of the apprentices that completed the vocational training in the present year. This means that the establishment both contributes and benefits from the German dual vocational training system.
 - (iv) *Cooperative corporate governance*: there is not a variable in the dataset that directly deals with this theme. Nonetheless, respondents are asked whether investment plans are set out in writing, so this question was selected to approximate the topic. We assume that if investment plans are explicitly indicated, more voices in the firm could veto strategic decisions and condition the course of the company.
 - (v) With these four variables, the main explanatory variable of the investigation is created. The variable *institutional spheres* captures the number of institutions present in a firm. Thus, when it is equal to four, it is capturing the adoption of a non-market corporate strategy by an establishment, i.e. the coherence concept. When this happens, the establishment is what we have termed “varieties of capitalism firm” (VoC firm).

- (c) *Structural variables*. Following the insights from business literature, we consider three variables that may affect the overall performance of the establishment and, particularly, its innovation pattern. They are industry, exports and establishment size.
- (i) *Industry*: this variable takes four values, due to manufacturing industries are clustered using the OECD taxonomy of economic activities based on R&D (Galindo-Rueda and Verger, 2016): medium-low technology (MLT), medium technology (MT), medium-high technology (MHT) and high technology (HT).
 - (ii) *Exports*: it takes three values: non-exporter, low and medium exporter (establishments which exported between 1% of their sales and the average value of the total sample) and high exporter (those which exported above-average sample sales).
 - (iii) *Size*: three establishment sizes are differentiated in the analysis: small (5-49 employees), medium (50-199 employees) and large (200 or more employees) establishments.

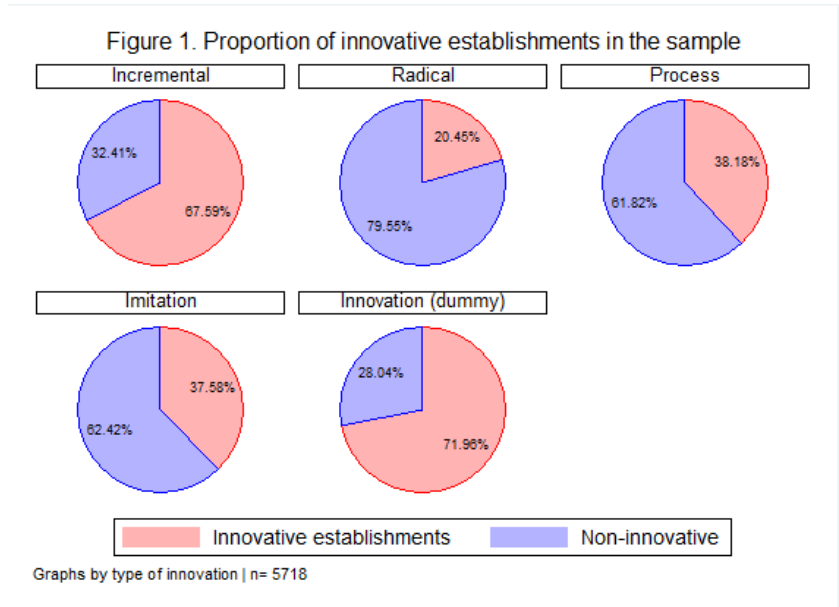
Additionally, other controls are included in the estimations and are defined in the Appendix (Table A.1.).

The 3-years sample is composed by 5718 observations in total. Although the fact that the analysis is not referred to a continuum, but grounded on three points in time, may pollute the results (e.g. it would be possible that in the year of the interview no innovations have taken place, while that an innovation has occurred in the subsequent or precedent year), the number of observations is sufficiently high to overcome almost completely this potential bias.

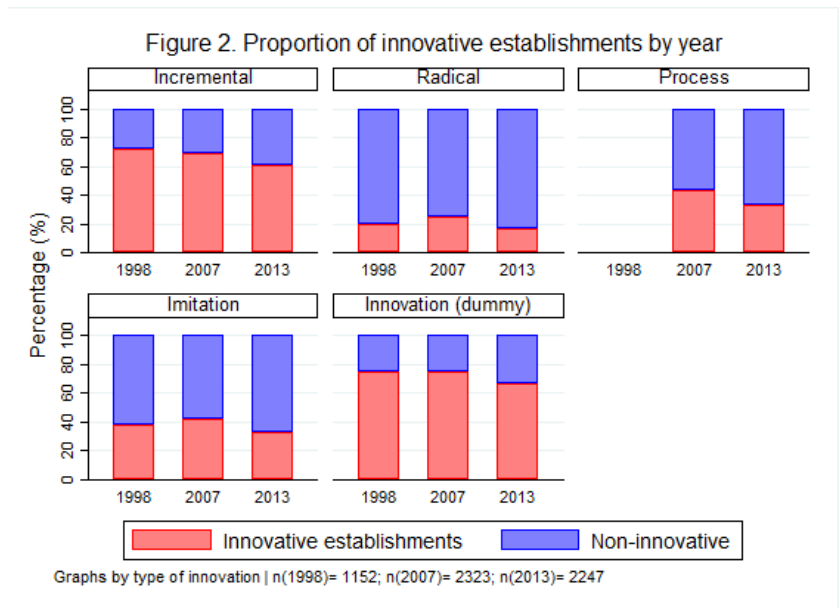
4. Sample description and preliminary analysis

At the outset, Figure 1 shows that incremental innovation is the most common type in German manufacturing industries. On the other side, as might be expected, radical innovation is the rarest one, performed by only the 20.45% of the sample. Process innovation and imitation are undertaken by slightly more than one third of the establishments.

Moreover, German establishments have become less innovative over time. Figure 2 offers a comparison of the proportion of establishments that innovate between the three sample years. As can be observed, it has decreased in all sorts of innovation, particularly when referring to the incremental one. Nonetheless, as mentioned above, this has to be read with caution due to the changes in the questionnaire.



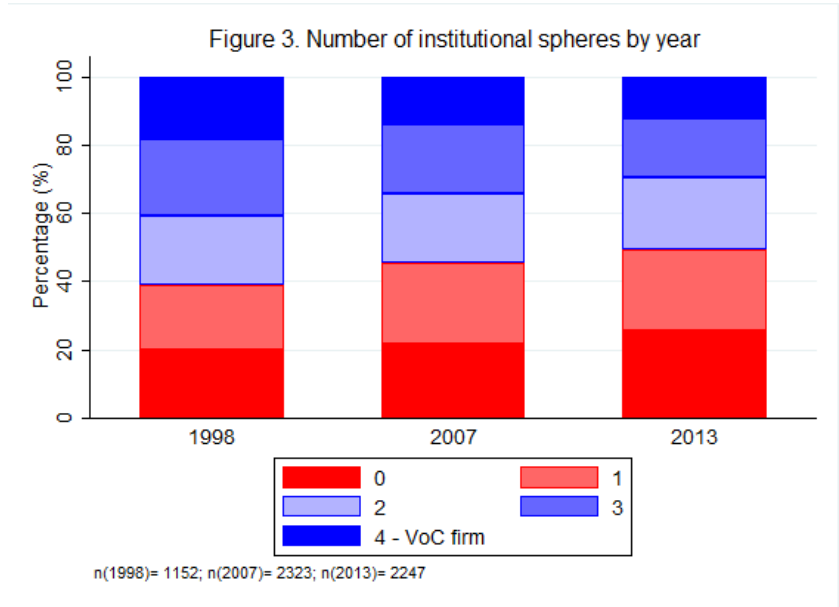
Source: IAB Establishment Panel, own calculations



Source: IAB Establishment Panel, own calculations

The institutional features of the sample are graphed in Figure 3. The sample partially reflects the strong signs of institutional change displayed by the German political economy. Note that the share of VoC firms has decreased from 18.23% to 11.97% in 2013, and the share of establishments with three institutional spheres also experienced a sharp decline. On the other side, the category that increased the most is the one with no coordinated institutions. In the Appendix the level and evolution of the four individual institutions are displayed (Table A.3.). Figure 3 also suggests that, contrary to what Hall and Soskice claimed, there is not only one possible competitive strategy in a particular economy, but a wide array of them. Furthermore,

the supposed optimal strategy in Germany, which is supported by the country's non-market institutions, is carried out by a minority of establishments.



Source: IAB Establishment Panel, own calculations

Focusing on the relationship between institutions and innovation, preliminary results suggest the importance of coordinated institutions for innovation. Table 1 displays conditional probabilities $P(\cdot)$ of a given innovation type, i.e. the proportion of establishments that have both introduced an innovation and present a particular institutional feature as a share of total establishments with that institutional feature. For instance, saying that the conditional probability to introduce an incremental innovation by establishments covered by both collective agreement and work council is 81.16%, is the same as saying that 81.16% of establishments within this subsample (establishments with collective agreement and work council) performed an incremental innovation²¹.

In general, the probability of an establishment innovating is always higher when an institutional feature is present. This is particularly true when looking at incremental and process innovation. On the contrary, institutional features seem to be of lesser importance for imitation and radical innovation.

When looking at the combination among institutions in an establishment, it is clear that the conditional probability to innovate increases with the number of coordinated institutional spheres interacting. VoC firms are particularly prone to implement incremental innovations; but, at the same time, they are in general more inclined to innovate than others. Although the theory states that coordinated institutions are not the best ones to promote radical innovation,

²¹ In this example: $P(\cdot \mid ca\&wc = yes) = \frac{(ca\&wc=yes) \cap (incremental=yes)}{ca\&wc=yes}$

data shows that it is more common in VoC firms than in others. In other words, it seems that, in Germany, the absence of coordinated institutions does not boost this innovation type (Table 2).

Table 2. Conditional probabilities to innovate by institutional feature

		Incremental	Radical	Process	Imitation	Dummy
Total sample	P(.)	66.67	20.64	38.27	37.52	71.51
(1) Coll. Agreem. & WC	P(. ca&wc=No)	58.81	17.98	31.19	35.42	64.37
	P(. ca&wc=Yes)	81.16	25.55	54.68	41.4	84.69
(2) R&D coop	P(. R&D=No)	51.74	12.20	25.56	30.23	57.91
	P(. R&D=Yes)	91.37	34.60	58.78	49.58	94.02
(3) Voc. Training	P(. VT=No)	57.13	16.56	28.49	32.48	62.55
	P(. VT=Yes)	78.27	25.60	50.57	43.65	82.42
(4) Corp. Governance	P(. CG=No)	48.64	11.56	20.26	27.91	52.94
	P(. CG=Yes)	78.05	26.37	49.68	43.59	83.24
(5) Institutional spheres	P(. Inst. S=0)	37.49	7.47	12.02	24.56	46.57
	P(. Inst. S=1)	59.00	15.15	31.28	32.52	69.24
	P(. Inst. S=2)	71.19	24.12	40.52	39.87	79.82
	P(. Inst. S=3)	84.09	28.44	56.57	46.84	90.13
	P(. Inst. S=4)	95.86	34.88	68.48	50.19	98.12
(6) Industry	P(. MLT)	57.77	15.90	30.97	34.45	66.72
	P(. MT)	65.31	18.67	37.53	36.36	73.92
	P(. MHT)	75.85	25.03	45.38	40.16	81.80
	P(. HT)	82.73	35.28	51.26	47.45	88.56
(7) Exports	P(. Non-exporter)	50.06	13.64	27.00	30.23	59.41
	P(. Low & medium)	73.29	22.14	40.06	41.91	81.77
	P(. High exporter)	85.64	30.43	55.05	43.79	89.71
(8) Size	P(. Small)	50.64	14.00	24.77	30.72	60.35
	P(. Medium)	71.39	22.31	38.12	39.85	79.40
	P(. Large)	88.63	30.05	66.04	46.48	92.83

Source: IAB Establishment Panel, own calculations

Nonetheless, Table 2 also shows that the three structural variables matter regarding innovation. A fairly linear relationship can be perceived: the probability to innovate increases

with the R&D intensity of the industry, with the exporting activity and with the size of the establishment. The former result challenges one of the VoC's basic axioms. One might expect that the probability to undertake incremental innovations would be greater in MHT industries than in HT industries, because firms in the former rely on this type of innovation to compete, since *"the problem [in MHT industries] is to maintain the high quality of an established product line, to devise incremental improvements to it that attract consumer loyalty, and to secure continuous improvements in the production process in order to improve quality control and hold down costs"* (Hall and Soskice, 2001: 39). However, it is clear that the more advanced the industry is, the greater the probability of an establishment performing any sort of innovation.

Lastly, Table 3 shows the tetrachoric correlations (correlation between any pair of binary variables) between innovation and institutions. It can be seen that all institutions are significantly and positively correlated to all innovation types. Again, institutions appear to be especially favourable to incremental innovation, but also to process innovation. The strongest correlations are found between R&D cooperation and the four innovation types. Nonetheless, these results are preliminary because structural variables and other observables are not controlled.

Table 3. Tetrachoric correlations

	Coll. agreement & work council	Cooperation in R&D	Vocational training	Corporate governance	VoC firm	n
Incremental	0.384***	0.675***	0.361***	0.471***	0.623***	5722
Radical	0.159***	0.452***	0.196***	0.334***	0.278***	5722
Process	0.356***	0.505***	0.207***	0.473***	0.452***	4570
Imitation	0.096***	0.307***	0.183***	0.257***	0.203***	5722
Inn. dummy	0.380***	0.682***	0.352***	0.512***	0.632***	5722

Source: IAB Establishment Panel, own calculations

5. Econometric analysis

In consistence with the abovementioned goals, the subsequent hypotheses are tested:

- HI. The combination of the four coordinated institutions in a firm would be beneficial to incremental and process innovation, but would negatively affect radical innovation.*
- HII. The effect of institutions on innovation might be affected by the structural variables of the firm, therefore institutions may be less important to innovation if the firm is either a high-exporter, large or operates in MHT or HT industries.*

Following the methodology of recent studies based on the same dataset (Addison et al, 2017a; Allen et al, 2011), the effect of institutions on innovation is assessed using logit regression models. Concretely, five models are estimated -one for each type of innovation-. They are pooled data models, in which the three available cross-sections -1998, 2007 and 2013- are introduced at the same time. The relevant explanatory variable is the number of institutional spheres found in each establishment. As indicated above, when the four spheres are present,

the establishment is a VoC firm. The model also includes the three structural variables – industry, exports and establishment size-, and, along with them, four additional controls: the location of the establishment, the state of equipment, satisfaction with past year profits and the expected business volume.

This approach is formalized in Equation (1):

$$L_i(\text{innovation} = 1) = \beta_0 + \beta_1 \text{Institutional spheres}_i + \beta_2 \text{Exports}_i + \beta_3 \text{Industry}_i + \beta_4 \text{Size}_i + \sum \beta_5 \text{Controls}_i + \varepsilon_i \quad (1)$$

In the equation, L_i stands for the logit of innovation²², which is a function of the linear combination of the set of variables on the right side of the equation and it is estimated using the maximum likelihood procedure. The formal interpretation of the coefficients is identical to that of the linear regression model. When the explanatory variable increases by one unit, the predicted values of the dependent variable -the logarithmic odds- increase by β units. However, it is hard to understand what “an increase in the logarithmic odds by β units” means. In order to facilitate the interpretation, the results are presented using odds ratio, average marginal effects and predicted probabilities. These transformations are explained in more detail below.

Multicollinearity problems between the independent variables were not found. In addition, the robustness of the regression results was examined by running the same five models by year.

5.1. Testing H1: results of the model

The results of the regressions serve us to test H1 and are presented in Table 4. As explained above, they are transformed in odds ratios to be easily interpreted²³. It is clear that the combination of the four institutional spheres is a key innovation driver. This occurs in all estimated models, but it is especially noteworthy for incremental and process innovation. Aside from this, the second model shows that radical innovation is also favoured by VoC firms, but to a lesser extent than other innovation types. Finally, imitation, as the less complex sort of innovation, presents positive but comparatively smaller effects, as might have been expected.

²² As it is well known, logit is the natural logarithm of odds.

²³ An odd ratio is a ratio of two odds. For example, in the incremental innovation model, the coefficient of the variable “institutional spheres”, when it takes the value 4 (VoC firm), is the ratio between the odd of being a VoC firm and innovate and the reference category of the variable (none institutional spheres), holding the other predictors constant at certain value:

$$\text{Odds ratio} = \frac{\left(\frac{\text{Pr}(\text{VoC firm} \cap \text{Innovation} = 1)}{\text{Pr}(\text{VoC firm} \cap \text{Innovation} = 0)} \right)}{\left(\frac{\text{Pr}(\text{Inst. sphere} = 0 \cap \text{Innovation} = 1)}{\text{Pr}(\text{Inst. sphere} = 0 \cap \text{Innovation} = 0)} \right)}$$

Thus, the coefficient 16.431 means that, holding the other variables constant, the estimated odds to innovate of VoC firms is 16.431 times the odds to innovate of firms with none institutional spheres. Naturally, an odds cannot be negative, and when it takes a value below 1 is indicating a negative relationship between the predictor and the dependent variable.

Odds ratios are obtained by computing the exponential of the corresponding coefficient from the logit model.

Table 4. Logistic regressions

	(1) Incremental	(2) Imitation	(3) Radical	(4) Process	(5) Innovation dummy
Institutional spheres (reference= 0)					
1	1.989*** (0.169)	1.367*** (0.124)	1.970*** (0.265)	3.059*** (0.362)	2.253*** (0.193)
2	2.801*** (0.280)	1.772*** (0.178)	3.313*** (0.462)	4.099*** (0.528)	3.264*** (0.339)
3	4.639*** (0.590)	2.319*** (0.268)	3.965*** (0.610)	6.055*** (0.881)	5.623*** (0.770)
4 – VoC firm	16.431*** (3.521)	2.686*** (0.361)	5.114*** (0.874)	7.652*** (1.301)	22.482*** (5.721)
Exports (reference= non-exporter)					
Low & medium exporter	1.638*** (0.123)	1.317*** (0.094)	1.253** (0.112)	1.069 (0.091)	1.724*** (0.137)
High exporter	2.174*** (0.221)	1.203** (0.102)	1.506*** (0.151)	1.281** (0.126)	2.055*** (0.223)
Industry (reference= MLT)					
MT	1.085 (0.088)	0.958 (0.072)	1.012 (0.096)	1.191* (0.107)	1.076 (0.091)
MHT	1.547*** (0.124)	1.027 (0.073)	1.290*** (0.111)	1.294*** (0.109)	1.484*** (0.125)
HT	2.020*** (0.303)	1.344*** (0.152)	1.960*** (0.245)	1.450*** (0.199)	2.146*** (0.356)
Size (reference= small)					
Medium	1.004 (0.085)	0.970 (0.079)	0.910 (0.091)	0.866 (0.081)	0.951 (0.084)
Large	1.337** (0.167)	0.994 (0.104)	0.930 (0.114)	1.671*** (0.202)	1.311* (0.179)
Year (ref= 1998;process= 2007)					
2007	0.958 (0.088)	1.292*** (0.101)	1.472*** (0.139)		1.171* (0.112)
2013	0.702*** (0.065)	0.917 (0.074)	0.938 (0.094)	0.708*** (0.049)	0.849* (0.081)
Location (reference= east)					
	1.083 (0.072)	0.810*** (0.049)	0.816*** (0.061)	1.279*** (0.093)	1.122* (0.077)
Equipment (reference= out-dated)					
Rather-old/medium	4.773* (4.453)	1.562 (1.304)	0.910 (1.021)	0.357 (0.343)	1.289 (1.044)
Rather new	6.519** (5.995)	1.668 (1.369)	1.184 (1.303)	0.623 (0.583)	2.077 (1.652)
Up-to-date	8.845** (8.160)	1.878 (1.545)	1.602 (1.767)	1.038 (0.976)	3.044 (2.434)
Past profit (ref= unsatisfactory)					
Sufficient	1.089 (0.158)	1.485*** (0.194)	1.133 (0.187)	1.349* (0.226)	1.146 (0.172)
Satisfactory	1.161 (0.152)	1.345** (0.159)	1.308* (0.191)	1.426** (0.215)	1.221 (0.166)
(Very)good	1.186 (0.151)	1.312** (0.150)	1.324** (0.187)	1.758*** (0.255)	1.303** (0.172)
Expected business vol. (ref=constant)					
Increase	1.376*** (0.102)	1.469*** (0.093)	1.218*** (0.092)	1.423** (0.109)	1.370*** (0.107)
Decrease	1.035 (0.093)	1.125 (0.095)	0.845 (0.094)	1.167 (0.119)	1.072 (0.100)
Constant	0.061*** (0.057)	0.122** (0.101)	0.041*** (0.045)	0.112** (0.106)	0.183** (0.148)
Pseudo-R2	0.1847	0.0442	0.0840	0.1577	0.1932
N	5718	5718	5718	4566	5718

Note: coefficients are odds ratios; Standard errors in parentheses

Source: IAB Establishment Panel, own calculations

On the other side, it has to be noted that the odds ratios of three structural variables are also statistically significant and positive, but its size is much smaller than that of the institutions. The results of some control variables are rather interesting; for instance, the probability to radically innovate and perform imitations is larger in eastern firms, whereas process innovation is more likely in the West. The state of the equipment is only relevant for incremental innovation. A satisfactory evaluation of the profit made in the last year is negative for incremental innovation, but positive for the remaining types. Lastly, the expectations of getting higher business volume encourage all kinds of innovation.

Reported in the Appendix are the models with the individual variables (Table A.4.). Two of them -cooperation to undertake R&D and corporate governance- impact positively on all innovation types. The effect of vocational training is only statistically significant to perform imitations or process innovations -although the estimated effect size is small-, while the impact of cooperative IIRR, even though negative, is only significant for imitative innovation.

All in all, the results lead us to *reject H1*: coordinated institutions are the main driver of all types of innovations, and the complete absence of them does not have a positive effect on radical innovation.

5.2. Testing HII (i): average marginal effects

To test the *Hypothesis II* we use the results of the logit models and calculate the marginal effects on innovation of each category of the institutional spheres variable when all other variables are at their means²⁴. These effects are computed for the three structural variables. By using this technique, problems of spurious relation are controlled and the effect of institutions is better isolated. For the sake of simplicity, in the following three graphs only VoC firms are represented. In the Appendix the coefficients for the rest of institutional spheres are included (Tables A8-A11).

Three general comments can be made to begin with. First, in comparison to the reference category (Inst. Sphere= 0), marginal effects are on average much higher for VoC firms in all categories of the abovementioned variables. Secondly, the average marginal effects do vary across categories of these variables. Third, as shown in the Tables A8-A11, the more institutions are present in an establishment, the higher the probability to innovate.

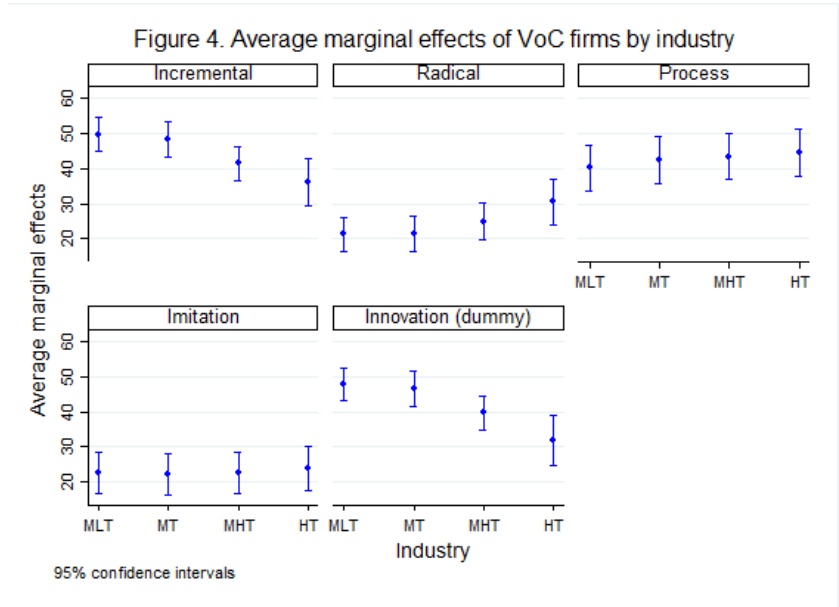
When looking at the industry (Figure 4), the effect of institutions on innovation differs among industry clusters and the type of innovation itself. For instance, the propensity to incrementally innovate of VoC firms in MLT and MT industries is almost 50 percentage points (pp) greater in comparison to the reference category, while in MHT and HT industries it is respectively around 40pp and 35pp greater. Nevertheless, when looking at radical innovation, the contrary is the

²⁴ Predicted logits are converted into predicted probabilities assuming mean values of the explanatory variables and using the following equation: $\Pr(\text{Innovation} = 1) = \frac{e^{L(\text{innovation}=1)}}{1+e^{L(\text{innovation}=1)}}$
Average marginal effects are the discrete change between two predicted probabilities.

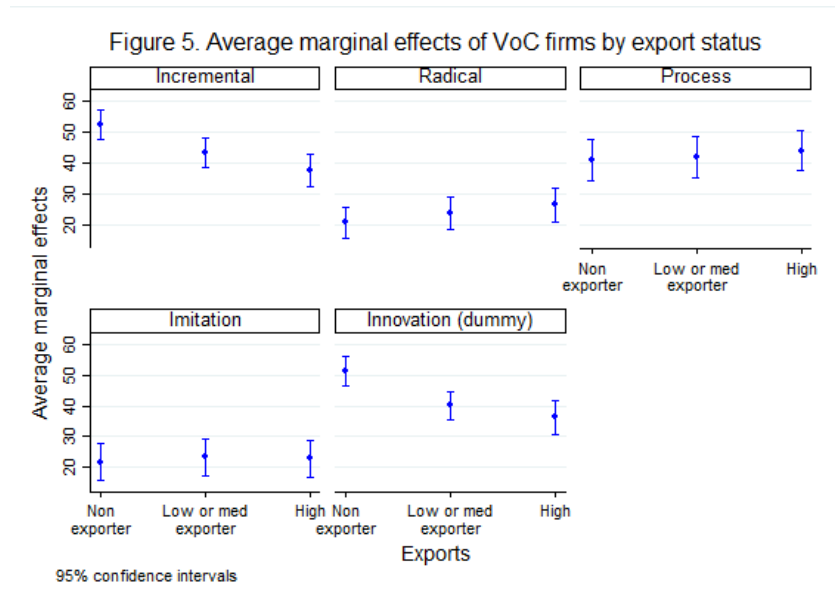
case and the combination of the four coordinated institutions has greater impact in MHT and HT industries. Process innovation and imitation present similar effects across industries.

Similar results are obtained if the exporting activity of the establishment is considered (Figure 5). Incremental innovation is benefited relatively more from coordinated institutions in non-exporting than in high-exporting establishments, while the contrary occurs for radical innovation. Again, the coefficients remain at almost the same level across categories for process innovation and imitation. The fact that marginal effects in HT industries and large exporters are lower might be reflecting the importance of these structural factors: the baseline innovation levels required to remain competitive in these categories are much higher than in the others, therefore the effect of institutions is lower (although large and statistically significant).

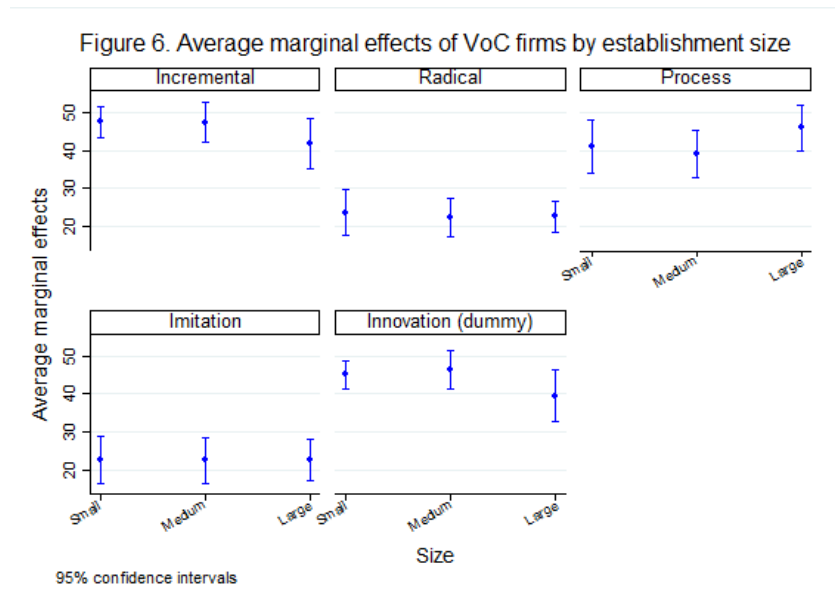
The probability to innovate of VoC firms is much more similar across size categories (Figure 6). Concretely, large establishments are benefited slightly less from coordinated institutions to incrementally innovate than small and medium ones. On the contrary, the effect on process innovation appears to be larger for them.



Source: IAB Establishment Panel, own calculations



Source: IAB Establishment Panel, own calculations



Source: IAB Establishment Panel, own calculations

Broadly speaking, the results show that coordinated institutions are favourable not only to incremental but to all types of innovation and that being a VoC firm is worthy in all industries, types of exporting status and sizes. Again, these findings present somewhat of a challenge to the Hall and Soskice's hypothesis that radical innovation is better promoted by market institutions. It seems that in Germany the main road to any kind of innovation is a non-market corporate strategy.

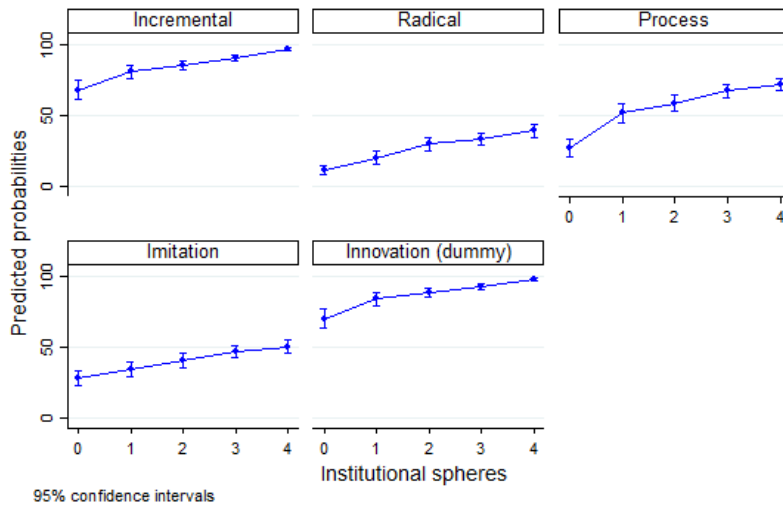
5.3. Testing *HII* (ii): predicted probabilities to innovate of core firms in core industries

In this section, we continue testing *HII* by focussing on German core manufacturing firms. These firms usually operate in international export markets, concentrate a large amount of resources and employ many workers. Furthermore, they operate in the most advanced manufacturing industries, i.e. MHT and HT ones. Thus, due to their own structural features, it is expected that core firms would be highly innovative, so the role of institutions here might be of lesser importance. Ultimately, this is the definitive test for the effect of coordinated institutions. For that purpose, we calculate predicted probabilities to innovate at each value of the institutional spheres variable only taking into consideration the abovementioned core firms. Results are plotted in Figures 7 (MHT industries) and 8 (HT industries).

Interestingly enough, it can be detected that the probability to innovate increases again with the number of institutional spheres. VoC firms always present the highest predicted probability to innovate, which is particularly important in incremental -above 97% in both MHT and HT industries- and process innovation -above 70% -. Furthermore, this relation remains for radical innovation, challenging again the assumption that coordinated institutions are inefficient tools to undertake it.

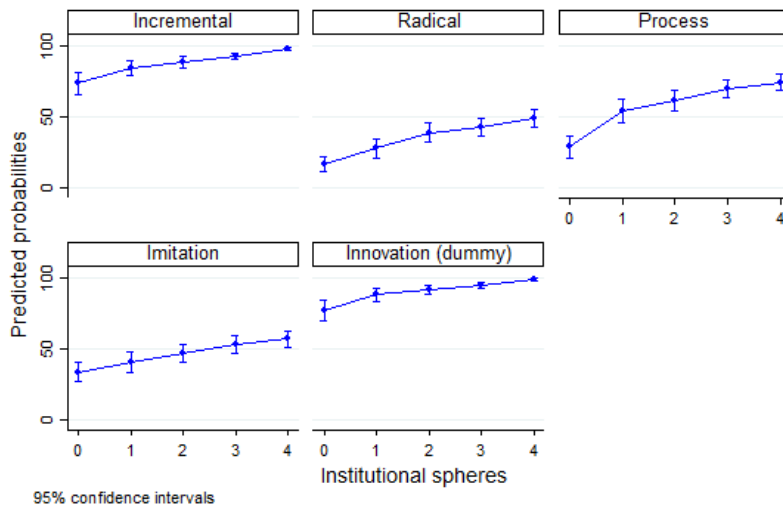
The main conclusion here is that, although highest marginal increases in the probability to innovate are found when passing from 0 to 1 institutional sphere, important increments are also obtained when passing from 3 to 4. Institutional coherence pushes the capability of a firm to perform innovations, and this also happens in the case of large exporting high-technology manufacturing firms. This means that coordinated institutions are critical for innovation, but also that it is worthwhile even for most advanced firms to be a VoC firm. Innovation is not just a matter of industry requirements or the individual features of firm, but of institutional settings. The obtained results support the idea that institutions endow firms with technological capabilities and comparative advantages, but in Germany this happens in all industry clusters and promotes a wide array of innovative activities. Therefore, *HII* is rejected too. These results also support the rejection of *HI*.

Figure 7. Predicted probabilities to innovate of large exporting establishments by number of institutional spheres (MHT industries)



Source: IAB Establishment Panel, own calculations

Figure 8. Predicted probabilities to innovate of large exporting establishments by number of institutional spheres (HT industries)



Source: IAB Establishment Panel, own calculations

Summing up, our results not only emphasize the importance of coordinated institutions for innovative performance, but also points to its versatility. Since they drive several forms of innovation, they are able to canalize the interaction among agents to produce different positive economic outcomes. In this sense, more evidence is needed to determine whether German VoC firms are more prone to radically innovate in comparison to ideal Anglo-Saxon firms in LMEs, and whether incremental innovation is also predominantly performed by the latter in these economies.

6. Discussion and conclusions

This chapter researched the link between institutions and innovation drawing on the VoC paradigm by Hall and Soskice (2001). The theory states that country-specific institutions, when fully coherent with each other, foster certain types of innovation and endow firms with comparative advantages to compete in some industries. Broadly speaking, firms embedded in CMEs are more likely to incrementally innovate and are relatively weak in performing radical innovations, while the contrary occurs in LMEs.

In the context of this debate and focusing on the German manufacturing sector, this investigation has examined some of the VoC's claims using the *IAB Establishment Panel*. Concretely, two goals have been addressed: (1) we explored the relationship between CME institutional coherence and the different types of innovation, and (2) estimated the effect of institutions when taking into account other structural determinants of innovation, such as firm size, the export status or the industry (Cohen and Kepler, 1996; Chandy and Tellis, 2000).

On the basis of logistic regressions two hypotheses have been tested. First (*H1*), it was expected that incremental and process innovation would be boosted by the combination of the four coordinated institutions, while radical innovation would be harmed by them. Nonetheless, we found that all types of innovation are favoured by coordinated institutions, and that the importance of institutional coherence only works in one direction in Germany: all types of innovation are favoured by the CME coherence, therefore it is when firms undertake a “non-market corporate strategy” when the probability to innovate is maximized.

Second, *HII* stated that the effect of institutions on innovation would be weaker in the presence of certain structural characteristics of a firm. Nonetheless, our results revealed that marginal effects of VoC firms on innovation are the highest in all categories of the structural variables. Furthermore, when looking at the most advanced firms in the economy – those that are large-sized, high exporters and located in MHT and HT industries -, which are usually innovation leaders, the relationship remained the same. Therefore the importance of coordinated institutions to undertake innovations is great even for advanced firms and it is worthwhile for these companies to be a VoC firm.

Our findings challenge some statements of the VoC paradigm and point to its need for reform. First of all, descriptive evidence showed that there is not one single competitive strategy in an economy. Thus, firms are not passive institutional takers, but can select among a wide array of competitive strategies to organize their capabilities and interact with their economic environment. In our sample, less than 20% of establishments pursue a coordinated strategy, while 20% of them adopt a fully-market corporate strategy. The relationship found between both types of institutional coherences and innovation patterns is linear: the more coordinated institutional spheres are present in a firm, the greater the probability to innovate. The same institutional combination that encourages incremental and process innovation is also beneficial for radical innovation. On the contrary, a coherent liberal strategy is detrimental to innovativeness. Put differently, the main road to innovation in Germany is a non-market

corporate strategy, based on institutional mechanisms that promote stable commitments and trusting relationships among economic actors.

Our results are coherent with Herrmann (2008) and the strand of literature that empirically tested the relationship between labor institutions and innovation using the IAB Establishment Panel (Addison et al 2017a, 2017b). However, future research might be focused on offering a theoretical explanation of the relationship between radical innovation and coordinated institutions found in this work, and exploring the channel by which institutional constraints support the development of new products or the application of new production processes. It seems that these institutions are more versatile than VoC expected, and are able to coordinate agents to promote a wide array of positive economic results. Another research line might explore the same relationship in other LMEs. It might be the case that in these economies, a full-market corporate strategy would be the most adequate one to undertake all types of innovation, and, in general, a concrete strategy is always the best one in an economy, no matter the sort of innovation the firm would like to carry out.

Lastly, it is worth mentioning the consequence of this chapter's results for policy-making: to keep up the pace of innovation and aggregate technical progress, social agents and political authorities must preserve and develop institutional tools to promote social partnership and the participation of the economic actors that are part of the firm in the decision-taking process. Nonetheless, descriptive evidence has shown that VoC firms are, in fact, a minority in the German manufacturing sector, and it is a consensus that their number has been decreasing over time due to the erosion of the *Modell Deutschland* (Streeck, 2009; Thelen, 2014). This leads to a somewhat contradictory dynamic in the German economy: the most innovative firms, which are supposed to lead the technical progress and productivity growth, account for a diminishing proportion of the total firm population. This means that, in absence of policies that protect coordinated institutions, to keep up the pace of aggregate technical progress, a greater proportion of it must be undertaken by a smaller amount of firms, unless another efficient institutional combination is found.

Appendix – Chapter 3

Table A.1. Variable descriptions for the logistic models

Incremental innovation: Dummy variable operationalized by the question “in the last 2 years, did your establishment improve or further develop a product or service, which had already been part of your portfolio?”
Radical innovation: Dummy variable operationalized by the question “have you started to offer a completely new product or service in the last two years for which a new market had to be created?”
Imitative innovation: Dummy variable operationalized by the question “in the last two years, has your establishment started to offer a product/service that had been available on the market before?”
Process innovation: Dummy variable operationalized by the question “Did you develop or implement procedures in the last two years which have noticeably improved production processes or services?”
Innovation dummy: this variable takes value 1 if the establishment has performed either incremental, radical or process innovation.
Industrial relations: Dummy variable coded as 1 if the establishment is covered by a collective agreement (either at firm or sectoral level) and a work council.
Cooperation among firms and other institutions: Dummy variable that takes value 1 if the establishment undertakes research and development activities in cooperation with other establishments, universities, consultants or non-university research institutions. This variable is operationalized by the question “Research and Development is often carried out in cooperation with others. How does it work in your case?” And the response options are “(a) We cooperate with other establishments; (b) With other universities/universities of applied sciences; (c) with external consultants; (d) no cooperation for R&D”. In 2013 there is an additional option, “(e) We cooperate with non-university research institutions”.
Vocational training: Dummy variable coded as 1 if the establishment declares to have offered a permanent position to at least one of the apprentices that completed the vocational training in the present year. Thus, all of the following conditions have to be met: (a) the establishment qualifies to provide professional training; (b) at least one hired apprentices has completed his/her training in the last year and has terminated his/her apprenticeship contract with the establishment; (c) at least one of these former apprentices has been offered a permanent position by the establishment.
Corporate governance: Dummy variable operationalized by the question “Please indicate whether the following instruments exist in your establishment/ office: Investment planning set out in writing”
Institutional spheres: Variable that captures the number of coordinated institutions used by the establishment. It can take value 0 (the establishment does not employ coordinated institutions), 1 (it uses only one), 2, 3 or 4. As can be seen, this variable does not take into account which institutions are present in the establishment, only the amount of them. When the four institutions are registered in an establishment, it is a VoC firm.
Exports: It is built as of a continuous variable that captures the proportion of the sales achieved in foreign countries in the previous year. It takes three values: non-exporter (the establishment does not export), low and medium exporter (the establishment achieved abroad between 1% of its sales and the average value of the total sample), and high exporter (the establishment achieved abroad above-average sales). In 2013 the question slightly changes and the variable is computed on the business volume.
Size: Variable which takes three values: small (5-49 employees), medium (50-199 employees) and large (200 or more employees).
Industry: Following the OECD classification of R&D intensity (Galindo-Rueda and Verger, 2016), manufacturing industries are clustered into four categories. Based on the WZ08 classification, industries at the 3-digit level are ranked as follows: HT (211/212, 254, 261/268, 303), MHT (201/206, 271/293, 302, 304, 309, 325), MT (221/245, 301, 321/324, 329, 331/332) and MLT (101/192, 251/253, 255/259, 310).
Location: Dummy variable that takes value 1 if the establishment is located in a western state and is equal to 0 if it is located in the East.
State of the equipment: It is captured by the question: “How do you assess the overall technical state of the plant and machinery, furnitures and fixtures of this establishment compared to other establishments in the same industry?” Answers are given using a scale from 0 (out-dated) to 4 (up-to-date).
Past profits: The owner/manager is asked to give an assessment of the profit situation of the business in the last fiscal year. Answers are given using and scale from 0 (unsatisfactory) to 3 (very satisfactory).
Expected profits: The owner/manager is asked about the expected business volume in the current year as compared to the previous one. Three options: constant, increase or decrease.

Table A.2. Share of innovative establishments in the total sample and by year

	1998	2007	2013	Total
Incremental	72.48%	69.13%	61.15%	66.67%
Radical	19.79%	25.10%	16.47%	20.64%
Imitation	38.19%	42.14%	32.40%	37.52%
Process		43.44%	32.93%	38.27%
Dummy	74.48%	74.47%	66.93%	71.51%
n	1,152	2,323	2,247	5,722

Source: IAB Establishment Panel, own calculations

Table A.3. Establishments' institutional features (total sample and by year)

		1998	2007	2013	Total
Coll. Agreem	No	44.88%	66.55%	73.30%	64.84%
	Yes	55.12%	33.45%	26.70%	35.16%
R&D coop	No	64.67%	62.07%	61.37%	62.32%
	Yes	35.33%	37.93%	38.63%	37.68%
Voc. Trainin _i	No	51.65%	53.34%	58.12%	54.88%
	Yes	48.35%	46.66%	41.88%	45.12%
Corp. Gov	No	38.37%	37.06%	40.54%	38.69%
	Yes	61.63%	62.94%	59.46%	61.31%
Inst. spheres	0	19.62%	21.70%	25.32%	22.70%
	1	19.10%	23.59%	23.99%	22.84%
	2	20.75%	20.45%	21.36%	20.87%
	3	22.31%	20.58%	17.36%	19.66%
	4	18.23%	13.69%	11.97%	13.93%
n		1,152	2,323	2,247	5,722

Source: IAB Establishment Panel, own calculations

Table A.4. Logistic models - individual institutional variables

	<i>Incremental</i>	<i>Imitation</i>	<i>Radical</i>	<i>Process</i>	<i>Dummy</i>
Coll. Agr. & WC (ref= no)	0.955 (0.090)	0.789*** (0.062)	0.868 (0.080)	0.993 (0.092)	0.929 (0.093)
R&D coop. (ref= no)	5.446*** (0.499)	1.816*** (0.121)	2.750*** (0.220)	2.479*** (0.194)	5.950*** 0.6247528
Voc. Training (ref= no)	1.099 (0.085)	1.170** (0.080)	1.015 (0.085)	1.164* (0.094)	1.112 (0.090)
Corp. Governance (ref= no)	1.708*** (0.126)	1.457*** (0.102)	1.645*** (0.150)	2.080*** (0.176)	2.100*** (0.161)
Exports (ref=non-ex)					
Low & medium exporter	1.414*** (0.109)	1.234*** (0.088)	1.129 (0.103)	0.986 (0.085)	1.502*** (0.122)
High exporter	1.780*** (0.187)	1.105 (0.096)	1.296** (0.134)	1.128 (0.114)	1.684*** (0.189)
Year (ref=1998 / 2007 process)					
2007	0.870 (0.081)	1.184** (0.093)	1.337*** (0.129)		1.057 (0.103)
2013	0.590*** (0.056)	0.806*** (0.066)	0.802** (0.083)	0.673*** (0.047)	0.710*** (0.069)
Industry (ref= MLT)					
MT	1.062 (0.088)	0.948 (0.071)	0.968 (0.093)	1.168* (0.106)	1.044 (0.089)
MHT	1.372*** (0.113)	0.970 (0.069)	1.164* (0.101)	1.208** (0.103)	1.317*** (0.113)
HT	1.413** (0.222)	1.179 (0.136)	1.584*** (0.203)	1.199 (0.168)	1.513** (0.262)
Size (ref= small)					
Medium	1.219** (0.107)	1.091 (0.088)	1.133 (0.114)	0.998 (0.094)	1.153 (0.106)
Large	2.077*** (0.272)	1.221* (0.130)	1.243* (0.159)	2.015*** (0.253)	2.035*** (0.289)
Location (ref= east)					
West	1.208*** (0.083)	0.868** (0.053)	0.873* (0.066)	1.374*** (0.101)	1.267*** (0.090)
Equipment (ref= out-dated)					
Rather-old/medium	3.959 (3.723)	1.472 (1.218)	0.813 (0.902)	0.345 (0.316)	1.144 (0.898)
Rather new	5.194* (4.814)	1.506 (1.224)	1.013 (1.101)	0.583 (0.520)	1.773 (1.364)
Up-to-date	7.010** (6.519)	1.661 (1.354)	1.369 (1.491)	0.964 (0.863)	2.567 (1.987)
Past profit (ref= unsatisfactory)					
Sufficient	1.078 (0.159)	1.470*** (0.192)	1.134 (0.188)	1.339* (0.226)	1.123 (0.172)
Satisfactory	1.131 (0.152)	1.300** (0.154)	1.268 (0.187)	1.393** (0.213)	1.179 (0.164)
(Very)good	1.149 (0.150)	1.256** (0.144)	1.274* (0.182)	1.717*** (0.252)	1.253* (0.170)
Expected bus,vol (ref= constant)					
Increase	1.321*** (0.099)	1.427*** (0.091)	1.175** (0.090)	1.388*** (0.107)	1.306*** (0.104)
Decrease	0.989 (0.091)	1.111 (0.094)	0.822* (0.092)	1.152 (0.118)	1.027 (0.097)
Constant	0.096** (0.089)	0.153** (0.126)	0.067** (0.073)	0.170** (0.153)	0.270* (0.211)
Pseudo-R2	0.216	0.053	0.101	0.165	0.224
N	5718	5718	5718	4566	5718

***p < 0.01, **p < 0.05, *p < 0.1; Standard errors in parentheses

Table A.5. Logistic models – models by year (incremental and radical innovation)

	Incremental innovation			Radical innovation		
	1998	2007	2013	1998	2007	2013
Institutional spheres (reference=0)						
1	1.625** (0.339)	1.894*** (0.253)	2.186*** (0.285)	1.372 (0.434)	1.736** (0.334)	2.861*** (0.690)
2	1.911*** (0.458)	3.185*** (0.524)	2.882*** (0.435)	2.218** (0.723)	3.068*** (0.619)	4.710*** (1.173)
3	2.913*** (0.832)	5.033*** (1.045)	5.106*** (1.018)	2.752*** (0.949)	3.504*** (0.774)	6.020*** (1.689)
4- VoC firm	16.204*** (8.426)	11.058*** (3.825)	23.928*** (8.010)	3.879*** (1.437)	5.026*** (1.255)	6.074*** (1.901)
Exports (reference=non-exporter)						
Low&medium exporter	1.938*** (0.358)	1.574*** (0.196)	1.543*** (0.175)	1.147 (0.244)	1.330** (0.173)	1.261 (0.197)
High exporter	3.025*** (0.847)	2.525*** (0.433)	1.765*** (0.258)	1.412 (0.347)	1.582*** (0.230)	1.506** (0.260)
Industry (reference= MLT)						
MT	1.294 (0.265)	1.066 (0.139)	1.043 (0.128)	1.306 (0.285)	1.158 (0.159)	0.759 (0.128)
MHT	1.638** (0.323)	1.580*** (0.204)	1.495*** (0.181)	1.500** (0.299)	1.304** (0.165)	1.224 (0.179)
HT	1.312 (0.407)	2.262*** (0.587)	2.303*** (0.532)	2.161*** (0.587)	2.446*** (0.467)	1.435* (0.309)
size (reference= small)						
Medium	1.152 (0.234)	0.986 (0.135)	0.979 (0.125)	1.036 (0.265)	0.954 (0.139)	0.768 (0.129)
Large	1.458 (0.381)	2.091*** (0.474)	0.921 (0.177)	0.920 (0.266)	0.914 (0.165)	0.976 (0.205)
Location (reference= east)	1.189 (0.190)	0.954 (0.103)	1.167 (0.117)	0.560*** (0.096)	0.874 (0.096)	0.911 (0.117)
Equipment (reference= out-dated)						
Rather-old/medium	0.567 (0.234)	3.405 (4.698)	1.633 (1.972)	0.678 (0.330)	0.525 (0.207)	0.155 (0.194)
Rather new	0.739 (0.138)	6.057 (8.179)	1.924 (2.288)	0.788 (0.140)	0.797* (0.097)	0.182 (0.219)
Up-to-date	1.000 (omitted)	8.377 (11.353)	2.457 (2.939)	1.000 (omitted)	1.000 (omitted)	0.302 (0.366)
Past profit (reference= unsatisfactory)						
Suficient	0.700 (0.207)	1.302 (0.336)	1.227 (0.273)	1.366 (0.426)	0.846 (0.219)	1.469 (0.448)
Satisfactory	0.836 (0.230)	1.212 (0.282)	1.391* (0.278)	1.501 (0.419)	1.008 (0.230)	1.762** (0.485)
(Very)good	0.705 (0.191)	1.363 (0.305)	1.406* (0.273)	1.449 (0.398)	1.049 (0.227)	1.766** (0.473)
Increase	1.309 (0.221)	1.332** (0.150)	1.466*** (0.181)	1.166 (0.199)	1.117 (0.120)	1.420 (0.194)
Decrease	1.234 (0.258)	1.142 (0.187)	0.913 (0.117)	0.661 (0.172)	0.901 (0.163)	0.867*** (0.148)
Constant	0.794 (0.274)	0.056** (0.078)	0.131* (0.156)	0.090*** (0.035)	0.112*** (0.032)	0.140 (0.168)
Pseudo-R2	1150	2319	2247	1150	2319	2247
N	0.1982	0.2013	0.1617	0.0688	0.0813	0.0899

***p < 0.01, **p < 0.05, *p < 0.1; Standard errors in parentheses

Source: IAB Establishment Panel, own calculations

Table A.6. Logistic models – models by year (Process innovation and imitation)

	Process innovation			Imitation	
	2007	2013	1998	2007	2013
Institutional spheres (reference=0)					
1	3.377*** (0.551)	2.765*** (0.480)	1.050 (0.227)	1.588*** (0.222)	1.275* (0.186)
2	4.267*** (0.770)	4.065*** (0.754)	1.128 (0.268)	2.013*** (0.318)	1.840*** (0.292)
3	6.473*** (1.293)	6.001*** (1.289)	1.602* (0.410)	2.850*** (0.509)	2.122*** (0.407)
4- VoC firm	8.706*** (2.071)	7.182*** (1.775)	1.871** (0.533)	2.971*** (0.630)	2.718*** (0.611)
Exports (reference=non-exporter)					
Low&medium exporter	0.994 (0.117)	1.148 (0.142)	1.316 (0.220)	1.363*** (0.150)	1.339*** (0.155)
High exporter	1.496*** (0.204)	1.092 (0.157)	1.206 (0.246)	1.315** (0.170)	1.162 (0.160)
Industry (reference= MLT)					
MT	1.242 (0.155)	1.113 (0.146)	1.140 (0.196)	1.025 (0.118)	0.845 (0.104)
MHT	1.381*** (0.162)	1.215 (0.149)	1.202 (0.192)	1.090 (0.118)	0.907 (0.105)
HT	1.837*** (0.362)	1.150 (0.225)	1.599** (0.382)	1.291 (0.234)	1.267 (0.233)
size (reference= small)					
Medium	0.788* (0.103)	1.120 (0.265)	1.215 (0.238)	0.933 (0.117)	0.897 (0.117)
Large	1.492** (0.252)	0.610 (0.543)	0.946 (0.217)	0.973 (0.158)	1.099 (0.191)
Location (reference= east)					
	1.485*** (0.150)	1.081 (0.113)	0.623*** (0.086)	0.7492*** (0.071)	1.018 (0.100)
Equipment (reference= out-dated)					
Rather-old/medium	0.397 (0.542)	0.324 (0.395)	0.693 (0.258)	1.667 (2.168)	0.800 (0.954)
Rather new	1.154 (1.520)	0.410 (0.488)	0.775* (0.114)	1.424 (1.813)	0.968 (1.132)
Up-to-date	1.703 (2.249)	0.806 (0.965)	1.000 (omitted)	1.477 (1.886)	1.072 (1.260)
Past profit (reference= unsatisfactory)					
Sufficient	1.238 (0.300)	1.478* (0.345)	1.000 (0.240)	1.881*** (0.426)	1.690** (0.370)
Satisfactory	1.412 (0.308)	1.415* (0.298)	1.014 (0.219)	1.636** (0.336)	1.540** (0.307)
(Very)good	1.833*** (0.381)	1.687*** (0.345)	0.923 (0.198)	1.724*** (0.338)	1.400* (0.272)
Increase	1.341*** (0.136)	1.557*** (0.184)	1.326 (0.185)	1.520*** (0.142)	1.458*** (0.163)
Decrease	1.186 (0.189)	1.156 (0.154)	0.869 (0.167)	1.233 (0.182)	1.123 (0.140)
Constant	0.055** (0.073)	0.133* (0.158)	0.510 (0.148)	0.1266 (0.164)	0.1737 (0.203)
Pseudo-R2	2319	2247	1,150	2319	2247
N	0.1681	0.1394	0.0405	0.0511	0.0343

***p < 0.01, **p < 0.05, *p < 0.1; Standard errors in parentheses

Source: IAB Establishment Panel, own calculations

Table A.7. Logistic models – models by year (Innovation dummy)

		Innovation dummy		
		1998	2007	2013
Institutional spheres (reference=0)				
	1	1.661** (0.349)	2.207*** (0.300)	2.512*** (0.329)
	2	1.931*** (0.469)	3.510*** (0.607)	3.706*** (0.580)
	3	3.106*** (0.916)	7.003*** (1.648)	5.965*** (1.264)
	4- VoC firm	18.144*** (1.030)	18.741*** (8.256)	29.913*** (1.179)
Exports (reference=non-exporter)				
	Low&medium exporter	2.106*** (0.400)	1.744*** (0.234)	1.539*** (0.181)
	High exporter	3.251*** (0.958)	2.525*** (0.481)	1.546*** (0.238)
Industry (reference= MLT)				
	MT	1.260 (0.262)	1.089 (0.149)	1.010 (0.128)
	MHT	1.757*** (0.358)	1.589*** (0.220)	1.330** (0.167)
	HT	1.534 (0.503)	2.171*** (0.624)	2.605*** (0.685)
size (reference= small)				
	Medium	1.057 (0.219)	0.937 (0.137)	0.934 (0.124)
	Large	1.389 (0.377)	1.594* (0.407)	1.106 (0.232)
Location (reference= east)				
		1.168 (0.190)	1.082 (0.123)	1.145 (0.120)
Equipment (reference= out-dated)				
	Rather-old/medium	0.490* (0.204)	0.722 (1.079)	0.443 (0.472)
	Rather new	0.739 (0.142)	1.365 (2.003)	0.673 (0.701)
	Up-to-date	1.000 (omitted)	2.160 (3.183)	0.915 (0.962)
Past profit (reference= unsatisfactory)				
	Sufficient	0.714 (0.217)	1.179 (0.321)	1.422 (0.324)
	Satisfactory	0.787 (0.223)	1.035 (0.255)	1.794*** (0.368)
	(Very)good	0.723 (0.202)	1.327 (0.317)	1.728*** (0.344)
Expected business vol. (reference= constant)				
	Increase	1.259 (0.217)	1.312** (0.158)	1.476*** (0.192)
	Decrease	1.245 (0.265)	1.107 (0.190)	0.992 (0.131)
	Constant	0.903 (0.319)	0.316 (0.472)	0.386 (0.403)
	Pseudo-R2	1,150	2319	2247
	N	0.2019	0.2144	0.1735

***p < 0.01, **p < 0.05, *p < 0.1; Standard errors in parentheses

Source: IAB Establishment Panel, own calculations

Table A.8. Average marginal effects of one sphere by industry, size and exports

	<i>Incremental</i>		<i>Imitation</i>		<i>Radical</i>		<i>Process</i>		<i>Innovation dummy</i>	
<i>Industry</i>										
MLT	0,17 (.021)	***	0,064 (.019)	***	0,061 (.012)	***	0,183 (.019)	***	0,196 (.02)	***
MT	0,17 (.021)	***	0,063 (.018)	***	0,061 (.012)	***	0,2 (.02)	***	0,194 (.02)	***
MHT	0,161 (.02)	***	0,065 (.019)	***	0,074 (.014)	***	0,209 (.021)	***	0,179 (.019)	***
HT	0,149 (.02)	***	0,071 (.021)	***	0,099 (.02)	***	0,22 (.024)	***	0,154 (.021)	***
<i>Size</i>										
Small	0,169 (.02)	***	0,065 (.019)	***	0,07 (.014)	***	0,19 (.019)	***	0,192 (.02)	***
Medium	0,169 (.021)	***	0,064 (.018)	***	0,065 (.012)	***	0,175 (.018)	***	0,194 (.021)	***
Big	0,162 (.021)	***	0,065 (.019)	***	0,066 (.013)	***	0,238 (.024)	***	0,178 (.021)	***
<i>Exports</i>										
Low & Medium	0,164 (.02)	***	0,068 (.02)	***	0,07 (.013)	***	0,196 (.02)	***	0,18 (.02)	***
High Exporter	0,153 (.02)	***	0,066 (.019)	***	0,08 (.016)	***	0,214 (.022)	***	0,169 (.019)	***
N	5178		5178		5178		4566		5178	

***p<0.01, **p<0.05, *p<0.1
Standard error in parenthesis

Source: IAB Establishment Panel, own calculations

Table A.9. Average marginal effects of two spheres by industry, size and exports

	<i>Incremental</i>		<i>Imitation</i>		<i>Radical</i>		<i>Process</i>		<i>Innovation dummy</i>	
<i>Industry</i>										
MLT	0,249 (.023)	***	0,123 (.021)	***	0,133 (.015)	***	0,249 (.022)	***	0,272 (.023)	***
MT	0,247 (.023)	***	0,121 (.021)	***	0,134 (.016)	***	0,27 (.023)	***	0,268 (.023)	***
MHT	0,228 (.022)	***	0,124 (.021)	***	0,159 (.018)	***	0,279 (.023)	***	0,242 (.022)	***
HT	0,207 (.024)	***	0,134 (.023)	***	0,204 (.024)	***	0,291 (.026)	***	0,204 (.025)	***
<i>Size</i>										
Small	0,245 (.022)	***	0,125 (.022)	***	0,15 (.018)	***	0,257 (.024)	***	0,264 (.021)	***
Medium	0,245 (.024)	***	0,123 (.021)	***	0,141 (.015)	***	0,239 (.019)	***	0,267 (.024)	***
Big	0,23 (.024)	***	0,124 (.021)	***	0,143 (.016)	***	0,311 (.025)	***	0,241 (.025)	***
<i>Exports</i>										
Low & Medium	0,235 (.023)	***	0,13 (.022)	***	0,15 (.016)	***	0,264 (.022)	***	0,244 (.022)	***
High Exporter	0,215 (.022)	***	0,126 (.022)	***	0,17 (.019)	***	0,285 (.024)	***	0,227 (.023)	***
N	5178		5178		5178		4566		5178	

***p<0.01, **p<0.05, *p<0.1
Standard error in parenthesis

Source: IAB Establishment Panel, own calculations

Table A.10. Average marginal effects of three spheres by industry, size and exports

	Incremental		Imitation		Radical		Process		Innovation dummy	
Industry										
MLT	0,349	***	0,188	***	0,164	***	0,344	***	0,361	***
	(.026)		(.025)		(.019)		(.027)		(.026)	
MT	0,342	***	0,186	***	0,165	***	0,366	***	0,353	***
	(.026)		(.025)		(.019)		(.027)		(.026)	
MHT	0,307	***	0,19	***	0,194	***	0,376	***	0,311	***
	(.025)		(.025)		(.021)		(.027)		(.025)	
HT	0,274	***	0,202	***	0,245	***	0,388	***	0,257	***
	(.029)		(.027)		(.028)		(.03)		(.031)	
Size										
Small	0,339	***	0,19	***	0,184	***	0,353	***	0,346	***
	(.024)		(.027)		(.024)		(.03)		(.022)	
Medium	0,339	***	0,188	***	0,173	***	0,333	***	0,352	***
	(.027)		(.025)		(.018)		(.024)		(.027)	
Big	0,31	***	0,19	***	0,175	***	0,406	***	0,31	***
	(.03)		(.024)		(.017)		(.026)		(.031)	
Exports										
Low & Medium	0,318	***	0,196	***	0,184	***	0,361	***	0,314	***
	(.025)		(.026)		(.02)		(.026)		(.025)	
High Exporter	0,285	***	0,192	***	0,207	***	0,382	***	0,289	***
	(.025)		(.025)		(.022)		(.027)		(.026)	
N	5178		5178		5178		4566		5178	

***p<0.01, **p<0.05, *p<0.1
Standard error in parenthesis

Source: IAB Establishment Panel, own calculations

Table A.11. Average marginal effects of VOC firm by industry, size and exports

	Incremental		Imitation		Radical		Process		Innovation dummy	
Industry										
MLT	0,497	***	0,225	***	0,213	***	0,402	***	0,479	***
	(.025)		(.031)		(.025)		(.034)		(.024)	
MT	0,483	***	0,222	***	0,215	***	0,424	***	0,464	***
	(.026)		(.03)		(.025)		(.034)		(.026)	
MHT	0,414	***	0,227	***	0,248	***	0,434	***	0,396	***
	(.025)		(.03)		(.027)		(.033)		(.025)	
HT	0,36	***	0,238	***	0,306	***	0,445	***	0,319	***
	(.035)		(.032)		(.033)		(.035)		(.037)	
Size										
Small	0,476	***	0,227	***	0,237	***	0,411	***	0,452	***
	(.02)		(.032)		(.03)		(.036)		(.019)	
Medium	0,475	***	0,225	***	0,224	***	0,391	***	0,463	***
	(.026)		(.03)		(.025)		(.033)		(.026)	
Big	0,419	***	0,226	***	0,227	***	0,46	***	0,395	***
	(.033)		(.029)		(.021)		(.031)		(.035)	
Exports										
Low & Medium	0,435	***	0,233	***	0,237	***	0,419	***	0,401	***
	(.025)		(.031)		(.026)		(.033)		(.024)	
High Exporter	0,378	***	0,229	***	0,263	***	0,439	***	0,364	***
	(.027)		(.03)		(.027)		(.033)		(.028)	
N	5178		5178		5178		4566		5178	

***p<0.01, **p<0.05, *p<0.1
Standard error in parenthesis

Source: IAB Establishment Panel, own calculations

Chapter 4

Productive linkages in a segmented model: analyzing the role of services in the exporting performance of German manufacturing

1. Introduction

The German export-led growth model has drawn attention from many scholars. From 2000 onward, exports started to grow much more rapidly than imports, and foreign demand became the primary source of growth. Trade balance reached 7% of the GDP in 2007, and has remained at similar values so far (*OECD.statistics*, own calculations). Together with a stagnant domestic demand, the commercial surplus was obtained thanks to the rapid growth of both manufacturing and service exports. The process was, in turn, led by high and medium-high technology manufacturing industries, which accounted for around 70% of total exports between 1995 and 2007 (COMEXT, own calculations).

This performance coincided in time with an unequal process of wage devaluation, by which Germany managed to slow down the growth of its nominal unit labor costs (ULC) against other competitors. This strategy was accomplished by a long path of decentralization of the wage bargaining (Hassel, 2014) and labor market reforms (Hüfner and Klein, 2012), and gave rise to a dual or segmented economy. More specifically, the weakening of labor institutions has been concentrated in service industries, where wages experienced a dramatic fall and the overall erosion of working conditions have been particularly tough. On the other hand, sectoral wage bargaining and work councils are still well grounded in manufacturing firms, particularly in the larger ones. Here, wages have slowly increased and working conditions have been better preserved. Furthermore, German manufacturing firms engaged, at the same time, in a process of production restructuring, characterized by the outsourcing of certain service activities with the aim of reducing costs (Goldschmidt and Schmieder, 2017). Hence, they contributed through this channel to the consolidation of the dual economy (Doellgast and Greer, 2007).

There is a consensus about the negative effect of this process on domestic demand and import growth. However, the debate on how wage dynamics impact exports is much more open. Some observers have pointed out that the liberalization of the service periphery has been functional to the performance of the manufacturing sector because it has helped to protect the working conditions of core workers, while containing the labor costs throughout the value chain by supplying cheap service inputs (Hassel, 2014; Thelen, 2014). As a consequence, manufacturing exports became more cost-effective, thus fostering export growth (Dustmann et al, 2014; Baccaro and Benassi, 2017).

On the contrary, we consider that these elements, although significant, are of secondary importance for German competitiveness. We agree with the strand of literature that stresses that the link from ULC to exports is fragile for this economy, which is specialized in the production of high quality and complex products (Danninger and Joutz, 2008; Felipe and Kumar, 2014; Müller et al, 2015). Therefore, German exporting performance should rely on non-price factors, which in turn are related with the institutional foundations of German capitalism (Storm and Naastepad, 2015).

Furthermore, we highlight that the relationship between services and manufacturing is not just a matter of saving costs. In the last few years, knowledge-intensive business services (KIBS) became more important for manufacturing productive strategies. These advanced services are knowledge suppliers and innovation drivers, and support manufacturers to compete in the international market via non-price strategies (Franke and Kalmbach, 2005; Ciriaci et al, 2015). Given the sophistication of German exports, we argue that this linkage with services, and not the cost-saving one, has a predominant role in explaining the exporting performance.

This chapter aims to contribute to the debate on the sources of German manufacturing competitiveness. Concretely, we research the existing channels through which domestic services could have contributed to the manufacturing export boom: the wage moderation in supplier firms; and the integration of advanced services (KIBS) into manufacturing productive strategies. To that end, we draw on the subsystem approach to the input-output analysis (Pasinetti, 1973). We compute vertically integrated ULC and the participation of KIBS services into manufacturing sectors. Afterward, with manufacturing subsystems as units of analysis, we estimate an export model to capture the causal effect of the variables of interests. Hence, the novelty of our approach is that it allows us to assess the productive relations that exist within the German dual model, and estimate their impact on the commercial success. Our calculations are based on the World Input-Output Database (WIOD, release 2016). We consider 18 manufacturing subsystems and the research period is 2000-2014.

It is worth mentioning that we are conscious that offshoring strategies of German manufacturing have played a role in the evolution of its competitiveness, nonetheless we only focus on the aforementioned two processes because our interest relies on the domestic level and on making sense of the dual model.

The hypotheses to be tested are the following:

- HI. Labor cost competitiveness is of secondary importance for Germany, the non-price factors being the drivers of the export success.*
- III. Wage restraint in the service part of the value chain is the centerpiece in the contention of ULC and export prices.*
- HIII. Nonetheless, due to the high quality production strategies of German manufacturers, wage restraint in the services is of minor importance for export growth.*

HIV. Lastly, we hypothesize that the growing integration of KIBS into manufacturing production strategies has a positive effect on non-price competitiveness and has driven export volumes up.

The remainder of the article is organized as follows. The next section reviews the literature on the price-elasticity of German exports. Section 3 briefly describes some features of the wage devaluation process and the reorganization of production in the manufacturing sector. The fourth section presents the input-output methodology and describes the empirical results regarding ULC and the interlinkages between manufacturing and services. Section 5 presents the econometric model and its results. Section 6 concludes.

2. A review on the price-elasticity of German exports

The issue of how responsive German exports are to changes in relative prices in general, and labor costs in particular, is a hot debate.

On the one hand, an important strand of the literature has highlighted that ULC are non-reliable predictors of export success. The well-known Kaldor's paradox states that those economies in which the market share for exports grows more are usually those in which ULC grow faster (Kaldor, 1978). This finding suggests that what really determines competitiveness in the long-run are non-price factors, such as technical progress and investment levels (Fagerberg, 1988). Furthermore, the composition of countries' export baskets is crucial for making international comparisons, and so is the economy against which ULC evolution is evaluated. For instance, as Felipe and Kumar (2014) observe, a simple comparison between German and Southern European countries ULC is misleading a significant part of the picture. Germany is highly specialized in complex products and does not compete directly with these less advanced economies, which should benchmark their cost-competitiveness against others with the same type of productive specialization. In addition, institutional features of coordinated economies entail competitive advantages to produce high value added goods (Soskice, 1999). Furthermore, although the corporatist wage-setting system – characterized by an export-led pattern bargaining – has always promoted moderate pay hikes to ensure price stability, wage costs have been traditionally higher in Germany than in most countries, compelling manufacturing firms to compete through differentiation strategies (Streeck, 1991).

Regardless of this clarification, many observers pointed to the wage devaluation as the main explanatory cause of the German commercial success (Dieppe et al., 2011; Thorbecke and Kato, 2012). Price competitiveness is the result of the evolution of domestic export prices against the prices of foreign competitors. The latter variable is exogenous and the former, according to these works, is the central component of firms' cost structure and thus the main determinant of prices. Therefore, anti-inflationary wage policies like the ones undertaken by Germany should be the first option to improve international competitiveness in the short-run.

Nonetheless, wage devaluation is not the only way to reduce labor costs. In fact, firms with higher productivity can offer reduced prices because their costs per unit of output are lower.

Indeed, some articles have pointed out that Germany owes more to that than to the nominal wage squeeze (Storm and Naastepad, 2015; Garzón and Fernández, 2016). Nonetheless, the policy debate in the context of the European Union has been predominantly focused on wages rather than productivity²⁵.

Regarding empirical work, most authors estimate a standard export equation in which real exports are a negative function of relative prices and a positive function of the world demand. Two main indicators of cost-competitiveness are employed: (a) the relation between export and import prices, (b) and the real effective exchange rate, deflated by either a consumer price index or ULC (or, in some cases, relative ULC adjusted by nominal exchange rates).

Table 1 summarizes the price-elasticities found by the literature. Overall, the size of the effect is quite different among studies. For instance, Storm and Naastepad (2015) estimate a non-significant coefficient, while Stockhammer et al (2011) find an elasticity below -1 for the period 1987-2005, meaning that a 1% increase in relative prices is associated with a more than proportional fall in exports. It also seems that the estimated effect is slightly higher in the more recent time period. Furthermore, those models based on export and import prices tend to capture a larger coefficient than those based on relative labor costs measures (average elasticity of -0.67 and -0.30, respectively).

The relative price indicator is normally accompanied by a measure of world demand, which captures the income-elasticity of exports. It is assumed that this variable comprises non-price factors, such as technology, quality or the ability to hook into global demand thanks to marketing strategies or distribution channels. In most models, the estimated coefficient of world demand is the largest one.

In the majority of studies, the export function is referred to the whole economy. The only exception in the table below is the article by Carlin et al (2001), which performs several panel data models with manufacturing industries and countries as observations. Interestingly, they find German exports less sensitive to relative ULC changes than the exports of other advanced economies, such as Japan or the US. Moreover, they also capture a negative relation between the R&D intensity of the industry and its cost-elasticity, as well as an increasing price-sensitiveness in export markets over time.

²⁵ For instance, the *Euro Plus Pact* constituted a central policy at the European level, in which most member states committed to implementing an internal devaluation to become more competitive.

Table 1. Price-elasticities of German exports

Article	Data	Time	Coefficient	Measure of cost-competitiveness
<i>Based on export prices</i>				
Andersen (1993)	A	1960–1990	-0.48	pX/pM
Stockhammer et al. (2011)	A	1970-2005	-0.78	pX/pM
Stockhammer et al. (2011)	A	1970-1987	-0.67	pX/pM
Stockhammer et al. (2011)	A	1987-2005	-1.24	pX/pM
ECB model (Dieppe et al., 2011)	Q	1991q1-2007q2	-1.04	pX/pM
Onaran and Galanis (2012)	A	1971-2007	-0.43	pX/pM
Baccaro and Benassi (2017)	A	1971-2014	-0.86/-0.80	pX/pM
IMK model (Horn et al, 2017)	Q	1986q1/ 1991q1-2016q1	-0.5	pX/pX_world
<i>Based on unit labor costs</i>				
Carlin et al (2001)**	A	1970-1991	-0.12	RULC
Naastepad and Storm (2006)	A	1960–2000	-0.12	RULC
Danninger and Joutz (2008)	Q	1993q1–2005q4	-0.42/-0.14	REER/ULC
Bayoumi et al. (2011)	Q	1980–2009	-0.56	REER/ULC
Thorbecke and Kato (2012)	Q	1980q2-2011q1	-1	REER/CPI
Thorbecke and Kato (2012)	Q	1980q2-2009q3	-0.64	REER/ULC
Breuer and Klose (2014)	Q	1995q1-2012q2	-0.82	REER/ULC
European Commission (2014)	Q	1994q1-2014q1	-0.81	REER/export prices
Storm and Naastepad (2015)	Q	1996Q2-2008Q4	Insignificant	REER/ULC
Baccaro and Benassi (2017)	A	1971-2014	-0.40 / insignificant	REER/ULC
<i>Average elasticity</i>				
	pX/pM		-0.67	
	REER/ULC		-0.30	

*Notes: A (annual), Q (quarterly), pX/pM (export prices relative to import prices), REER/ULC (real effective exchange rate based on ULC), REER/CPI (based on a consumer price index), RULC (relative unit labor costs). **Carlin et al (2001) use the export market share as dependent variable.

Source: own elaboration

Another important point is that, frequently, labor cost moderation is not fully passed onto sale prices, particularly when assuming market imperfections (Storm and Naastepad, 2015; Horn et al, 2017). Therefore, the relationship between ULC and price-competitiveness is much more complex. In this respect, German non-financial corporations have been increasing their profit share since the mid-90s, while their investment levels have remained constant (Braun and Deeg, 2019). Thus, it seems likely that part of the wage restraint has served, de facto, to increase profit margins at the price of lower economic growth (indeed, the German demand regime is overwhelmingly identified as wage-led, see among others Naastepad and Storm, 2007; Hein and Vogel, 2008; Stockhammer et al, 2011).

In sum, it is difficult to obtain a clear picture of the price sensitiveness of German exports. The calculated average elasticities suggest, however, that the effect of relative prices is not

superfluous. Nonetheless, these elasticities do not indicate how relevant labor costs are to the formation of export prices, which in turn are determined by other variables. As we will show in Section 5, our export equation does take into account these considerations.

3. Production reorganization in the manufacturing sector: wage moderation, outsourcing and increasing demand of KIBS

We argue that non-price factors are behind the exporting performance of German manufacturing. This is not to say that relative prices are not relevant, but, given the advanced productive specialization of the sector, we consider that high value added strategies, based on innovation and differentiation, should be more important. Actually, services can enhance manufacturing competitiveness through these two channels: they can help to contain costs, and to improve the quality of manufactured goods. This section reviews the literature on both channels.

3.1. The relationship between services and manufacturing: wage growth in a dual model

Previous works have highlighted the relevance of taking into account the whole supply chain when analyzing the cost-competitiveness of the manufacturing sector (Dustmann et al, 2014; Albu et al, 2018). In Germany this issue is particularly important because of the nature of the wage policies pursued. Since the mid-90s, the country experienced a dramatic evolution of wage inequality. The fall of wages at the lower end of the income distribution was particularly severe. As a result, the low-wage sector expanded strongly, and it is currently one of the largest among advanced economies (Gräbka and Schöder, 2019).

The increase in low-end inequality has been driven by the erosion of labor institutions (Dustmann et al, 2009; Card et al, 2013). Overall, the wage bargaining was decentralized and the margins of the labor market were flexibilized through the liberalization of atypical employment. Nonetheless, the weakening of labor institutions has been concentrated in some segments of the economy, giving rise to a dual or segmented German model (Hassel, 2014; Eichhorst, 2015).

Observers have identified an institutional core around the manufacturing sector, where social partners and sectoral bargaining are still strong and keep considerable bargaining power. Some industries within the core set the limit which bargained salaries growth cannot surpass in the rest of the economy (Traxler and Brandl, 2012). Furthermore, although wage negotiations have been decentralized here as well, workers are represented by powerful work councils at the firm level, which renegotiate sectoral agreed working conditions with guarantees. In this respect, core workers have tended to reach plant-level agreements with the management, by which job protection was exchanged for internal flexibility regarding wages and working time (Seifert and Massa-Wirth, 2005; Herzog-Stein et al, 2018). Besides, non-standard work levels are much below-average, despite the liberalizing reforms which predominantly contribute to the expansion of agency work (Spermann, 2011; Benassi, 2016).

On the other hand, the margin or periphery of the German labor market is mainly identified with services. In these industries, the coverage of collective bargaining fell abruptly and union density has always been much lower (Eichhorst, 2015). Moreover, the presence of work councils is more unusual. Yet, an important amount of service workers have been, in fact, expelled from collective bargaining. Besides, firms tend to rely much more on atypical contracts and precarious work.

This segmented system generates a particular structure of wage inequality, which partially lies in the divergent evolution of pay hikes between service and manufacturing industries. Actually, the core and the periphery are seen as the two sides of the same coin. The liberalization of the service periphery acts as a mechanism to protect the working conditions of core workers, while containing labor costs throughout the manufacturing value chain (Hassel, 2014; Thelen, 2014).

It is worth mentioning that this picture is somewhat simplistic, and other variables like the skill level or the firm size play a role in shaping the dualization (see Eichhorst and Marx, 2011; Eichhorst, 2015; Addison et al, 2017c, for a more detailed analysis). Nonetheless, it helps to explain why the decoupling of wages from productivity growth has been deeper in services than in manufacturing (Baccaro and Benassi, 2017). Moreover, Germany is the only European economy, along with Austria, in which wages in services grew less than in manufacturing (Hassel, 2017). This is a quite remarkable fact given that services are more sheltered from international competition.

3.2. The relation between services and manufacturing: Outsourcing and increasing demand of KIBS

Two related processes of production reorganization have taken place throughout the last few years in advanced economies: the outsourcing of certain service activities from core manufacturing firms, and the increasing demand of knowledge-intensive business services (KIBS). The German case has been no exception.

First of all, the main incentives for a company to outsource are cost-saving and flexibility against changes in aggregate demand (Abraham and Taylor, 1996). Managerial strategies of leading companies have focused on their core competences, while subcontracting the remainder of the operations with external firms. Outsourced jobs are often worse paid than if they had been performed within the boundaries of the leading firm, allowing for cost-reductions. Furthermore, by substituting labor relations for market ones, firms are much less constrained and gain flexibility in taking rapid strategic decisions.

The fierce - price-competitiveness to get a service contract, along with the weakness of unions and the low coverage of industrial relation institutions, frequently result in wage compression within subcontractors. The pervasive use of outsourcing by manufacturing firms in Germany and its consequences on wages has been well documented. For instance, Silvia and Schroeder (2007) pointed out that large manufacturing companies alleviate their cost-pressures by imposing low prices on their suppliers, which could not comply with collectively agreed wages. Another recent work by Goldschmidt and Schmieder (2017) reports a wage penalty of

outsourcing between 10% and 15% in logistics, cleaning, security and food services. Moreover, according to this study, sourced-out jobs account for around 9% of the increase in German wage inequality.

Scholars in political economy and industrial relations have widely studied the effect of outsourcing of low-level services (such as call-centers or canteens) on the evolution of the system of labor relations. They conclude that the surge in outsourcing has contributed to enlarging the size of the periphery by transferring workers from the “coordinated” to the “liberalized” part of the economy (e.g. Doellgast and Greer, 2007; Holst, 2014, Doellgast and Berg, 2018).

Nonetheless, the interlinkages between manufacturing and services go far beyond cost-saving issues. Another source of productive restructuring in manufacturing -which has drawn much less attention from political economists -, is the importance of KIBS to satisfactorily meet their final demand.

KIBS firms could comprise outsourced jobs, but also new ones that require high levels of investment to be performed within core manufacturing firms. KIBS are high-level services, such as consultancy or engineering, that provide technical knowledge and assessment to other firms, acting as external knowledge suppliers (Den Hertog, 2000). They are highly innovative, and not only in their own right, but promote innovation and foster technical progress in the sectors with which they cooperate, like the manufacturing ones (Castellacci, 2008; Ciriaci et al, 2015). KIBS are more capital-intensive than any other services, and are major users of information and communication technologies. Moreover, they have become a significant part of the so-called systems of innovation. In sum, they currently constitute an important piece for manufacturing non-price competitiveness because they contribute to enhancing value added and productivity growth (Tomlinson, 2000; Castaldi, 2009).

Since German manufacturing is widely known for its high-quality products and for being established in a non-price competitive strategy, where product differentiation is a central concern (Felipe and Kumar, 2014), it would be expected that KIBS should be important for it. Indeed, Windrum and Tomlinson (1999), drawing on an input-output methodology, found that the development and integration of these advanced services into other activities of the economy was quite high during the 80s and the 90s, even when comparing the country with other service-intensive economies like the UK or the Netherlands. Furthermore, these authors estimate the impact of KIBS connections with other economic activities on total output and total productivity, and report a high and significant coefficient for Germany.

In another input-output analysis, Franke and Kalmbach (2005) highlight that the growth of business services in Germany is directly related with the intermediate demand of inputs from the export-oriented manufacturing due to technological and labor-saving reasons. Other works, adopting a comparative international perspective and also employing an input-output framework, have pointed out that German manufacturing is highly connected with KIBS. For instance, Ciriaci and Palma (2016) show that KIBS employment in the manufacturing sector has increased much more in Germany than in other European countries, and its actual level is only

higher in France. Furthermore, the more technologically advanced the sector is, the greater the contribution of KIBS in its employment share.

Consequently, other relationships between manufacturing and services apart from the cost-saving ones should be taken into account to evaluate the impact of productive reorganization on competitiveness.

4. A subsystem approach to the study of manufacturing competitiveness

A subsystem approach to input-output (Pasinetti, 1973) is employed to analyze manufacturing cost-competitiveness and its relationship with services. This method considers that a final commodity is a composite good that requires from inputs from other industries to be manufactured. A vertically integrated sector or subsystem represents all the domestic activities that directly or indirectly satisfy the final demand of a particular good or service. It is thus a completely independent production system, in which every domestic input required to meet the final demand is included.

Vertical integration is a useful methodology to capture productive interlinkages among industries and to explore the labor cost structure of manufacturing final goods. Nonetheless, it is worth mentioning that a subsystem is an abstract economic entity that cannot be found in reality, where economic activities are interconnected among themselves. In contrast, the traditional approach to the economic analysis does not capture any sort of productive interdependence. On the contrary, it classifies commodities according to the industry that produces them, therefore implicitly assuming that each industry is an autonomous unit of production.

In order to disaggregate the economy into vertically integrated sectors, the IO matrix is reorganized through the following equations:

$$B = (\hat{q})^{-1}(I - A)^{-1}\hat{y} \quad (1)$$

$$C = \hat{h}B \quad (2)$$

Equation (1) reclassifies any variable from a sector base to a subsystem one. \hat{q} is the diagonalized vector of production. “ $\hat{}$ ” indicates that the corresponding vector is transformed into a diagonal matrix. The generic element q_i represents the total output at current prices of branch i . $(I - A)^{-1}$ stands for the Leontief inverse matrix and the generic element a_{ij} measures the output of branch i directly or indirectly required to produce a unit of final output of branch j . Lastly, \hat{y} is the diagonalized vector of final demand, and its generic element y_i represents the output of branch i destined for final uses.

On the basis of B, the C matrix is derived (Equation (2)). In this matrix, \hat{h} is the diagonalized vector of either employment, labor compensation or value added, i.e. the variables of interest. As can be seen, the operator B is used to remap our variables of interest, h , from industries to subsystems. Therefore, the generic element c_{ij} represents the amount of a given variable of branch i that is directly or indirectly used by the subsystem j to meet its final demand. For

instance, if h were the vector of employment (measured in persons), each row would be the number of persons employed in branch i to satisfy the final demand of the subsystem j . The sum of each row of a column, would be the vertically integrated employment of the subsystem. This operation is repeated for each year of the period 2000-2014. We use data from the German National Input-Output Tables (NIOT), obtained from the WIOD Database, which offers data for 56 economic activities, classified according to the ISIC revision 4 (see Timmer et al, 2015, for further details). We consider 18 manufacturing sectors for the analysis²⁶.

Due to the fact that we are using domestic input-output tables, imported inputs are not taken into account. Therefore, the effects of the international division of labor are not analyzed in the present article. Nonetheless, in Germany inputs from KIBS, and services in general, are almost entirely provided domestically (Ciriaci and Palma, 2016). Furthermore, by introducing imported intermediate inputs, C would no longer be invariant to changes in relative prices, thus affecting the analysis (Montresor and Vittucci Marzetti, 2007).

Table 2 shows the important differences that arise between the subsystem and the traditional approach. When using the former method, the size of the manufacturing sector is around 10 percentage points (pp) larger. Besides, the underestimation of the size of the manufacturing sector tends to increase over time. In Germany, the share of manufacturing value added in the economy has increased according to the subsystem perspective, while it has decreased under the traditional one. Both approaches capture a fall in the employment share, but it is much greater when using the latter method. This pattern suggests that manufacturing increasingly relies on inputs from other sectors, as has been pointed out by previous works (Franke and Kalmbach, 2005; Dustmann et al, 2014; Ciriaci and Palma, 2016). It is worth noting that the differences between the changes in value added share and employment share are indicating a larger labor nominal productivity increase in manufacturing than in the rest of the economy.

Table 2. Size of the manufacturing sector according to the subsystem and the traditional approach (Average share and change 2000-14)

	VA		Employment	
	Subsystem approach	Traditional approach	Subsystem approach	Traditional approach
Total manufacturing	31.65%	22.46%	27.37%	18.32%
Δ Change (pp)	0.67	-0.35	-0.23	-2.07
HT and MHT manuf.	19.57%	12.97%	14.78%	8.22%
Δ Change (pp)	1.43	1.03	0.35	-0.55
MT and LT manuf.	12.08%	9.49%	12.59%	10.10%
Δ Change (pp)	-0.77	-1.38	-0.58	-1.52

*Note: Subsystems are classified by technological intensity according to the OECD taxonomy (Galindo-Rueda and Verger, 2016)

Source: WIOD, own calculations

Productive specialization of the German economy is also reflected in the table. A larger share of economic resources is involved in the production of high and medium-high technology

²⁶ We do not consider the coke and petroleum products sector due to its volatility in prices.

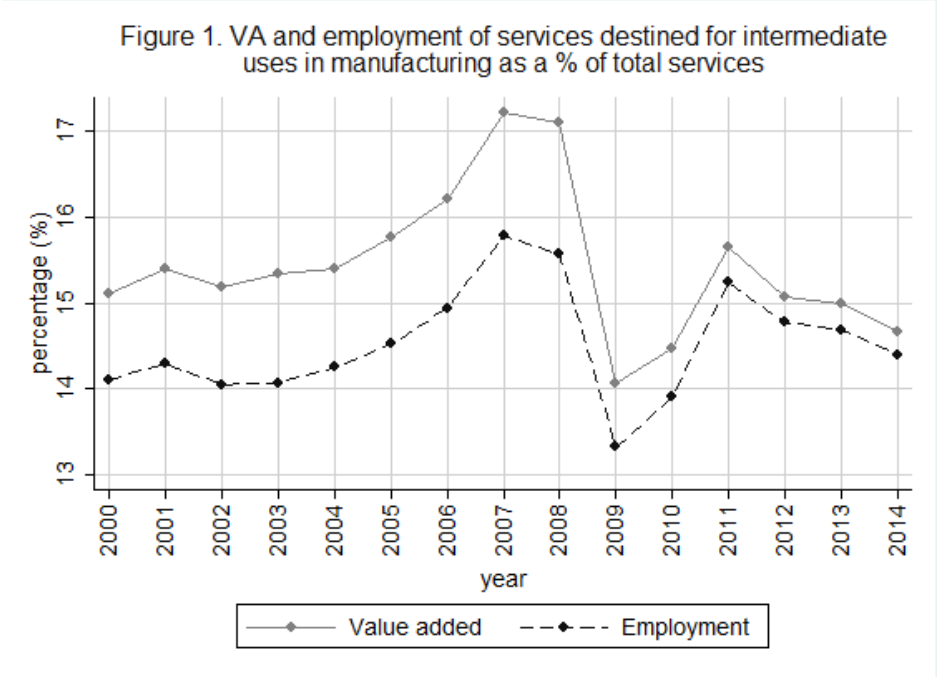
(HMHT) manufacturing goods. These sectors increased their importance in the economy regarding both value added and employment. Besides, the underestimation of the traditional approach is greater for these advanced activities, particularly when looking at the employment share (which is lower than the share of medium and low-technology sectors). Furthermore, the differences in productivity levels among sectors can be appreciated. Holding an employment share 2.2pp higher, HMHT manufacturing produces 7.5pp of value added more than medium and low-technology manufacturing. The classification of manufacturing and service sectors is detailed in the appendix (Table A5).

As a first approximation, the connection between services and manufacturing can be shown by calculating the following indicator:

$$Service_{input} = \frac{\sum_{j=d}^b c_{s,m}}{\sum_{j=j}^a c_{s,j}} \tag{3}$$

Where the numerator indicates the amount of service inputs (either value added or employment) destined to satisfy the demand of manufacturing final products; and the denominator denotes total value added or employment in all services for both intermediate and final demand.

Figure 1 shows that around 14% of employment (15% of the value added) in services is destined for intermediate uses of manufacturing subsystems. The drop in 2009 is registering the effects of the crisis, when the intermediate demand of manufacturing declined due to the heavy fall in foreign demand. The subsequent increase from 2010 onward depicts the rapid economic recovery experienced by Germany.



Source: WIOD, own calculations

Summing up, an important part of the service sector is connected with the industry, and the evolution of its labor costs directly affects manufactured goods. The next section explores the labor cost structure of manufacturing subsystems.

4.1. Exploring the cost-structure of German manufacturing subsystems

As previously described, the wage restraint process in Germany has been unequal, and the service sector has been much more affected than manufacturing. The subsystem perspective captures how the diverse dynamics of wage growth within sectors affect their labor cost competitiveness.

The main indicator of labor cost competitiveness is the nominal ULC, which is the result of dividing the nominal gross mean wage by the real productivity. In coherence with the subsystem approach adopted in this article, vertically integrated ULC are calculated. This indicator captures the mean wage costs directly or indirectly needed to produce one unit of a certain commodity in constant prices. Once real value added, employment and wages have been vertically integrated with the matrix C (Equation 2), the calculation of ULC is straightforward. This is formalized by Equation (4):

$$ULC_j = \frac{(W'_j/L'_j)}{(VA'_j/L'_j)} \quad (4)$$

Where W is the labor compensation, L stands for the number of persons employed and VA is the real value added of the subsystem j . The apostrophe symbol indicates that the variable has been vertically integrated.

Furthermore, it is possible to calculate the mean wage and real productivity for the service part of each manufacturing subsystem, and compute the relationship between the mean wage in services and the total vertically integrated productivity:

$$ULC_{sm} = \frac{(W'_{sm}/L'_{sm})}{(VA'_m/L'_m)} \quad (4a)$$

In Equation (4a) the mean wage of service inputs is divided by the total productivity of the VIS and not by its own productivity. Note that if a service job (e.g. the staff of a canteen) is sourced out from a core manufacturing firm to a supplier, the associated wage costs for the supply chain would be lower (due to institutional factors), although the employee's productivity would remain exactly the same (he or she is performing exactly the same job). Therefore, this research strategy takes into account the cost-saving effects of outsourcing and the overall "benefits" of the wage restraint in services for manufacturing labor-cost competitiveness.

Table 3 reports the results of Equations (4) and (4a) for the 18 manufacturing subsystems. They are presented in yearly growth rates. Overall, a mild increase in ULC can be appreciated. Four sectors managed to cut costs down, whereas in only six of them the growth rate was above 1%. Such moderation in the ULC evolution was achieved despite the low growth rates of real productivity. It should be kept in mind that service activities tend to be much less productive

per hour worked (Baumol, 1967; Fernández and Palazuelos, 2012), therefore productivity growth in manufacturing subsystems is usually lower than in manufacturing industries when using the traditional approach. As a matter of comparison, one could observe the marked gap existing between the service part and the rest of the VIS. In the former, productivity was stagnant, the latter being the one that drove total vertically integrated productivity up.

On the other side, nominal wage growth was also modest. Electronic and optical equipment was the only sector in which the growth was above 2%. Considering that inflation over the period grew around 1.5% per year²⁷, the increase in real wages remained close to zero. Here again, the differences between services and the rest of the VIS arise. Overall, wages grew more in the non-service part of the sector (the only exceptions are the manufacturing of paper products and printing and reproduction of recorded media). As expected, the divergence among manufacturing and service wages appreciated by other works across the whole economy also takes place within manufacturing subsystems.

In sum, the greater wage restraint in services along with the modest evolution of productivity served to contain labor cost over the period.

Table 3. Growth of vertically integrated nominal ULC, mean wage (WL) and real productivity (P), 2000-14

	Subsystem			Service part			Rest		
	Δ ULC	Δ WL	Δ P	Δ ULC	Δ WL	Δ P	Δ ULC	Δ WL	Δ P
Chemicals	1.27%	1.74%	0.46%	1.04%	1.51%	-0.42%	1.58%	2.04%	0.97%
Basic pharma prod	-0.17%	1.50%	1.66%	-0.43%	1.23%	-0.92%	0.06%	1.73%	2.66%
Elect & optical prod	-2.71%	2.08%	4.79%	-3.51%	1.28%	-0.18%	-2.49%	2.30%	6.69%
Electrical equipment	1.70%	1.89%	0.19%	1.05%	1.25%	-0.18%	1.89%	2.09%	0.25%
Mach. & equipment n.e.c.	1.68%	1.64%	-0.04%	1.43%	1.40%	-0.04%	1.89%	1.86%	0.02%
Motor vehicles	-0.06%	1.74%	1.80%	-0.45%	1.35%	-0.24%	0.42%	2.22%	2.95%
Other transport eq.	0.97%	1.84%	0.87%	-0.10%	0.77%	-0.93%	1.76%	2.63%	1.88%
Food, Bev & Tobacco	1.70%	1.27%	-0.43%	1.59%	1.16%	-0.19%	1.74%	1.31%	-0.79%
Textiles	0.45%	1.82%	1.37%	0.21%	1.59%	0.47%	0.56%	1.93%	1.68%
Wood	0.78%	1.03%	0.25%	1.11%	1.36%	0.06%	0.78%	1.03%	0.13%
Paper	0.24%	1.54%	1.29%	0.31%	1.60%	0.11%	0.29%	1.58%	1.74%
Printing & repr. media	-1.18%	0.39%	1.57%	-0.02%	1.56%	-0.38%	-1.43%	0.14%	2.09%
Rubber & plastic products	0.30%	1.35%	1.05%	0.19%	1.24%	-0.36%	0.38%	1.43%	1.54%
Other non-met. min. prod.	0.61%	1.42%	0.82%	0.63%	1.45%	0.03%	0.66%	1.48%	1.13%
Basic metals	1.30%	1.58%	0.28%	1.14%	1.42%	0.16%	1.45%	1.73%	0.29%
Fabricated metal products	0.70%	1.32%	0.62%	0.56%	1.18%	-0.03%	0.79%	1.41%	0.76%
Furniture; other manuf.	0.85%	1.56%	0.71%	0.76%	1.47%	0.32%	0.93%	1.65%	0.78%
Rep. & inst. mach & equip	0.70%	1.34%	0.63%	0.35%	0.98%	-0.52%	0.92%	1.56%	1.04%

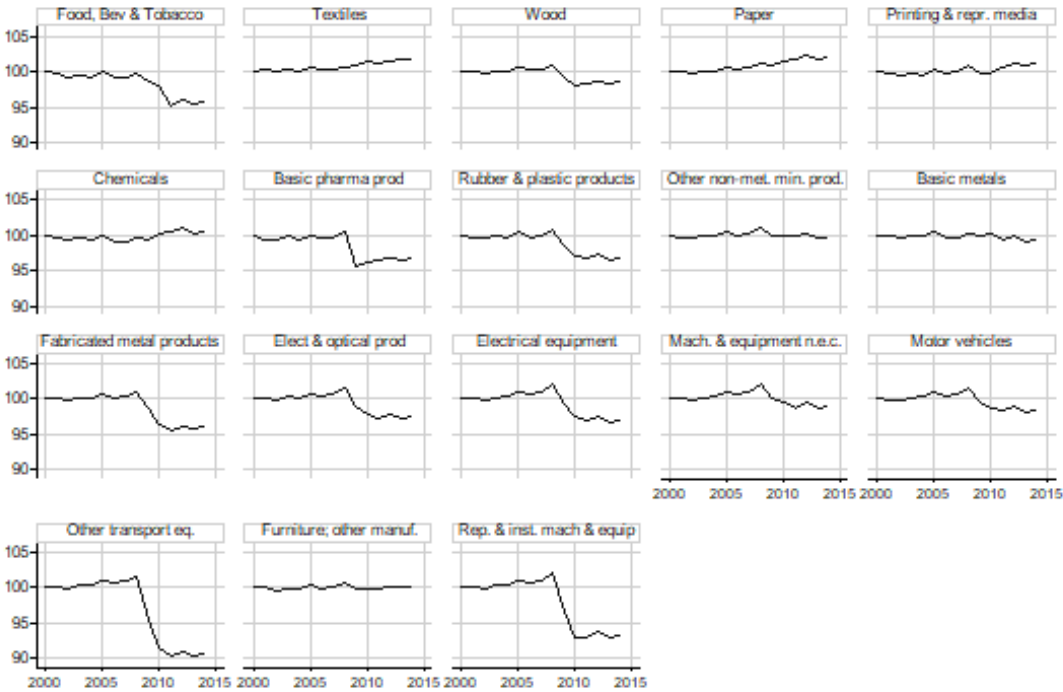
* Note: ULC of services and rest are computed as denoted in Equation (4a)

Source: WIOD, own calculations

²⁷ Own calculations based on the CPI index reported by OECD.stats

Furthermore, from 2008 onward, in several manufacturing subsystems service wages present a slight decline relative to wages in the whole service sector (Figure 2). This indicates that the small recovery registered in wages after the economic crisis has mainly affected services that do not supply manufacturing. Moreover, our results suggest that manufacturing is still a driver of the wage restraint in services, where suppliers suffer from sharp price pressures and workers are less protected from IIRR institutions (Palier and Thelen, 2010; Hassel, 2014). However, it should be borne in mind that the data do not capture the introduction of the statutory minimum wage in 2015, which might have changed the picture a bit.

Figure 2. Wage growth in services integrated in manufacturing subsystems relative to wage growth in total services (2000=100)



Source: WIOD, own calculations

4.2. The integration of services into manufacturing productive strategies: outsourcing and the increasing demand of KIBS

Division of labor has advanced over time and services have been increasingly integrated with manufacturing activities. Consequently, the amount of resources dedicated to satisfy the final demand of manufacturing goods is still large, although more heterogeneous, as shown in Table 2.

The subsystem methodology captures this process of production reorganization by analyzing the evolution of service employment that satisfies the final demand of manufacturing products. This can be easily done by performing the following operation with the matrix *C*:

$$Services_m = c_{g,m} + \dots + c_{u,m} = \sum_{i=g}^u c_{i,m} \quad (5)$$

In this equation, all industries that go from g to u , i.e. all of the services activities, are added up within a generic manufacturing subsystem m . Results can be expressed in absolute terms or as a share of vertically integrated employment. We opt for the latter option, because it is much more intuitive. This operation can be performed on each variable of interest.

The evolution of service employment in manufacturing subsystems has been used as a proxy of outsourcing by Montresor and Vittucci Marzetti (2007) or Sarra et al (2018), among others. Nonetheless, the increase in service jobs is not only induced by outsourcing, but also by the greater demand of new advanced services that were not previously performed within manufacturing firms (Ciriaci and Palma, 2016). In practice, it is not possible for the subsystem methodology to differentiate which of both factors is affecting the employment growth. However, the research done on Germany points out that low-level services are much more affected by subcontracting strategies than high-level ones. For that reason, two service categories are presented: KIBS (based on Ciriaci et al, 2015) and what we have called “personal services”, which are more labor intensive and require low skills to be performed (Baumol, 1967; Fernández and Palazuelos, 2012), thus comprising potentially outsourced jobs due to cost-saving reasons. Both taxonomies are reported in the Appendix (Table A.5.).

Results of the Equation (5) are reported in Table 4 (data on value added are presented in the Appendix, Table A1). To make the outcome more readable, we have also grouped the 18 subsystems by technological intensity following the OECD criteria. Overall, service industries as a whole account for approximately one-third of the manufacturing subsystem employment share. The differences among observations are outstanding: advanced subsystems display higher share of service employment than non-advanced ones.

Outsourcing practices and the increasing demand of KIBS have been a central pillar in the manufacturing restructuring process. First, vertical integration of KIBS into manufacturing has advanced considerably over the period. Furthermore, high and medium-high technology manufacturing relies more on labor inputs from KIBS than less technological-intensive manufacturing (in the latter the share of KIBS employment is around 3pp lower). Nonetheless, there is much heterogeneity within both types of subsystems. For instance, more than 20% of employment in chemicals and pharma products sectors comes from KIBS. This proportion is much lower for machinery and equipment or transport equipment, although it has grown significantly (5pp and 9pp, respectively).

On the other hand, the degree of KIBS integration into less technological systems is much lower. One might think that these disparities in the employment structure are partially explained by the evolution of productivity levels, but it is clear from Table 3 that the relation is not so direct; hence productive strategies are playing a role here. These results are in line with Ciriaci and Palma (2016): the technological intensity of the manufacturing subsystem is a determinant of the degree of KIBS vertical integration. Our findings also suggest that the high connectivity found by Wildrum and Tomlinson (1999) between KIBS and the rest of the economy in

Germany during the 80s and 90s has moved forward throughout the 2000s, and is particularly profound in manufacturing.

Table 4 Services vertical integration into manufacturing subsystems, employment (Average share and change 2000-14)

	Total services		KIBS		Personal services	
	Average	ΔChange(pp)	Average	ΔChange(pp)	Average	ΔChange(pp)
Total manufacturing	33.85%	3.95	14.10%	3.99	4.78%	1.34
<i>HT and MHT manuf.</i>	<i>36.09%</i>	<i>4.26</i>	<i>15.55%</i>	<i>3.80</i>	<i>4.70%</i>	<i>1.10</i>
Chemicals	43.13%	4.09	21.62%	2.98	5.12%	1.47
Basic pharma prod	42.90%	2.41	22.19%	1.87	6.77%	-0.30
Motor vehicles	39.65%	7.40	15.23%	3.99	4.59%	1.68
Elect & optical prod	39.05%	-2.60	15.31%	0.86	7.43%	1.16
Other transport eq.	33.38%	10.97	15.74%	8.99	4.56%	2.98
Electrical equipment	32.47%	-0.33	14.17%	2.57	4.47%	1.12
Mach. & equipment n.e.c.	28.94%	4.81	13.13%	4.88	3.43%	0.50
<i>MLT and LT manuf.</i>	<i>31.21%</i>	<i>3.42</i>	<i>12.39%</i>	<i>4.10</i>	<i>4.87%</i>	<i>1.64</i>
Basic metals	36.37%	2.81	14.27%	4.13	3.32%	0.52
Other non-met. min. prod.	34.94%	2.74	15.57%	3.90	3.45%	0.32
Food, Bev & Tobacco	34.17%	4.06	13.52%	3.85	5.61%	4.29
Paper	32.15%	2.80	13.73%	4.31	4.15%	-0.57
Textiles	31.23%	1.94	8.79%	3.71	10.27%	-0.90
Rep. & inst. mach & equip	28.75%	3.83	13.47%	5.14	3.93%	0.68
Wood	28.36%	7.62	10.45%	4.61	4.92%	2.20
Rubber & plastic products	27.67%	2.80	13.13%	4.21	3.35%	0.99
Furniture; other manuf.	25.38%	3.10	8.78%	3.19	5.17%	0.32
Printing & repr. media	20.39%	5.12	11.47%	3.87	2.57%	0.58
Fabricated metal products	20.14%	3.53	8.77%	4.16	2.57%	0.81

Source: WIOD, own calculations

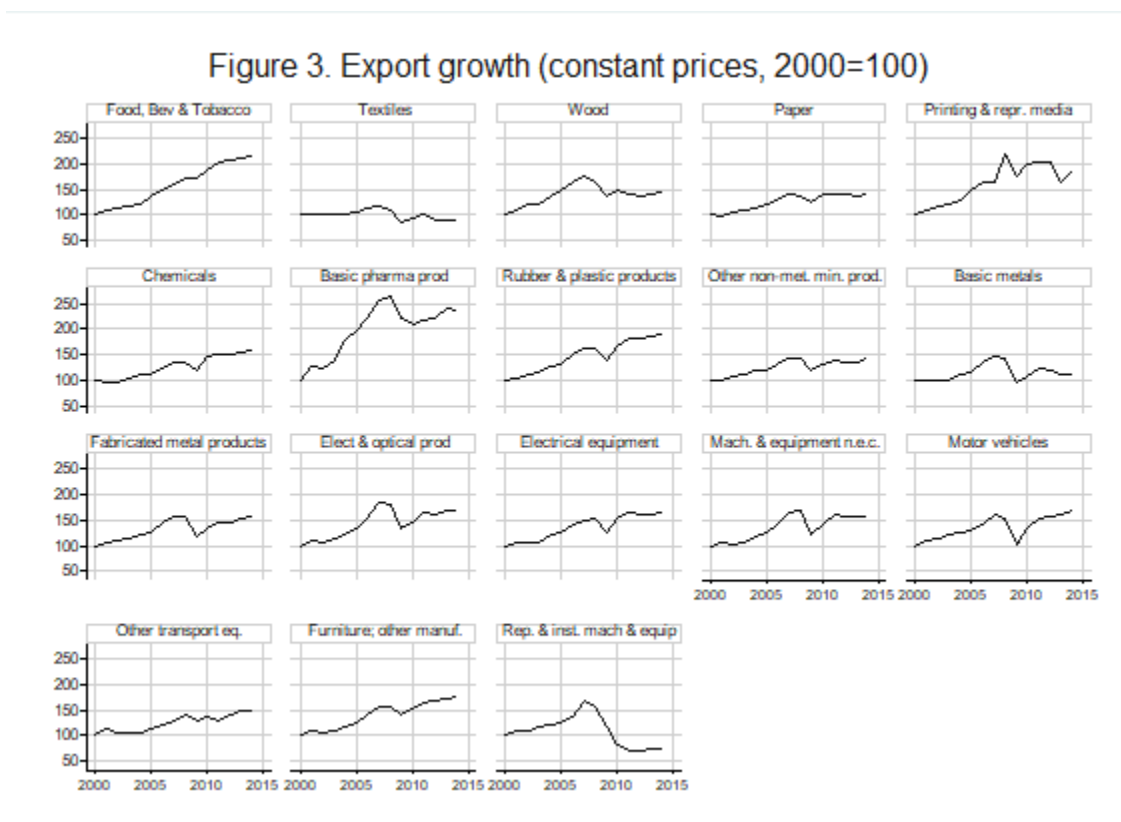
On the other hand, personal services account for less than 5% of the manufacturing employment, but have gained relative importance. Here, the differences in the average levels between the high and low technological intensive subsystems are minimal, although again we find high heterogeneity within both high- and low-intensive technology subsystems.

As a general conclusion, the growth of the “service economy” is partly explained by the increasing demand of service inputs from manufacturing. Nonetheless, an important share of these inputs comes from high-level services (KIBS). This sort of relationship is frequently ignored by some scholars, who are mainly focused on the role of services as suppliers of cheap inputs. All things considered, this section’s results point to the suitability of taking into account both types of productive linkages when analyzing the competitiveness of the manufacturing sector.

5. The nexus between cost-competitiveness and export growth: an empirical analysis

The remainder of the article seeks to establish a causal relationship between the processes of wage squeeze and manufacturing restructuring and export growth. This way, we will be able to test our four hypotheses.

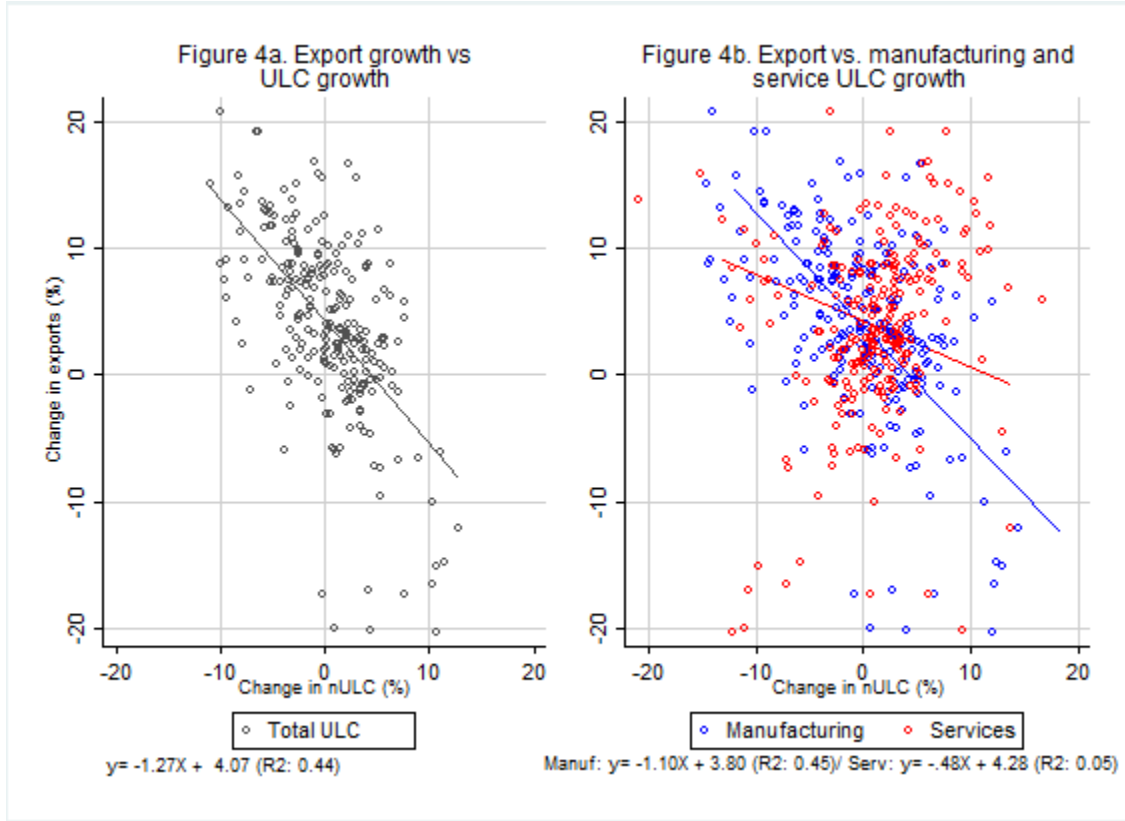
Before presenting our econometric model, we briefly show the evolution of exports (Figure 3). Overall, a steady growth can be appreciated throughout the period in all sectors except textiles and repairs and installation of machinery and equipment. A fall in 2009 is appreciated as well, followed by a subsequent rebound in the succeeding years, showing the rapid recovery experienced by the manufacturing sector. It should be noted that the input-output methodology considers any exported good as a final commodity, although it might be the case that it is an intermediate input of a foreign subsystem.



Source: WIOD, own calculations

A first approximation to the relationship between labor cost competitiveness and exports growth is presented in Figures 4a and 4b. It seems that cost-saving policies have been important for the commercial success of the economy (Figure 4a). Moreover, when splitting up ULC into the manufacturing and service part of the subsystem, it seems that both of them present a strong effect on exports (Figure 4b). Nonetheless, this relationship is not so straightforward, because ULC impact exports indirectly through prices, which also depend on other variables.

Hence, it requires introducing a price equation along with more controls to correctly assess this effect.



Source: WIOD, own calculations

5.1. The export model

This subsection in particular illustrates the theoretical model behind the empirical analysis. Our export model is a triangular system, in which ULC impact export prices, which in turn affect export growth through relative prices. Similar theoretical relationships are established in Stockhammer et al (2011).

The specification is written as follows:

$$\Delta \ln(pX)_{jt} = \alpha_{0j} + \beta_1 \Delta \ln(ULC')_{jt} + \delta_2 \Delta \ln(pM)_{jt} + \varepsilon_{jt} \quad (6)$$

$$\Delta \ln(pX)_{jt} = \alpha_{0j} + \beta_1 \Delta \ln(ULC')_{mjt} + \beta_2 \Delta \ln(ULC')_{sjt} + \delta_3 \Delta \ln(pM)_{jt} + \varepsilon_{jt} \quad (6a)$$

$$\Delta \ln(X)_{jt} = \alpha_{0j} + \rho_1 \Delta \ln(pX - pM)_{jt} + \gamma_2 \Delta \ln(wY)_t + \alpha_3 \Delta \ln(KIBS')_{jt} + \varepsilon_{jt} \quad (7)$$

Where $j=1, \dots, N$, represents manufacturing subsystems (cross-sectional dimension) and $t=1, \dots, T$ denotes the time dimension. Again, the apostrophe means that the variable has been vertically integrated. Variables are expressed in first differences of logarithms (Δ), so the results are interpreted as growth rate elasticities.

Equation (6) indicates that export prices are not only a negative function of vertically integrated ULC, but also depend positively on import prices (pM). The latter captures both the effect of imported intermediate inputs prices and the extent to which exporters set prices strategically (Horn et al, 2017). Hence, it is assumed that firms do not operate in perfect competitive markets and may charge a mark-up on their marginal costs. On the other hand, Equation (6a) is just an extension of the former one, and splits up the ULC growth within each VIS j in services s and the rest of activities m . As can be appreciated, both equations consider ULC to be an exogenous variable, which is previously determined by external institutional factors, such as the coverage of the collective bargaining or the union density. Furthermore, in the results section an additional model will be presented, in which the effect of both components of the ULC (wages and productivity, both vertically integrated) is differentiated.

Equation (7) illustrates the growth of real exports as a negative function of price competitiveness, expressed as the relationship between export and import prices ($pX-pM$), and a positive function of world demand excluding Germany (wY). In addition to these two standard explanatory variables, we introduce the growth in the share of KIBS employment ($KIBS'$) integrated in each subsystem j . As abovementioned, the increasing demand of these types of services is associated with the ability of manufacturing subsystems to innovate and compete through differentiation strategies. Therefore, it is expected that the sign of the effect will be positive. The definition of each variable is presented in the Appendix (Table A4).

Lastly, with the estimated coefficients of both equations, we will compute the contribution of each variable to export growth.

5.2. Estimation strategy

As a first step, and after performing the usual tests of cross-sectional dependence (Breusch-Pagan test), autocorrelation (Wooldridge test) and heteroskedasticity (Wald test), Equations (6) and (6a) are estimated using OLS Panel Corrected Standard Errors (PCSE) correcting for heteroskedasticity and cross-sectional dependence (autocorrelation problems were not found)²⁸. The results of the tests are presented in the Appendix (Table A2).

Nonetheless, a main concern in these two equations is that ULC might be endogenous, because they can be explained not only by institutional factors, but also by the evolution of productivity and technological progress, which in turn impacts export price growth. To address this issue, we estimate an additional OLS PCSE model with ULC lagged one period. Additionally, we also compute a difference generalized method of moments (diff-GMM) model (Arellano and Bond, 1991) as a robustness check. We are aware that this estimator performs better with “large N and small T ” (Roodman, 2009), but it is the best way to control that the results are neither biased nor inconsistent, given that no other instruments are available.

²⁸ Given the structure of the data ($N > T$), the FGLS estimator was not considered due to its tendency to produce extremely optimistic standard errors (Beck and Katz, 1995).

Regarding Equation (7), the employed estimation strategy is two-stage least squares (2SLS). We have a triangular system, in which export prices are endogenous and the rest of variables exogenous. Endogeneity arises because of potential problems of reverse causality, i.e. it might be the case that an increase in exports demand would drive export prices up. To avoid such a problem, we take advantage of Equation (6) and instrument relative prices with ULC and import prices. A similar strategy is applied by León-Ledesma (2002).

We will report the results of both the first and the second-stage regressions of the 2SLS model. Although first-stage results are not typically presented, in this case it is interesting to do so because the specification is quite similar to Equation (6). Furthermore, in a system of simultaneous equations all the exogenous variables are used as instruments for all endogenous variables, otherwise the problem of reverse causation would not be handled properly. The results of both equations are robust to heteroskedasticity and cross-sectional dependence.

All the regression models include VIS fixed effects to account for idiosyncratic differences in productive techniques and other factors across sectors which are unlikely to be explained by the other variables. This decision is also supported by the results of the Hausman test, which shows that the null hypothesis of consistency and efficiency of the random effects estimator should be rejected (Table A2, in the Appendix).

5.3. Results

Table 5 reports the results of the export price equation. Columns 1 and 4 show the results of Equation (6), while the outcome of Equation (6a) is presented in columns 3 and 6. Columns 2 and 5 show the results when the effect of wages and productivity is differentiated. In all cases the estimated coefficients are statistically significant and present the expected signs. As can be seen, the results of all the specifications are quite similar. The results of the 2SLS regressions are the ones of the first-stage equation, although the table only presents the variables of interest, i.e. labor costs and import prices.

Our estimations yield a rather small effect of ULC: a decrease of 1pp in this variable drives down export prices between 0.16 pp and 0.18 pp, depending on the model. This outcome reinforces the argument that, usually, there is not a complete pass-through of labor costs onto prices. Furthermore, taking into account that labor cost are a small proportion of total costs (around 25%, according to Storm and Naastepad, 2015: pp. 15, Table 2), the residual role of this variable in competitiveness can be better understood. Reported in the Appendix are the results of the model with lagged ULC and the diff-GMM model, in which ULC are treated as endogenous (Table A3 in the Appendix). As can be appreciated, the coefficients are similar and significant.

Widening the analysis, when the ULC is separated into its components (productivity and mean wage), both of them present a similar effect size. Therefore, they are equally important for the evolution of prices and exports. On the other hand, the two parts of the manufacturing subsystem present different effects on prices. The evolution of labor costs in service industries is, in fact, the driving factor behind the coefficient of total ULC; while the effect of ULC of the rest of the VIS (which mainly comprises manufacturing activities) is close to zero and non-

significant in some specifications. When introducing both variables separately, the effect of ULC in the rest of the VIS became statistically significant and its effect is slightly larger (see Table A3 in the Appendix). This suggests that wage restraint policies in services were functional to reduce manufacturing prices, despite their weak effect. Moreover, it also fits with the argument that the regained cost-competitiveness was due to wage compression in service suppliers, allowing manufacturing core workers to enjoy higher wage increases without damaging competitiveness.

Finally, the coefficient of import prices is the strongest one. This might be reflecting that imported input prices are important for the cost structure of German exporters. As pointed out by Horn et al (2017), Germany is highly dependent on raw materials and energy imports. At the same time, this result may be a sign of pricing-to-market behavior.

Table. 5 Exports price equation results

	(1) OLS PCSE	(2) OLS PCSE W/L & P	(3) OLS PCSE Serv. & rest	(4) 2SLS	(5) 2SLS W/L & P	(6) 2SLS Serv. & rest
ULC'	0.155*** (0.030)			0.184*** (0.043)		
ULC (rest)'			0.035 (0.031)			0.044 (0.056)
ULC (services)'			0.165*** (0.034)			0.156** (0.066)
W/L'		0.137* (0.077)			0.158** (0.081)	
P'		-0.157*** (0.029)			-0.187*** (0.046)	
Import prices	0.511*** (0.042)	0.511*** (0.042)	0.477*** (0.046)	0.525*** (0.101)	-0.523*** (0.102)	-0.525*** (0.101)
Constant	-1.621*** (0.437)	-1.605*** (0.441)	-1.993 (0.423)			
Observations	252	252	252	252	252	252
R-squared	0.956	0.956	0.958	0.755	0.756	0.762
Number of VIS	18	18	18	18	18	18
VIS FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

2SLS models are the result of the first stage of the triangular system
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 presents the results of Equation 7, estimated by 2SLS. The three columns of the table show the results obtained when relative prices are instrumented with either ULC or wages and productivity or ULC in services and the rest of the subsystem. As mentioned above, the other instrument included is the price of imports. The validity of the instruments is confirmed by the Sargan-Hansen test. The null hypothesis that the instruments are uncorrelated with the error term is rejected, therefore they can be considered exogenous. Additionally, the outcomes of the

Cragg-Donald test allow us to conclude that the instruments are not weak (they all exceed the 5% threshold value).

Regarding the results of the model, the coefficient estimates have the expected sign and are statistically significant. It should be noted that the three types of instruments produce analogous results, and the obtained price coefficient is around -0.7 in the three cases. Hence, a 1pp drop in prices raises export growth by 0.7pp. This result is coherent with the existing literature on German exports (see Table 1 in Section 2).

As usual, the size of the world income coefficient is the highest one, and shows a strong response of German exports to the evolution of world demand. Lastly, the coefficient of KIBS is quite interesting. A 1pp raise in KIBS employment share in manufacturing subsystems is associated with an increase of 0.55pp of manufacturing exports. According to our theoretical proposal, this indicates that high quality production standards introduced by the cooperation between these advanced services and industrial firms have been quite positive to reinforce competitiveness.

Table 6. Exports equation results

	(1) Total ULC	(2) W/L & P	(3) ULC Serv. & rest
(pX-pM)	-0.719*** (0.218)	-0.732*** (0.218)	-0.679*** (0.211)
wY	2.517*** (0.348)	2.506*** (0.346)	2.553*** (0.359)
KIBS'	0.560*** (0.151)	0.558*** (0.151)	0.564*** (0.148)
Observations	252	252	252
R-squared	0.567	0.566	0.568
N	18	18	18
VIS FE	YES	YES	YES
Sargan-Hansen test	$\chi^2(13): 15.63$ p = 0.270	$\chi^2(14): 17.77$ p = 0.217	$\chi^2(14): 16.07$ p = 0.309
Cragg-Donald Wald F	32.434	30.171	31.113

All models are estimated by 2SLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All in all, price factors did play a role in the explanation of the German export success. Nonetheless, non-price variables, such as the ability of exporters to meet world demand evolution and their traditional high-quality production strategies –complemented with the participation of advanced services-, have led the exporting performance of the country.

We can now confirm the four hypotheses presented in the previous section:

- We obtained empirical support for *HI*, which state that the German export success was driven by non-price factors and that labor costs dynamics were of secondary importance.
- *HII* and *HIII* on the relevant but weak effect of wage moderation in services that satisfy the final demand of manufacturing goods were also verified.
- Lastly, *HIV* that KIBS vertical integration into manufacturing contributed positively to export growth has been confirmed as well.

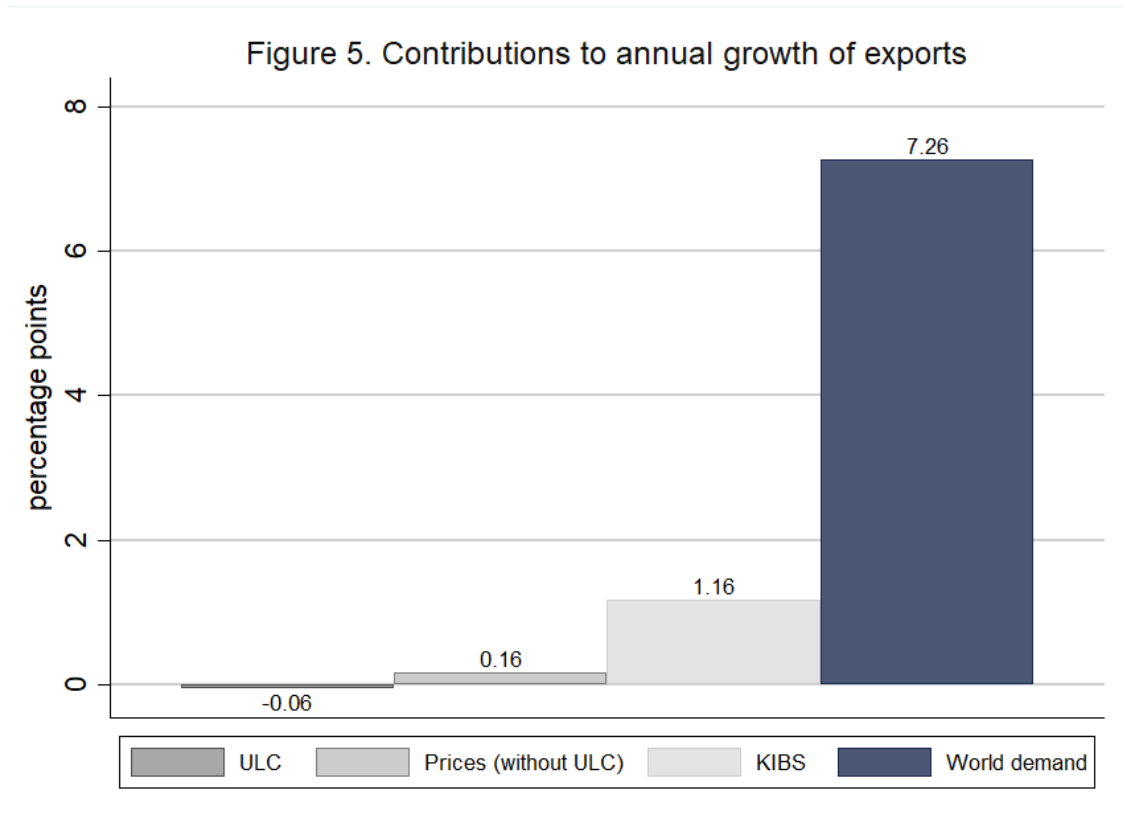
5.4. Contributions to export growth over the period 2000-2014

We can inquire further into the role of the variables interest on the commercial success. With the estimated coefficients it is now possible to compute their contribution to export growth by the following calculation:

$$\Delta X = [(\epsilon_{ULC}^{pX} * \epsilon_{pX}^X) * \Delta ULC] + [(\epsilon_{(pX-pM)}^X * \Delta(pX - pM)) - ((\epsilon_{ULC}^{pX} * \epsilon_{pX}^X) * \Delta ULC)] + [\epsilon_{KIBS}^X * \Delta KIBS] + [\epsilon_{wY}^X * \Delta wY] \quad (8)$$

The equation illustrates the total effect of a change in the explanatory variables on exports. For instance, regarding ULC and assuming that import prices have been constant throughout the period. We see that the annual growth of exports thanks to ULC is equal to the yearly growth of the latter variable multiplied by its effect on export prices (ϵ_{ULC}^{pX}) and by the effect of the latter on export volumes (ϵ_{pX}^X). We used coefficients from specifications 4 (Table 5) and 1 (Table 6), and the obtained growth rate elasticity ($\epsilon_{ULC}^X = \epsilon_{ULC}^{pX} * \epsilon_{pX}^X$) is -0.134. Furthermore, due to the coefficient of the service part of the VIS being nearly as large as ϵ_{pX}^X , the contribution can be almost entirely attributed to it. In second place, we subtract the total effect of ULC from the contribution of relative prices and obtain the effect of price factors non-related with labor costs.

We calculated the weighted average for the whole manufacturing sector (each VIS is weighted by its share in total exports). The figure shows that labor cost competitiveness did not impact significantly on export growth. On the contrary, on average, its contribution was negative. Prices, excluding ULC, present a positive but small impact on exports. It is interesting to note that KIBS integration into manufacturing productive strategies have boosted exports 1.16 pp each year. Lastly, the expansion of world demand has been the main driver of German commercial success, proving the relevance of non-price factors.



Looked at together, the evidence presented in this section suggests that the role played by labor cost competitiveness was of minor importance. This is due to two factors: the incomplete pass-through of ULC onto export prices and the fact that non-price factors (i.e. world demand and the participation of KIBS in manufacturing production processes) are better predictors of export growth than relative prices. This is not to say that price-competitiveness is not an issue for the German industry (certainly, a price growth-rate elasticity of 0.7 indicates the contrary), but that variables other than labor costs must be considered in the analysis of prices, such as the cost of imported inputs or the firms' profit mark-up.

6. Concluding remarks

The question of which were the drivers of the German exporting success has been addressed numerous times without consensus in the literature. Several events occurred at the same time in the country during the last thirty years. On the one hand, exports started to grow rapidly and became the first source of growth. On the other hand, labor costs were reduced against other competitors thanks to a process of institutional reforms concentrated in the service sector, and the restructuring of the manufacturing production processes. In a nutshell, while some authors establish a causal link between these events and highlight the importance of labor costs competitiveness (Dieppe et al., 2011; Thorbecke and Kato, 2012; Baccaro and Benassi, 2017), others claim that the exporting success has nothing to do with wages, but with the advanced productive strategies of German manufacturers (Danninger and Joutz, 2008; Felipe and Kumar, 2014; Storm and Naastepad, 2015).

This article sought to contribute to this debate by applying a novel methodology that combines the subsystem approach to the input-output and panel data regressions. The use of a subsystem approach allowed us to consider the productive interlinkages that exist in the German dual model between manufacturing producers and service suppliers. Moreover, we showed that the traditional approach to the economic analysis underestimates the size of manufacturing by around 10pp regarding value added and employment, so the unit of analysis is considerably different.

The application of a subsystem approach is particularly important for the study of German manufacturing competitiveness for two reasons. First of all, because the process of wage devaluation was much more intensive in services than in manufacturing, so the latter could obtain cheaper inputs from the former and improve its labor cost-competitiveness. Second, because German manufacturers outsourced certain service activities for cost-saving reasons, and increased their demand of KIBS, which currently constitute an important piece for their high quality production, and contributed to enhance their non-price competitiveness.

We found that non-price factors were the main drivers of manufacturing exports. Although a high price coefficient was captured (-0.7), the effect of labor costs on price formation and export volumes is negligible (-around 0.13). Moreover, our estimations report an average yearly contribution of ULC to export growth of -0.06 pp. In addition, when separating the service part and the rest of the VIS, we found that the impact of ULC on prices is due to the wage restraint in the former, although its effect has been rather low.

Lastly, our results suggest that the relationship between manufacturing and services is not only a matter of saving costs. On the contrary, the interlinkages with KIBS have driven export volumes up over the period. These high-level services are innovation drivers and help manufacturing firms to compete in the international markets through differentiation strategies (Ciriaci et al, 2016).

All in all, our analysis challenges the view that policies of wage devaluation were useful to regain competitiveness and cast doubts on the functionality between the two segments of the dual model. Interestingly enough, the predominant productive linkage between manufacturing and service reinforce the typical high-quality production of coordinated models. We therefore detect a source of continuity in German exporting strategies, which is based on a productive restructuring undertaken to gain competitiveness through differentiation.

Some policy implications follow these findings. To begin with, it seems worthwhile for policy-makers to invest in the development of domestic KIBS. These advanced services proved to be helpful to improve international competitiveness and are also labor intensive industries, so they can also play a role in reducing the unemployment rate without deteriorating aggregate productivity. Thus, they can be part of a “high road” strategy for economic growth.

In addition, we have detected that the fall in labor costs was not fully passed onto prices. Future research might explore the effects of that. For instance, a logical consequence of this is the increase in the profit share. Some authors have found a low sensitiveness of corporate investment to higher profits (Stockhammer et al, 2011; Braun and Deeg, 2019). This, in

combination with the lower propensity to consume out of wages, has resulted in low rates of economic growth. It seems that, if wages had grown at a faster pace, the economic growth would have been more balanced, with higher increases in domestic demand without damaging export growth.

Appendix – Chapter 4

Table A1. Services vertical integration into manufacturing subsystems, Value added (Average share and change 2000-14)

	Total services		KIBS		Personal services	
	Average	Δ Change(pp)	Average	Δ Change(pp)	Average	Δ Change(pp)
Total manufacturing	30.57%	-0.85	11.52%	-0.35	2.33%	0.08
<i>HT and MHT manuf.</i>	<i>28.91%</i>	<i>-1.94</i>	<i>11.36%</i>	<i>-1.14</i>	<i>2.06%</i>	<i>-0.02</i>
Chemicals	31.80%	-3.87	10.93%	-2.03	2.02%	0.02
Basic pharma prod	31.02%	-0.25	14.03%	-1.42	2.09%	0.21
Motor vehicles	29.23%	-3.93	10.89%	-1.92	3.00%	0.02
Elect & optical prod	28.33%	-3.06	11.49%	-0.97	2.11%	0.14
Other transport eq.	26.86%	2.70	11.62%	1.98	1.98%	0.78
Electrical equipment	25.60%	0.79	10.52%	0.67	1.64%	-0.10
Mach. & equipment n.e.c.	24.86%	-6.16	12.32%	-5.22	2.23%	-0.58
<i>MLT and LT manuf.</i>	<i>33.28%</i>	<i>1.26</i>	<i>11.80%</i>	<i>0.97</i>	<i>2.77%</i>	<i>0.32</i>
Basic metals	41.36%	3.90	14.66%	1.56	3.65%	2.08
Other non-met. min. prod.	34.60%	-0.69	9.61%	1.24	6.21%	-2.01
Food, Bev & Tobacco	33.75%	1.24	13.30%	0.09	1.85%	-0.14
Paper	31.96%	7.18	10.11%	2.54	2.86%	0.71
Textiles	30.93%	0.34	10.66%	0.50	1.62%	-0.06
Rep. & inst. mach & equip	28.82%	1.51	10.59%	1.14	2.03%	-0.53
Wood	28.35%	0.64	12.15%	0.87	2.08%	-0.06
Rubber & plastic products	27.78%	-0.92	8.88%	-0.04	3.04%	-0.70
Furniture; other manuf.	27.30%	-0.26	11.34%	0.47	1.75%	0.17
Printing & repr. media	24.93%	5.76	11.17%	2.81	1.81%	0.28
Fabricated metal products	21.88%	1.15	8.10%	1.57	1.46%	0.10

Source: WIOD, own calculations

Table A2. Specification tests – Export prices model

FE - RE	Hausman	chi2(2)= 6.28, Prob>chi2 = 0.0433
Cross-sectional dependence	Pesaran	115.149, Pr = 0.0000
Autocorrelation	Wooldridge	F(1, 17) = 1.331, Prob > F = 0.2646
Heteroskedasticity	Wald	chi2 (18) = 132.37, Prob>chi2 = 0.0000

Table A3. Robustness checks for export price equation

	(1) OLS PCSE Services	(2) OLS PCSE Rest	(3) OLS PCSE	(4) diff GMM
ULC' (services)	0.179*** (0.029)			
ULC'(rest)		0.0922*** (0.028)		
Lagged ULC'			0.061* (0.035)	
ULC'				0.327*** (0.111)
Import prices	0.479*** (0.047)	0.535*** (0.043)	0.557*** (0.044)	0.843*** (0.027)
Constant	-2.017*** (0.419)	-1.449*** (0.453)	3.927*** (0.501)	
Observations	252	252	234	234
R-squared	0.958	0.953	0.951	
Number of VIS	18	18	18	18
VIS FE	YES	YES	YES	YES
Year FE	YES	YES	YES	
Number of instruments				13
Arellano-Bond test for AR(1)				z = -3.30 Pr > z = 0.001
Arellano-Bond test for AR(2)				z = 0.34 Pr > z = 0.735
Hansen test				$\chi^2(11)$: 13.85 p = 0.241

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A4. Description of data included in the econometric models

Exports growth (constant prices): Is the first difference of logarithms of exports of a given year (obtained in the German NIOT) minus the difference in logarithms of exports in previous years' prices (obtained in the WIOT). *Source: WIOD.*

Imports growth (constant prices): Is the first difference of logarithms of imports of a given year (obtained in the German NIOT) minus the difference in logarithms of imports in previous years' prices (obtained in the WIOT). *Source: WIOD.*

Export prices: It is obtained by subtracting from the growth of exports in current prices the growth of exports in constant prices (again we use first differences of logarithms). *Source: WIOD.*

Import prices: It is calculated by subtracting from the growth of imports in current prices the growth of imports in constant prices (here again we use first differences of logarithms). *Source: WIOD.*

World Demand: We first subtracted the German GDP from the world GDP, both in constant prices, and then we calculated the difference in logarithms. *Source: World Bank*

Nominal ULC: It is the first difference of logarithms of the labor compensation and labor productivity, both vertically integrated (see Equation (5)). The labor compensation and employment is obtained from the Socio-economic accounts. The employment is measured in persons instead of hours to avoid bias. This is because the latter variable is only available for salary earners and not for total employment, while the labor compensation refers to salary earners and self-employees. *Source: WIOD.*

KIBS: It is the first difference of logarithms of the share of KIBS employment vertically integrated into manufacturing subsystems. *Source: WIOD.*

Table A5. Classification of economic activities (ISIC revision 4)

1. Manufacturing	2. Knowledge intensive business services (KIBS)
<p><i>1.1. High and medium-high technology</i></p> <p>C20 Manufacture of chemicals and chemical products C21 Manufacture of basic pharmaceutical products and pharmaceutical preparations C26 Manufacture of computer, electronic and optical products C27 Manufacture of electrical equipment C28 Manufacture of machinery and equipment n.e.c. C29 Manufacture of motor vehicles, trailers and semi-trailers C30 Manufacture of other transport equipment</p> <p><i>1.2. Medium and medium-low technology</i></p> <p>C10-C12 Manufacture of food products, beverages and tobacco products C13-C15 Manufacture of textiles, wearing apparel and leather products C16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials C17 Manufacture of paper and paper products C18 Printing and reproduction of recorded media C19 Manufacture of coke and refined petroleum products C22 Manufacture of rubber and plastic products C23 Manufacture of other non-metallic mineral products C24 Manufacture of basic metals C25 Manufacture of fabricated metal products, except machinery and equipment C31-C32 Manufacture of furniture; other manufacturing C33 Repair and installation of machinery and equipment</p>	<p>J62-J63 Computer programming, consultancy and related activities; information service activities M69-M70 Legal and accounting activities; activities of head offices; management consultancy activities M71 Architectural and engineering activities; technical testing and analysis M72 Scientific research and development M73 Advertising and market research M74 - M75 Other professional, scientific and technical activities; veterinary activities N Administrative and support service activities</p> <hr/> <p style="text-align: center;">3. Personal services</p> <hr/> <p>G47 Retail trade, except of motor vehicles and motorcycles I Accommodation and food service activities P85 Education Q Human health and social work activities R-S Other service activities</p>

Chapter 5

Conclusions

Since the early-1990s, Germany has experienced a profound transformation of its economic institutions, and especially labor institutions. This process attracted attention from many observers in political economy due to the “coordinated nature” of German capitalism. The country’s economic institutions encouraged certain sorts of cooperative relations between labor and capital, as well as among companies themselves. Under these institutional agreements, Germany performed quite well during the 1970s and the 1980s, achieving price stability and high competitiveness in advanced manufacturing industries, as well as comparatively low levels of income inequality. Nonetheless, during the 1990s the efficiency of these institutions began to be questioned.

That decade was challenging for the country. After the reunification between Western and Eastern *Länder*, it experienced low yearly growth rates (1.4%) and severe difficulties to create jobs (0.22%). As a consequence, the unemployment rate grew steadily until 2005, when it reached a historical value of 11.2%. Furthermore, the country also experienced some loss of price competitiveness due to the entrance of new competitors into its main export markets. In addition, the fall of the Iron curtain and the progressive openness of commercial and financial markets offered new opportunities for the manufacturing sector, where traditional institutions were grounded. Thus, firms put more pressure on domestic suppliers and undertook a restructuring process, characterized by the outsourcing of certain service activities. Besides, they relocated production toward Eastern Europe, thus threatening the German industrial base and exacerbating the problem of unemployment.

The rigidities imposed by labor institutions were pointed out as the main cause of these economic problems. On the one hand, they were blocking the development of the main source of employment creation in advanced economies, the service sector; and on the other hand, they impeded economic agents to adapt rapidly enough to the new market conditions and opportunities.

Then, the economy embarked on a long process of institutional reforms, particularly concentrated in the labor market. Collective actors lost a significant part of their members, besides, their capacity to enforce and ensure compliance with labor regulations weakened. In the face of rising unemployment and threats of disinvestment, manufacturing trade unions adopted defensive strategy to protect their core affiliates. The tightness of the labor law was slightly relaxed by the introduction of opting-out clauses in sectoral collective agreements and by the progressive casualization of labor relations. Plant-level bargaining gained importance, because distributive issues were gradually decentralized. Therefore the role of work councils became more relevant, and manufacturing firms gained internal flexibility. Nonetheless, the

coverage of sectoral bargaining decreased and a large share of the workforce was excluded from the IIRR system, since the presence of work councils and union strength was much lower outside the manufacturing sector.

Many observers praised this process – known as *Pacts for Employment and Competitiveness* - and claimed that the coordinated nature of the German institutions was behind it (e.g. Seifert and Massa-Wirth, 2005; Carlin and Soskice 2009). Focusing on the manufacturing sector, they highlighted that social partnership played a central role, and the cooperative orientation of unions and employers enable a relatively peaceful decentralization of the wage-setting process. This way, manufacturing firms could implement flexible restructuring measures to maintain competitiveness, while core workers preserved their jobs. Besides, although the scope and coverage of coordinated institutions was reduced, manufacturing firms continued enjoying some competitive advantages provided by them, such as peaceful labor relations and cooperation of highly skilled workforce.

Nevertheless, the problem of unemployment persisted and, in 2003, the coalition government between the SPD and the Green Party passed a package of far-reaching reforms of the labor market, known as Hartz Reforms. They mainly affected services, through the abolition of the maximum limit of hours for minijob contracts and the implementation of active labor market policies, but also impacted on manufacturing hiring strategies through the full liberalization of agency work (the main form of non-standard work in the sector).

At the end of this long path of institutional reforms, companies gained both internal and external flexibility. Moreover, the problem of unemployment was solved thanks to the expansion of service employment (mainly low-level), the creation of many low-wage jobs and the reduction of hours worked per employee. In addition, another important result of this process was the wage devaluation of the country against other competitors, which reinforced the traditional export-oriented nature of the country.

This dissertation drew on the Varieties of Capitalism debate to study the transformation and appearance of a new German model. While a great deal has been written and said about the topic, there are still several –mainly empirical – blackspots. With the motivation of filling these gaps in the literature and contributing to a better understanding of the German puzzle, this PhD dissertation offered an empirical analysis organized in the following three contributions:

- (1) The first one aimed to obtain empirical evidence about the extent to which the traditional German model of labor market and IIRR is widespread in the private economy, and to capture the effect that the transformation of the employment structure has had on the process of institutional change.
- (2) Second, drawing on the varieties of capitalism theory of innovation, we aimed to investigate the economic outcomes of coordinated institutions in the sector where they are still more or less strong: manufacturing.
- (3) And third, we researched the causes of the commercial success of the country by exploring the existing productive linkages between manufacturing and services.

The conclusions obtained are the following. Regarding the first contribution (Chapter 2), we used a plant-level dataset, the *IAB Establishment Panel*, to descriptively analyze the presence and evolution of the four main types of atypical employment along with the dual system of industrial relations in several types of firm. Furthermore, we applied a shift-share technique to estimate which part of the institutional change is due to the change in the employment structure, and which is explained by strategic decisions within firms.

The evidence obtained revealed that the retrenchment of traditional institutions affected many types of firm, including the manufacturing ones. We detected a small core manufacturing sector, composed by large firms in technological intensive industries where collective bargaining and work councils are still strong. Nonetheless, these firms have also increased their demand of non-standard work and are slowly abandoning sectoral agreements in favor of firm-level ones. On the other hand, we found that 63% of the workforce is currently located in small and medium firms in non-advanced manufacturing industries and business services, as well as in consumer service companies. These types of firms have substantially raised their levels of atypical employment, and have left the dual system of IIRR. The rest of the labor force (33%) is employed in a group of establishments that either present atypical employment levels far-above the average, or a coverage level of the dual system of IIRR below average. We showed that almost all types of firms were involved in one way or another in the process of institutional change.

Additionally, our findings point out that structural change was an important driver of the erosion of traditional institutions. Nonetheless, the main explanatory factor was the firms' strategic decisions, i.e. their preferences regarding their coordination strategies with the workforce.

This chapter's results were read with references to the theses of dualization (Thelen, 2014) and liberalization (Baccaro and Howell, 2011). We detected that, despite the existence of a small core, one cannot say that employers are strategically interested in preserving coordinated institutions. Besides, the fact that firms across the whole economy abandoned coordinated institutional arrangements explains why the effect of the change in the employment structure is relatively small. Hence, once labor institutions are flexibilized, it is expected that causal work relations and individualized wage bargaining spread across the entire economy.

Once we got a precise overview on the presence and evolution of coordinated labor institutions, we analyzed their economic effects. In particular, we focused on the manufacturing industries, where the model is still grounded (Chapter 3). Although coordinated institutions are in marked retreat, are they still effective in achieving economic outcomes? In order to answer that question, we looked at the innovation practices of firms. According to the Varieties of Capitalism approach, innovation is one of the main economic outcomes of national institutions. Therefore, it is the perfect indicator to assess their efficiency.

In this chapter, we took advantage again of the *IAB Establishment Panel*. We created a variable that captured the concept of institutional coherence, with the aim of estimating the joint impact of coordinated institutions on four types of innovation (incremental, radical, process

innovation and imitations). Several theoretical assumptions of VoC scholars were empirically tested drawing on logistic modelling, concretely: (1) the idea that coordinated institutions foster incremental innovation, but discourage radical innovation; besides (2) in order to properly capture the effect of institutions and control problems of spurious causality, we focused on the most advanced and productive firms in the economy (i.e. large exporting firms in high-technology industries).

Our findings support the VoC claim that coordinated institutions are efficient to incrementally innovate. Nonetheless, contrary to what that theory predicts, they do not harm radical innovation. Furthermore, when digging deeper into the empirical analysis, we found that even in most advanced firms of the economy -i.e. those that because of their own specific features are innovation leaders- coordinated institutions still make a difference. Therefore, we conclude that the main road to innovation in Germany is a “non-market” corporate strategy. It is interesting to note that, while the German model eroded over time, coordinated institutions still yield positive economic outcomes and seem to be efficient to innovate.

Lastly, we researched the causes of the remarkable exporting performance of German manufacturing by exploring the productive linkages between this sector and services (Chapter 4). Some works pointed out that the process of wage devaluation and the production restructuring in manufacturing were required to regain competitiveness (e.g. Baccaro and Benassi, 2017). Furthermore, as we explained, the pay moderation was much tougher in the sector that is sheltered from international competition (services) than in the exposed sector (manufacturing). The dominant narrative is that the wage squeeze was a necessary condition for export growth, because it served to keep price growth under control and to provide cheap inputs to manufacturing companies. We casted serious doubt on the impact of the wage restraint on the export boom, because Germany is specialized in the production of high-quality and complex goods, in which price-competitiveness is not the most important factor. Furthermore, we already knew from Chapter 3 that coordinated institutions are still efficient in endowing firms with innovative capabilities to compete in international markets.

The empirical analysis of this chapter was based on the *World Input-Output Database* (WIOD). We applied a subsystem approach to the input-output analysis to explore the cost structure of manufacturing subsystems. We calculated vertically integrated unit labor costs and differed between the labor costs of the service part of the subsystem and the rest. In addition, we considered another channel through which services might have contributed to manufacturing export growth. Concretely, we focus on knowledge-intensive business services (KIBS), which are highly innovative and promote innovation and technical progress in the sectors with which they cooperate. The demand of KIBS inputs from manufacturing firms has been increasing over time, and they might help to foster manufacturing competitiveness via non-price factors.

With manufacturing subsystems as units of analysis we estimated a panel data model to capture the causal effects of these variables on exports. We found that non-price factors were the main drivers of manufacturing exports. Specifically, exports grew mainly as a result of the ability of German manufacturers to take advantage of the world demand growth, as well as the positive linkages with advanced services. On the other hand, a high price growth rate elasticity was

captured (-0.7), but the specific effect of labor costs, although statistically significant, was small (-0.13). Furthermore, this effect is due to the wage moderation in the service part of the subsystem. Therefore, our results suggest that in Germany the link between ULC and exports is weak and that the relationship between manufacturing and services is not only a matter of saving costs. Overall, these findings challenge the narrative that wage moderation was fruitful for export growth.

The three empirical contributions of this research are interconnected. We showed that the traditional German model is in marked retreat. Although there are some parts of the economy in which it is still strong, there seems to be a tendency toward liberalization. This is not to say that Germany is converging toward an Anglo-Saxon type of capitalist organization, but overall, in absence of constraining IRR institutions and labor organization, employers tend to casualize labor relations and take advantage of the opportunities offered by the market.

Any sort of productive reorganization or institutional change is logically shaped by the interaction between employers' strategies, organized labor and their institutional resources to limit employers' discretionary decisions, along with the economic policy guidelines of the state. During the period analyzed, state involvement aimed for the flexibilization of labor regulation. In this context, naturally, the institutional erosion and deterioration of working conditions are sharper in those types of firm in which workers are less skilled, have less control over production processes and are poorly organized, i.e. in those companies in which their negotiating power is weaker. On the other hand, workers in core manufacturing firms are well represented in unions and powerful work councils, and firms are more dependent on a skilled workforce to produce. Therefore they have more resources to protect their working conditions. Nonetheless, despite this relative strength, in Germany less-skilled workers were also affected by segmentation dynamics.

In addition, as has already been pointed out in the conclusions of Chapter 2, liberalization is not a linear process (Eichhorst and Marx, 2011). There have been some initiatives to re-institutionalize the more deregulated segment of the labor market, and the State has slightly changed some of its policy guidelines. For instance, trade unions that are part of the DGB (especially *IG Metall*) have incorporated temporary agency workers into their strategies and press much more for the equalization of wages between them and directly employed workers. Moreover, the maximum wage permitted for marginal job contracts has increased since the implementation of Hartz Reforms. Besides, a national minimum wage (8.5€ per hour) was passed in 2015, and was incremented in 2017 (8.87€). This issue represents an important milestone for the political regulation of the labor market, and constitutes a turnaround in the policy conducted by the State. The combination of these initiatives with the low unemployment rate has pushed up wages at the lower-end of the distribution since 2016.

Regarding the economic effects of coordinated institutions, we detected a contradictory dynamic: while they are still efficient for economic performance, many firms opted to abandon them in order to embrace more flexible forms of coordination. We showed that innovation practices seem to be determined by these institutions, therefore companies that are supposed to lead the technical progress and productivity growth, account for a diminishing proportion of

the total firm population. Furthermore, the small effect of ULC on exports captured by our econometric model suggests that the rationale behind the productive restructuring as well as the wage moderation, rather than regaining of competitiveness, was the natural aim of businesses to widen their profit margins and break free from the constraints on their decision-making.

These results bring to the present the rather provocative concept of “beneficial constraints” elaborated by Wolfgang Streeck (1991, 1997a). The main idea is that certain impositions on the employers’ rational voluntarism might be beneficial in the long run for the economic performance. Social institutions, like the traditional German ones, limit the rational short-term oriented behavior of economic agents, forcing them to acquire compromises with other actors and take decisions that they would otherwise never take. Institutional support for work council formation, negotiated corporate governance or high employment protection can be, in some situations, positive for long-run corporate strategies. Nonetheless, although beneficial, there is an underlying tendency toward immediate profit maximization that continuously threatens these sort of institutions. For these reasons, in general, it seems that, in absence of these constraints and strong collective actors that enforce compliance, employers’ preferences work against coordinated institutions. In this sense, further research should focus on the role of KIBS in the innovation process of manufacturing firms. It might be the case that the strengthened links between KIBS and manufacturing companies is a way out of the institutional constraints without losing efficiency.

At this point, a note on the functionality of the wage moderation might be appropriate. We detected that the fall of wages in services and the regressive trajectory of income distribution was not fully passed onto prices. Our results point to the fact that the effect of labor costs on exports is rather low. Nonetheless, they impacted strongly on domestic demand (which was almost stagnated until 2003, and has grown slowly since then) and imports, thus affecting net export growth. Post-Keynesian authors highlight that Germany is a wage-led economy (Naastepad and Storm, 2007; Hein and Vogel, 2008). The increase in the profit share and the low sensitiveness of corporate investment to profit margins have resulted in lower rates of economic growth, despite the commercial success of the last twenty years. In other words, the impressive growth in external demand thanks to the wage moderation has not been enough to overcome the sclerotic growth of the domestic demand, also provoked by the evolution of wages. Besides, it does not seem to be a trade-off between wage inequality and competitiveness, at least in the German case. Therefore the macroeconomic management of the country may have been dysfunctional for the economic growth. In this line, the last IMF report on Germany (2019) also points out that the growth strategy of the economy is unbalanced. It shows that the persistent current account surplus has resulted in rising corporate savings, because profits were unevenly distributed due to the weakening of labor institutions (along with other reasons related with the particular structure of business ownership and corporate taxes), thus increasing wealth inequality.

All in all, despite Germany being signaled as an “economic superstar”, it seems that a certain rebalancing of its growth strategy would be positive to foster economic growth, as well as to

boost quality employment and reduce inequality (Horn et al, 2017). Institutions and collective actors should be a constituent part of that process.

On the other hand, the Varieties of Capitalism debate is theoretically very rich, but we have perceived lack of empirical evidence in some of its statements. The empirical approximation of the present dissertation constitutes a humble contribution to it. We tried to adopt a realistic approach to the study of the German model, based on empirical work rather than theoretical axioms. We also sought to overcome the methodological individualism of the Hall and Soskice's approach, and introduce more actors in the analysis, like the state. Moreover, we signaled that economic agents within social groups have heterogeneous interests in political economies. For instance, a cleavage between workers in advanced manufacturing industries and services, or between large assemblers companies and suppliers was observed. In addition, our analysis put forward that, contrary to VoC claims, there is not any pre-strategic interest of employers on coordinated institutions. In this sense, this research is also a realistic approach to the processes of institutional continuity and change in advanced economies.

We believe that our results go far beyond the Varieties of Capitalism debate. Our findings might also be useful for labor economics, since we partially addressed the issue of the evolution of labor institutions and their relation with unemployment, wages and structural change. The dissertation also provided conclusions about the institutional determinants of innovation. It is worth noting that, according to our results, firms in which social agents are strong and participate in the decision-taking process are innovation leaders. That result is in line with other works that point out that there is weak evidence of the claim that deregulation fosters innovation.

On the other hand, we also engaged in the debate on the determinants of exports and competitiveness. According to the obtained evidence, a process of wage devaluation vis-à-vis other competitors in a country like Germany does not have much further to go. First, there is not a mechanical relation between labor costs and export prices, but it depends on the structure of the market, i.e. whether producers can sustain mark-ups or not. Second, as we signaled above, this type of macroeconomic management probably has had more disadvantages than advantages, because it damaged the GDP growth. This might be a lesson for other countries that aim to regain competitiveness through wage moderation. A strategy based on productive upgrading and development of high productivity industries, although much more difficult to accomplish, would be more sustainable in the long run and would avoid any potential trade-off between domestic and external demand.

This PhD thesis also has several limitations, and a wide array of questions remain open. In the first place, the evolution and current situation of Germany would be better assessed in comparative terms. We have been stressing throughout the whole work that Germany has experienced a process of institutional liberalization without converging toward an Anglo-Saxon type of capitalism. This claim would be better supported by a comparative analysis. Likewise, a comparative perspective would provide a better understanding of the results of Chapter 3, in which innovation patterns of manufacturing firms were explored. The findings suggest that the main road to innovation in Germany is a non-market corporate strategy, but, is this result

replicated in liberal-market economies? Moreover, it might be the case that in liberal economies, a full-market corporate strategy would be the most adequate one to undertake all types of innovation, and that firms just adapt to fully exploit the available institutional resources. In this sense, a comparison between coordinated and liberal economies would also clarify whether the former are effectively more prone to incrementally innovate and the latter perform better radical innovations. Another limit of this chapter is that a fluid dialogue with other theories on the institutional determinants of innovation would have enriched the analysis. We are aware that, for instance, the regulation theory as well as the national systems of innovation one have a lot to say about this issue, and that they have theoretical tools to introduce the role of the state in the innovation process. Besides, regarding Chapter 4, probably the main limitation is that we only analyzed the domestic unit labor costs. Future research might employ the WIOD and build vertically integrated ULC across the whole global value chain, in order to explore the labor cost structure throughout the whole production process of a final commodity as well as the extent to which Germany has taken advantage of offshoring.

Lastly, as abovementioned the aim of this work is to shed light on partial aspects of the German model. To achieve a full understanding of it, it would be necessary to study other aspects of the economy, such as the fiscal rules, the welfare state (which is in marked retreat as well), as well as the relationships between institutions and other aspects of the macroeconomic performance. Fortunately, several approaches to political economy are addressing these issues, and are formulating interesting new research questions. Therefore, the discipline is advancing toward a better comprehension of Germany in particular, as well as the process of institutional change and the causal relations between institutions and macroeconomic performance in general.

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