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Institute of Economics
Scuola Superiore Sant'Anna

Piazza Martiri della Libertà, 33 - 56127 Pisa, Italy
ph. +39 050 88.33.43
institute.economics@sssup.it

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Wages and productivity in Argentinian manufacturing. A structuralist and distributional firm-level analysis

María Celeste Gómez [a]
Maria Enrica Virgillito [b]

[a] Centro de Inv estigaciones en Ciencias Económicas, CONICET and Universidad Nacional de Córdoba, Córdoba, Argentina. Global Labor Organization Affiliate.
[b] Institute of Economics and EMbeDS Department, Scuola Superiore Sant'Anna, Pisa, Italy, and Department of Economic Policy, Università Cattolica del Sacro Cuore, Milano, Italy. Global Labor Organization Fellow.

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Wages and productivity in Argentinian manufacturing.

A structuralist and distributional firm-level analysis [§]

María Celeste Gómez [a, *], Maria Enrica Virgillito [b]

Abstract

Wages and productivity represent two of the most relevant variables to consider in economic development. Given the low productivity levels that emerging countries reveal, the accumulation of productive capabilities and a narrower dispersion across sectors would enable emerging countries to overcome the middle-income trap. Yet, this positive trend in productivity should translate into higher wages. Thus, we pose the following questions applied to a middle-income trapped country: is there a link between labour productivity and wages in the Argentine manufacturing sector? Does it differ across techno-productive classes or wage levels? Which factors affect this nexus, considering premature deindustrialisation? Using a firm-level dataset from 2010 to 2016, we perform quantile regression estimates to evaluate the link between productivity and wages across the conditional wage distribution among manufacturing firms. Based on a structural analysis, we identify the differences in these elasticities at 2-ISIC code levels and across Pavitt taxonomies. Our results confirm a positive, but extremely low, pass-through between productivity and wages in the Argentinian manufacturing firms, different across sectors according to their techno-productive capabilities, robust under different empirical strategies.

JEL Codes: J31, D24, L6, O14, C21.

KEYWORDS: Gains from productivity, Development, Asymmetries

a. Centro de Investigaciones en Ciencias Económicas (CONICET and Universidad Nacional de Córdoba), Córdoba, Argentina. Global Labor Organization Affiliate. Email: mcelestegomez@unc.edu.ar. (*) Corresponding author.

b. Institute of Economics and EMbeDS Department, Scuola Universitaria Superiore Sant'Anna, Pisa, Italy, and Department of Economic Policy, Università Cattolica del Sacro Cuore, Milano, Italy. Global Labor Organization Fellow. Email: mariaenrica.virgillito@santannapisa.it

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1. Introduction

Wages and productivity are two of the most studied variables in the development literature. The former represents the ultimate growth engine in the global economy and a challenge for countries catching up, while higher productivity growth is required to break free from the middle-income trap that afflicts many emerging economies and promote inclusive growth (OECD, 2015; Paus, 2018a). The latter is also a crucial variable if we focus on workers' welfare conditions in the production area and pursue distributive justice.

There is solid evidence that pay and productivity heterogeneity are significant and growing both among and within productive sectors. In addition, there might be a positive relationship between the two dispersions in wages and productivity, known as the "great divergence(s)" (Berlingieri et al., 2017), a phenomenon that occurs in advanced economies (Dunne et al., 2004; Barth et al., 2016) as well as in emerging countries (Dias Bahia & Arbache, 2005; Barrera Insua & Fernández Massi, 2013). The interest behind these divergences is to what extent wage dispersion responds to productivity dispersion (Bhattacharya et al., 2011; Stansbury & Summers, 2017; Card et al., 2018; Dosi et al., 2020;).[1]

Latin America and Argentina in particular have a number of intrinsic elements in their productive structures, technological capabilities, and labour rules that all play a role in the wage-productivity nexus. One is the aforementioned middle-income trap, in which middle-income nations, on the one hand, are unable to trade internationally in standardised goods and/or labour-intensive products because they pay relatively higher salaries. On the other hand, due to their poor productivity and limited technological capabilities, these countries are unable to compete on a large enough scale in higher value-added sectors (Gill et al., 2007; Paus, 2017). In a system where globalisation accelerates productive inequality between countries, greater international competition necessarily drives more efficient use of resources. In reality, developing economies have fewer and fewer options for reducing productivity disparities and improving labour conditions (Santarcángelo, 2017; Graña, 2018; Dosi et al. 2021b). Natural resource comparative advantages in Latin American countries do not appear to favour these processes (McMillan & Rodrik, 2011).

From a distributional perspective, even studies that focus on wage-productivity pass-through in a structuralist framework generally point to single measures of elasticity, the conditional mean or the median (Stansbury & Summers, 2017; Card et al., 2018). As a result, there is a general lack of information regarding the distributional patterns that exist beyond it. However, it is essential to explore the link between productivity and wages throughout their distribution in Argentina, as well as the rest of Latin America's countries, showing persistent productive variability and wide wage disparity, in a context of deindustrialization. That is our main motivation, and it consists of three interconnected questions: What is the nexus between wages and productivity in the Argentinean manufacturing sector? Is it different along the wage conditional distribution and across industries and/or technology groups? What factors influence this relationship being Argentina a late-industrializing and a premature-deindustrialize middle-income country? To address this puzzle, we examine the wage-productivity pass-through patterns across techno-productive structures, defined as sectors and as Pavitt's classes (1984), employing conditional quantile regression on a firm-level dataset from the Argentinean manufacturing industry from 2010 to 2016.

[1] Among the mainstream literature, there is a growing recognition that technological change is not an exogenous force that we can barely adapt to. Rather, the role that institutions and policies play in the link between productivity and wages is increasingly identified (Acemoglu et al., 2022; Autor, 2022).

The paper is organised as follows: in the next section, we briefly provide a theoretical basis for structuralist and evolutionary literature. Then, we concentrate on the political and institutional context in Argentina since the late-industrialization phase (section 3). Section 4 gives a summary of the industrial sector's development in terms of productivity, trade, and labour markets. In section 5, we discuss the database and empirical strategy, and in section 6, we present our findings of the wage-productivity pass-through. Finally, concluding remarks follow.

2. Theoretical Background

To study the wage-productivity relationship in Argentina, we adopt the lenses of evolutionary and structuralist perspectives. These approaches develop their analysis starting from the productive side of the economy, focus on country's economic structure and relate it with development and growth conditions -or the lack of them- (Lewis, 1984; Syrquin, 1988). Evolutionary economics addresses the relationship between technological progress and economic growth and change. The evolutionary method introduces technical progress in a quite different way from neoclassical theory (where technological change represents an exogenous, *deus ex machina* phenomenon). In the former, technology status is the result of trajectories endogenously generated by the market structure, the nature, and strength of opportunities for technological advance, and the ability of firms to appropriate the returns of scientific research and development (Dosi, 1988). These endogenous mechanisms highlight the dynamic nature of capitalism (Schumpeter, 1934). According to this principle, firms decide whether to introduce (or not) innovations in the market based on their capabilities and decision rules. In that sense, microeconomic behaviour is crucial to the processes of structural change and technological development (Nelson & Winter, 1982).

We can argue from the foregoing that there is no single development model. Instead, the different technological and development trajectories are highly path-dependent. From a structuralist point of view, promoting specific sectors and products is critical if we recognise that they entail heterogeneous learning opportunities and different income elasticities of demand. In other words, "… today's specializations influence tomorrow's productivity growth, chances to innovate and demand potential." (Cimoli et al., 2009, p.3), and put it synthetically, microchips are not potato chips (Dosi et al., 2021b). According to such an approach, technological learning occurs throughout the different stages of the catching-up process and consists of diverse tasks such as imitation, reverse engineering, and marginal modifications of products and processes. However, the ability to engage in these activities is dependent not only on investments and innovation efforts, but also on firms' and countries' absorptive capacities.[2] In other words, and especially in the global context, the appropriability of knowledge is a reality in countries where formal "bridging institutions" between proper science and technology set the conditions for local, national, and regional technological developments (Freeman, 1974; Dosi, 1982). The rationale behind this concept is that, for innovation and technological progress to happen, firms must interact with other firms and with organizations including universities, research centres, government bureaus, and financial institutions, among others. Innovation is not an isolated activity but a collective process, a system of innovation (Malerba, 2002; Lundvall, 2016).

In terms of political economy, industrialisation is an intervention strategy that encourages the generation of crucial technological capabilities in areas where they do not exist or exist in rudimentary and/or deficient ways (Syrquin, 1988). However, it is also necessary to coordinate it with macroeconomic

[2] The original concept applied to firms and was first developed by Cohen & Levinthal (1990).

policies. Essentially, we are referring to technology- and industry-oriented measures that encourage the development of technological advances (Cimoli et al., 2009). That is why industrial policies represent predicaments, because national policymakers inevitably apply them (implicitly or explicitly) when deciding on the distribution of earning opportunities and production and trade patterns, or even when accepting their current position in the international division of labour and the current distribution of learning opportunities (Hausmann & Rodrik, 2006). The absence of industrial policy is a policy in itself, a conclusion particularly suited for developing countries like Argentina.

In Latin America, industrialisation faced many obstacles early on. The characteristics of this process in the middle of the nineteenth century did not allow Latin America to develop. Despite its initial results, restrictions associated with the impossibility of advancing to the "difficult substitution" phase and overcoming the technological and financial dependence on developed economies soon became evident (Ormaechea & Fernández, 2020). Hirschman (1968) discusses the reasons underlying the problems that arose in Latin American countries after the initial phase of import-substituting industrialisation (ISI). Among them, the author stresses the lack of training in technological innovation, the local resistance to investing in backward linkage (facing a virtual absence of a production chain), and the difficulties of delivering local exportable products. In political terms, Hirschman combines the previous with local political factors, i.e., the lobbying power of the primary export sector, which exerted successful pressures to prevent such a process —and later initiatives— from affecting their interests.

The role of manufacturing in development is a widely studied topic. Prebisch (1959) and Hirschmann (1968) and showed the special dynamism of industry by identifying that productivity increases to a greater extent than in other sectors and that gains from productivity growth translate into wage increases with a higher elasticity (Dosi et al., 2021b). Nowadays, several studies posit the manufacturing sector not only as an engine of growth and a channel for higher wage-productivity nexus, but also as an employment multiplier, and a driver of knowledge absorption (Bivens, 2003; Bogliacino & Pianta, 2011; Araujo et al., 2016; Berlingieri et al., 2017; Schwellnus et al., 2017; Cresti & Virgillito, 2022). Despite this, the industrialisation experiences did not always result in structural transformations to take advantage of the aforementioned conditions (Santarcángelo, 2019; Ormaechea & Fernández, 2020). In Argentina, the patterns of production and trade, the social structures, and the institutional architecture did not change to the extent needed to create a sustainable development path. Indeed, the economic structures of Latin American countries and other underdeveloped countries have remained anchored in natural resources and therefore stuck in inconclusive structural change processes (Chena & Caldentey, 2020). This phenomenon is not harmless for productivity. The lack of structural change translates into lower growth rate of labour productivity in all the developing regions (Paus, 2018b). In a comparison among developing countries, Mc Millan & Rodrik (2011) show that, conversely to the successful catching-up process revealed in Asian countries, in Latin American ones, economic transformations drove labour from high to low-productivity sectors.[3] Consequently, scarce growth in productivity is a primary cause of the region's poor economic performance during the last four decades (Pagés-Serra, 2010; Grazzi et al., 2016;).

The weak performance in productivity that Argentina as well as most Latin American nations face is historically expressed both in foreign productivity differentials (gaps in productivity with countries that operate on the technological frontier) and internal heterogeneity (productive disparity among industries) (Cimoli, 2005; CEPAL, 2010; Grazzi et al., 2016; Graña, 2018).[4] In line with this phenomenon,

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[3] Yu et al. (2015) discuss the experience of Chinese firms which followed up an impressive catching-up with significant institutional changes consisting of creative restructuring and the accumulation of absorptive capabilities, especially by domestic firms with low technological complexity.

[4] Further on, in the results section, we show the variability within productivity and wages at a micro -level analysis.

Argentinean manufacturing shows a clear neodualism in the productive sphere of business firms (Dosi et al., 2021a). A bunch of firms in a few industrial sectors that engage in innovation processes and exhibit international productivity standards comparable with technological leading countries (Chudnovsky et al., 2006; Raffo et al., 2008; Arza & López, 2010; Grazzi et al., 2016;), and a majority of small and medium enterprises (SME) that operates in low-productivity sectors, with low technological dynamism (Cimoli, 2005; Barrera Insua & Fernández Massi, 2013), and can only survive competition by decreasing salaries and degrading job conditions (Graña, 2018).[5]

This unfavourable production structure reduces development opportunities (Pagés-Serra, 2010; Aravena & Fuentes Knight, 2014) and can be rationalised under the middle-income trap framework (Paus, 2018b; Kang & Paus, 2020); a pattern indeed that not only affects Argentina's growth prospects, but also reveals an apparent paradox: natural-resource intensity does not improve productive performance because it promotes a bad specialisation strategy in products that are not demand-elastic (Reinert, 1995, Dosi et al., 2022). What is supposedly positive for the country, in fact, impedes and prevents any genuine structural change that might improve productivity standards.

Structuralist theory thus calls for changes in production dynamics, institutions, and cultural contexts. According to this perspective, these transformations would lead countries to develop production processes with more complexity, thus offering more learning potential and a greater ability to cope with potential expansions in demand (Dosi et al., 1990, 2022). Any structuralist analysis requires an exercise of grouping industrial sectors in such a way as to reflect knowledge and learning regimes. In that respect, Pavitt (1984) develops a taxonomy that groups sectors and firms in four distinct classes according to their technological content, the quality of their specialisation, and their position within the value chains (Dosi et al., 2021b).[6] The first class, the supplier-dominated (SD), includes firms where innovation is driven by means of exogenous change in capital inputs and the process of learning by using, typically associated with food and beverages, textiles, leather, and wood production. The scale-intensive (SI) class relates to firms with technological adoption of capital inputs and where learning is cumulative and reinforced by the economies of scale. This includes manufacturing of paper, rubber, plastics and derivatives, basic metals, and trailers and semi-trailers. The specialised suppliers (SS) class considers firms that act as suppliers of capital equipment, instruments, and components, where R&D investment and tacit knowledge express the endogenous process of learning, composed of machinery and equipment, and other transport equipment and devices. Finally, the science-based (SB) class comprises innovation processes that are strongly connected to applied and basic research, with a basic point of departure that involves communication and cooperation with scientific and technological systems. This class includes the manufacturing of basic chemicals and pharmaceutical products, as well as medical and optical instruments or devices.

Based on the Pavitt (1984) taxonomy, Dosi et al. (2021b) document in a cross-country analysis the existence of a variety of patterns of deindustrialisation according to the proposed technological classes.[7] The authors stress the relevance of specialisation in knowledge-disseminating and specialised suppliers sectors. They also argue that in this global context, orienting the productive and commercial structures

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5 In the Argentinean manufacturing sector, 80% of the firms reported in the National Survey on Employment and Innovation Dynamics (ENDEI in Spanish) are registered as SME. Considering that this survey includes firms with at least 10 employees in formal employment conditions, this share would be higher if we included micro-enterprises and informal ones.

6 Pavitt includes the SD and SI classes as part of a higher category, which he calls the *production-intensive* class. In this paper, as in the literature mentioned above, the disaggregated version is used because of the strong differences between the two.

7 In the methodological section, we provide a detailed description of the adaption to the Pavitt taxonomy.

to those areas is quite difficult, considering the high barriers to entry and the strong degrees of appropriability conditions prevailing nowadays. In agreement, Medeiros and Trebat (2017) explore the location of the global innovation processes and the role of global value chains in them. While developing countries concentrate their production on non-core activities, developed countries concentrate on innovation, competition, and monitoring of property rights; that is, core-business.

According to Syrquin (1988), economic development is seen as an interrelated set of long-run processes of structural transformation that accompany growth. From a historical and institutional perspective, these processes involve five tentative dimensions: science, technology, economics, politics, and culture, granting that these streams intermingle through positive or negative interactions (Freeman, 2019). From this perspective, countries' growth is not a purely economic concept but the result of specific conditions where these dimensions intervene.

Thus, institutions and policies define the development trajectories of countries in specific ways, both geographically and temporally. Taking into account the historical evidence, Adelman (2001) argues that policies that worked well for initiating economic growth were generally not appropriate for its continuation. That is the case of countries with abundant natural resources that significantly expanded primary exports at an early stage. Yet, further successful development would have required transforming economic institutions to share growth and foster the consolidation of a domestic market for manufacturing products, via wage and demand growth. A similar challenge arises in countries that initiated a structural transformation process but failed to develop it beyond a certain point. In particular, nations that undertook an industrialisation process but were unable to shift out of the import-substitution phase due to high costs or captive bureaucracies. The above examples show historical backgrounds that might relate to the development trajectory of Argentina.

In the next section, we outline the institutional context that characterises Argentina.

3. National Background

a. Industrial policies and institutions

Industrialisation in Latin America was not developed from the very beginning by targeted institutions that formalised, designed and evaluated it as a long-term policy. According to Love, this "process was fact before it was a policy, and policy before it was theory"(Love, 1995, p. 395). For Argentina, this sort of delay in defining an industrial policy is evident in the chronological order followed: first, the implementation in 1944 of the first industrial promotion regime. Later, the establishment of the first public office aimed to deal with industrial matters separately from the agricultural ones. Since that first episode, the organisational structure and functions of state agencies devoted to industrial policy have changed dramatically (Bascur & Coviello, 2021),[8] reflecting the difficulties of following a development path unrelated to the primary sector. A close examination of the industrial policies that were implemented after the first industrial promotion regime reveals that there have been numerous yet uncoordinated public initiatives.

[8] From 1944 to the present, there have been multiple changes in the status, functions, and in the organization of the industrial institutions. For a detailed description, see Rougier (2021).

b. An Overview of the Argentinean manufacturing sector

Argentina has a marked natural resource intensity, which makes it dependent on international trade in primary goods. In this context, the industrialisation process was designed to foster specific industrial branches through import substitution, with the state playing an active role (Santarcángelo, 2019). Labour-intensive industries have been promoted since 1944 and throughout the 1950s decade, with a focus on the domestic market. Labour conditions and wages were improved, lowering inequality and urban poverty levels. Nevertheless, this regime relied on the evolution of commodity prices and foreign currencies from external trade (Fizbein, 2015; Graña, 2018). With pros and cons, this was the first national project that fostered the manufacturing industry.

In the 1970s, an authoritarian and neoliberal government imposed a financial valorisation regime. Consequently, a structural breakdown occurred in the industrial fabric, undermining labour conditions and compressing wages (Rougier, 2021). This process continued for the next two decades, with manufacturing activity concentrating in natural resource-intensive sectors (Santarcángelo, 2019). In the 1990s, this structure coupled with an increasing market concentration and a growing share of foreign capital flows. This long-term process increased structural heterogeneity and deindustrialization, forcing small and medium-sized enterprises to develop survival strategies (Schorr, 2021). The labour market effects included broadening income gaps and increasing labour informality (Beccaria & Maurizio, 2008; Ghibaudo & Raccanello, 2021). At the end of the decade, a deep macroeconomic crisis ended up dismantling the productive base and rising unemployment, informality and poverty to new record levels.

The XXI century was accompanied by a major turn in the course of economic policy and in the accumulation regime. With the goals of rebuilding the internal market and increasing exports, policies boosted industrial activity and implemented social programmes that improved the living conditions of the population. Despite structural conditions (low productivity, technological and productive heterogeneity, and premature deindustrialization), industrial product and GDP increased at a rapid pace during the first decade of the century (Graña, 2018). While employment activity improved with a significant state stimulus, after 2008, Argentina could not manage to continue compensating for the productive lag. The goals of economic growth, job creation, income redistribution, and poverty reduction soon became increasingly elusive. In the 2010s the manufacturing activity stagnated, as did GDP, reflecting problems such as rising price levels and input supply constraints.

The country underwent a new regime of deregulation, trade liberalization, and financial valorisation from 2016 to 2019. While exports grew as a result of opening the economy, imports grew to a larger extent, with adverse effects on the trade balance and exchange rate stability.[9] Considering the industrial fabric, Argentina became the country that deindustrialised the most in that period, causing a marked decline in production and labour indicators as well as in the number of active firms (Schteingart & Tavosnanska, 2022).

c. Profiles of production and exports

In figure 1, GDP and industrial output per capita for the period 1970–2018 (1970=100) are plotted. Deindustrialization is reflected in the progressive uncoupling of GDP from manufacturing output, revealing the industry's declining share throughout the period. In 1974, industrial output rose to a peak, and then began to decline. A reversal came in 2002. From then on, manufacturing output grew

9 Financial insecurity caused by capital outflows should be mentioned as well (Médici, 2020).

continuously, reaching a peak in 2010 (although not at 1974 levels). At the end of the period, industrial output per capita was 10% lower than the levels registered at the beginning. In the structural dimension, both manufacturing and wholesale and retail trade, were the sectors with the highest output share, each accounting for more than 17% of GDP during the last decade of analysis (see table A1 in the appendix).

Figure 2 plots the shares of manufactured goods of industrial origin (MIO) versus those of agricultural origin (MAO) over the total export value.[10] The MIO series includes products like textiles, printed and published products, chemicals and pharmaceuticals, rubber and plastic, fabricated metal, among others. The MAO group comprises food and beverages in general, meat, dairy products and others. MAO has historically had a higher share of the export value. Nonetheless, MIO expanded its share between 1983 and 1990. This phase is connected with a "good" specialisation strategy in manufacturing products highlighted by diversification patterns in products made out of more complex processes, higher value-added and recording international demand with high income-elasticity. During the 1990s, MIO's share stagnated at circa 30% ±5 pp, and it could not exceed this level for the rest of the period. Until 2018, the export value was distributed almost evenly across the two series, MAO and MIO. This last period might be linked to a new "bad" specialisation phase, revealing a limitation for Argentine long-term prospects, again trapped in the export of less complex and more intensive natural-resource extracting products.

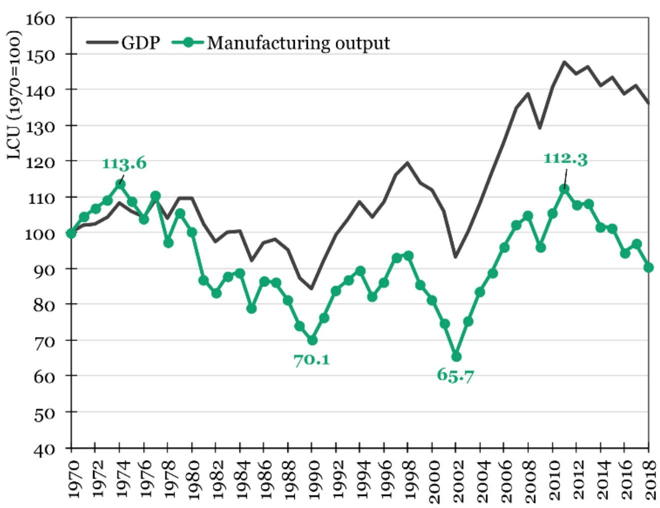

Figure 1. GDP per capita and industrial output. Argentina, 1970-2018. Constant LCU (1970=100). Source: our elaboration on Ferreres (2020).

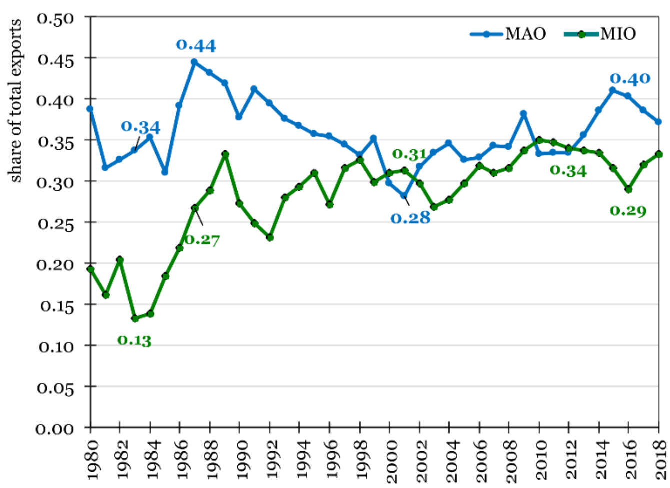

Figure 2. Share of manufacturing in total exports. Argentina (1980-2018). Current USD. Note: MIO= manufactures of industrial origin; MAO=manufactures of agricultural origin. Source: our elaboration on Ferreres (2020).

[10] During the 1980–2018 period, the share of total manufactured products in export value increased from 58% at the beginning to 70% at the end, to the detriment of commodity exports. Commodities (23%) and fuels (7%) accounted for the remaining 30% of export value in 2018.

d. Productivity and wages in the aggregate

In this subsection, we discuss the evolution of wages vis a' vis labour productivity. Figure 3 displays the indexes for real wages and productivity, and figure 4 shows the productivity-to-wage gap. From the comparison between both variables, we can outline four phases. The first one, until 1973, shows a coupling pattern between wages and productivity, with a gap at relatively low values. The second phase, from 1974 to 1990, describes a constant decoupling trend, starting with a deep fall in wages in 1976 (in line with the new financial valorisation regime). Instead, productivity stagnated, oscillating at ±5% of its initial value (figure 3). As a result, the gap rose to a higher, albeit relatively stable, level (figure 4). Both variables collapsed with the hyperinflation crisis at the end of the 1980s, but wages experienced the greatest drop, as expected. The third phase covers the entire period of the convertibility plan. From this decade, the wage- productivity gap began to enlarge throughout the whole period, with a maximum at the end of this phase. The last phase describes a slight coupling, although it cannot counterbalance the previous divergences. In the economic recovery of the 2000s, both variables grew, and the gap narrowed very slightly. At the end of the period, wages and productivity showed a permanent and significant gap.

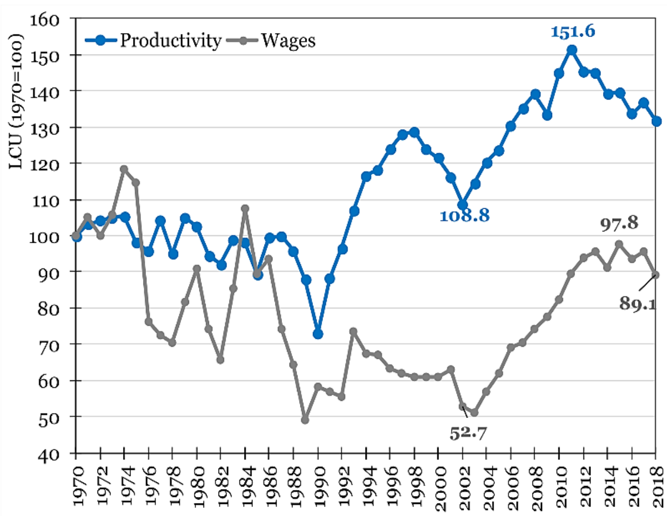

Figure 3. Labour productivity and average wage in the manufacturing sector. Argentina, 1970-2018. Constant LCU (1970=100) Source: our elaboration on Graña & Terranova (2020).

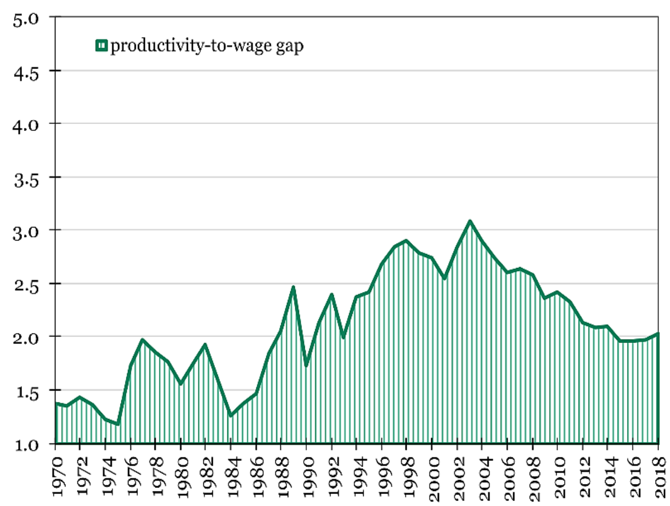

Figure 4. Productivity-to-wage gap in the manufacturing sector. Argentina, 1970-2018. Constant LCU (1970=100) Note: the gap is estimated as the average ratio of labour productivity to wages. Source: our elaboration on Graña & Terranova (2020).

e. Employment and wage structures and the role of labour institutions

To get a deeper analysis of the Argentine industry and its degrees of heterogeneity, it is crucial to examine the employment and pay structures that shape this sector. Based on the Pavitt taxonomy, figure 5 depicts the distribution of registered jobs in manufacturing for the 1996, 2006, and 2016 years. The supplier-dominated class accounts for nearly 57% of formal-sector jobs. That is, food and beverages, textiles, and leather products comprise the vast majority of manufacturing jobs. Another significant number of jobs is captured by scale-intensive firms, which account for circa one-quarter of formal employment. Science-based industries, on the other hand, cover barely one out of ten jobs.

This analysis brings two points worth considering. The first is that the data pertains to formal employment.[11] Labour informality is a recurrent issue in Argentina as well as in Latin America. Although manufacturing is in a better position than other sectors (see table A1 in the Appendix), industries with the highest rates of informality are mostly associated with the SD class, in particular food and beverages, textiles, clothing and leather production (Acosta & Montes-Rojas, 2014). Therefore, a study that could include firms with registered and unregistered labour would reveal an even higher share of workers in this class, displaying a greater concentration in manufacturing employment. The second is a lock-in over the years in such low-complex manufacturing industries. Indeed, over the previous decades, the SD class (and to a lesser extent, the SI class) has consistently captured the great majority of jobs.[12] Both factors highlight the absence of "genuine" structural transformations from less to more complex product manufacturing which are essential to embark on a path of sustainable development.

Figure 6 shows, for each year under analysis, the wage-industry gap between the Pavitt classes and the average industry level. The zero line represents the yearly average wage for the entire manufacturing sector. The vertical bars represent above-average wages, such as wages in the SI class and especially in the SB class. Conversely, the bars displayed below the 0% level report the technological classes that pay wages below the industrial average. From 1996 to 2016, firms from the SD class— the largest employer class—pay the lowest wages in the manufacturing, between 12% and 18% lower than the average level.[13] The SS class exhibits a narrow negative gap compared to the general manufacturing level in 1996, reaching values near the average in the following years. Notably over time there is a marked wage compression trend toward the average even in SB and SI classes.

[11] The ENDEI Database comprises firms that were selected with a stratified sample from the Argentine security system. Therefore, it includes information for firms that hire registered workers.
[12] The evolution of industrial employment follows, as expected, the GDP trend in figure 1. An additional driver for the strong growth in the series of registered jobs between 2004 and 2010 was the intense process of workers' formalization. This phenomenon reached its limit afterwards, revealing an historical core of persistent informality (see Trujillo-Salazar (2019)).
[13] This result is consistent with Barrera Insua & Fernandez Massi (2013). They perform a sectoral analysis of wages and productivity. Considering branches that are pooled under the SD class, they find significant heterogeneity in both dimensions. In the food and beverages branches, low wages combine with high productivity, while in textiles, leather, and wood manufacturing, both wages and productivity report undervalued levels.

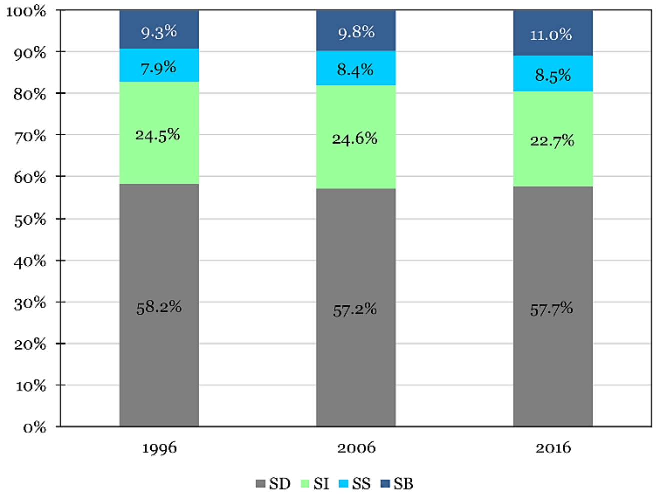

Figure 5. Employment distribution in Argentina by Pavitt classes (1996-2016). Note: (1) Registered jobs; (2) SD means supplier-dominated; SI, scale-intensive; SS= specialised suppliers; and SB, science-based class (3) To be consistent with later estimates, we excluded the following sectors which are not identified in the microdata at a firm level: ISIC Code Rev.3 No. 16,23 & 3410. Source: our elaboration on MTEySS.

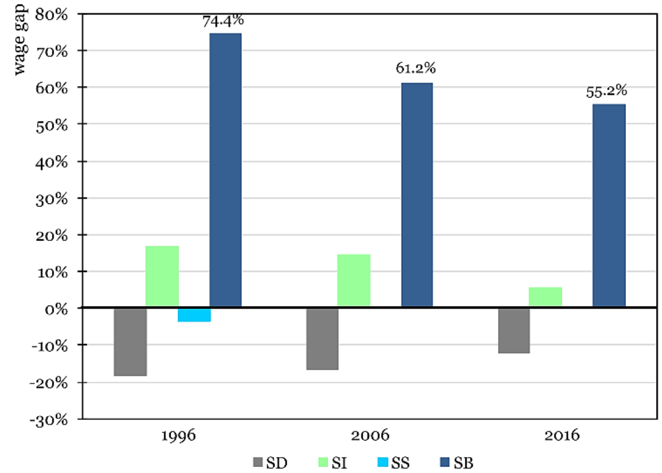

Figure 6. Wage gaps between Pavitt classes and average manufacturing levels. Argentina (1996-2016). Note: (1) Zero level represents average manufacturing level for each year; (2) In all cases, employment share-weighted averages were estimated. Source: our elaboration on MTEySS.

To conclude this subsection, we focus on the institutional factors that define wage regulatory regimes, that is, trade unions and minimum wages. The importance of this set of institutions and policies lies in the way they can impinge on the employer-employee balance of power (Stiglitz, 2021). According to Mishel and Bivens (2021), employer power is ubiquitous in labour markets. In view of the possibilities of wage suppression and the erosion of working conditions, as shown by the wage compression trend above discussed, these institutions and policies can provide a countervailing power.

In this sense, the path followed by Argentina goes in the opposite direction to that of most of the western developed countries (Acemoglu et al., 2001; Bishop & Chan, 2019; Stansbury & Summers, 2020). From the first years of the 21st century, a revitalisation of trade unions has taken place and a minimum wage policy has been implemented in Argentina (Marshall, 2013; Morris, 2017). This resulted in a consolidated national minimum wage institution and a largely centralised collective bargaining system at the level of economic activities with very broad coverage (Marshall, 2019).[14] Various studies give to minimum wages and collective bargaining an important role in having reduced wage inequality in the country (Maurizio, 2014; Alejo & Casanova, 2016; Gómez, 2020a).

Trade union action thus shows a strong weight in labour relations in Argentina, particularly in the manufacturing sector. According to data from the Ministry of Labour, manufacturing accounts for almost

[14] Trade union legislation in Argentina can be summarised into three principles. Under the Trade Union Law, only one trade union per branch and activity has a monopoly on worker representation. As far as collective bargaining is concerned, the *erga omnes* principle applies, meaning that collective agreements are valid for all workers, regardless of their membership status. Finally, the labour law grants stability and the right to strike, favours the centralisation of bargaining and extends its coverage (Gómez, 2020a).

34% of the total number of collective agreements negotiated between 2004 and 2018 (see table A2 in the Appendix). Unfortunately, our dataset does not allow its inclusion at the firm-level being such information missing. Nevertheless, we can relate collective bargaining coverage to the Pavitt classes from a secondary information source at industry level aggregation. From table 1, we observe that the SD class reports the lowest coverage (43.9%) collective bargaining among registered workers, while the SS class shows the highest values for this indicator (57.2%).

In the following section, we describe the data and empirical strategies employed in our estimations.

Table 1. Collective bargaining coverage by manufacturing sector. Pavitt taxonomy. Argentina (2014-2015)

ISIC Code 2-Digit	share of registered labour
SD. Supplier-dominated	43.9%
SI. Scale intensive	53.1%
SS. Specialised suppliers	57.2%
SB. Science-based	52.7%

Source: our elaboration on Encuesta Nacional de Estructura Social (PISAC).

4. Data and Methodology

a. Data description

We use data from the National Survey on Employment and Innovation Dynamics (ENDEI in Spanish acronym). This survey, carried out by the Ministry of Labour, Employment and Social Security and the Ministry of Science and Technology of Argentina (MTEySS and MINCyT in Spanish acronyms), provides information on Argentinian manufacturing firms with at least 10 workers registered in the local pension system. Its sample is randomly stratified by branch and by size and it represents almost 19 thousand firms in the local industry at the national level. In particular, the ENDEI includes data from manufacturing sectors disaggregated at 2-digit ISIC-Rev. 3 and at 4-digit in some representative branches of the local food manufacturing sector, while in terms of size, firms are divided into three categories based on the number of employees (10-25/26-99/100 or more workers).

This survey collects information on the periods 2010-2012 and 2014-2016. Every wave follows a repeated cross-sectional structure. Although it is not possible to track firms between both datasets (in order to obtain a panel data that would enable other empirical strategies), the survey design (consistent between both waves) provides an adequate representation of the Argentinean industrial structure in a relatively recent period.

The ENDEI includes firm-level data on labour, innovative, productive and commercial dimensions, among others areas. A point to notice is that it only includes registered firms that carry out their activities under formal labour conditions, which does not allow for a study over informal manufacturing firms.[15] Also, taking the firm as the sampling unit, all the analysis relies on the average wage measure per firm. Then, it is not possible to carry out any study of intra-firm inequality conditions.

The firms were grouped at two different aggregation levels, depending on the analysis considered. The most disaggregated level is defined for 2-digits ISIC-Rev.3,[16] and points to the need for sufficient observations per branch. A second disaggregation is according to the Pavitt Taxonomy (Pavitt, 1984), already described. A revised version includes four classes of firms, depending on the technological intensity of the manufacturing industries, which is proxied by the R&D intensity at the industrial level (Bogliacino & Pianta, 2011; Dosi et al., 2021b). Following this taxonomy, we briefly list the manufacturing branches that compose each technological class:[17] a) supplier-dominated (SD) class contains food and beverages, textiles, leather, and wood products among others (ISIC codes 15, 17, 19, 20, 28, 36); b) scale-intensive class consists in the manufacturing of paper, rubber and plastics products, basic metals, and trailers and semi-trailers (codes 21, 22, 26, 27, and 34); c) specialised suppliers, composed of machinery and equipment, and the other transport equipment (codes 29 and 35); and d) science-based industries, related to the manufacturing of basic chemicals and pharmaceutical products, medical and optical instruments or devices (codes 24 and 33).

To start with the description of our data, table 2 presents the main statistics for the variables included in our estimates, considering the years included in both rounds of the survey. Wage levels register a relatively pattern. With modest year-on-year variations.

Table 2. Summary statistics (mean) of the Argentine manufacturing firms

Year	No. of firms	Labour Productivity	Wage	(log) Labour Productivity	(log) Wage
2010	3373	145.35	3.69	11.42	8.09
2011	3373	149.51	3.83	11.47	8.13
2012	3373	150.70	3.94	11.51	8.16
2014	3630	163.01	3.78	11.53	8.17
2015	3630	166.50	3.86	11.57	8.19
2016	3630	156.71	3.63	11.51	8.13

Note: labour productivity and wage indicated in thousand (constant) LCU (2010=100). Source: our elaboration on ENDEI (MINCyT & MTEySS).

[15] Barrera Insua and Fernández Massi (2013) include worker-level data on informality by sector in the Argentine economy and estimate an informal employment rate of 32.2% for 2012, just below the overall economy rate of 34.6%.
[16] This involves bringing together all sectors of the food and beverage industry, as well as other sectors that the ENDEI originally provided with more disaggregation.
[17] For reasons of statistical confidentiality, ISIC codes no. 16, 23, 3410 and 37 were not included as they were not identified in the original database.

b. 90-10, 50-10 and 90-50 ratios

In order to describe the evolution of labour productivity and wages beyond their average values, given heterogeneity across firms in both dimensions, we present in figures 7a and 7b a time trend of three estimated ratios considering productivity (wages) distributions. To capture the largest share of the distribution, we calculate the 90-10 ratio (for the interdecile range), defined as the ratio of the 90th percentile to the 10th percentile of the productivity (wages) distribution. Also, to understand the source of the dispersion, we split the ratio in two. The 50-10 productivity (wage) ratio stands for the ratio of the median to the 10th percentile. Similarly, the 90-50 ratio expresses the rate between the 90th percentile and the median for the productivity (wage) distribution. For each variable, we calculate the first one to observe the inequality in the upper tail of the distribution, and the second one to address the dispersion in the bottom part. Finally, we indexed the values of these ratios to examine their time trend, taking 2012 as the base period.

The left panel in figure 7a shows the divergent trend between the ratios estimated for labour productivity between 2010 and 2014, and a convergent trend afterwards. In 2016, all the ratios turn back to values similar to those at the beginning of the period. The 90-10 ratio follow the same pattern than the 50-10 ratio, as both indicate an initial drop and a subsequent increase in the upper tail of the distribution. It is important to note that the values of the indexes reflect extensively high levels of dispersion. The highest level in these ratios comes naturally from the 90-10 ratio reported in 2014, where the 90th percentile of the productivity distribution is 9.6 times higher than its value at the bottom decile. For the 90-50 ratio (which captures the highest productivities), the maximum ratio was around 2.8, less than 30% of the interdecile gap. The 50-10 ratio initially falls and increases after to near 2010 levels. A different story applies to the wage ratios where a clear-cut decreasing pattern appears (see right panel). The 90-50 ratio shows the mildest decline, representing the 90th percentile 1.7 times the 10th percentile in 2016. Conversely, the interdecile range ratio reveal a sharp downturn, from three times to 2.4 during the estimation period. Such converge however might be both due to convergence at the top and the bottom.

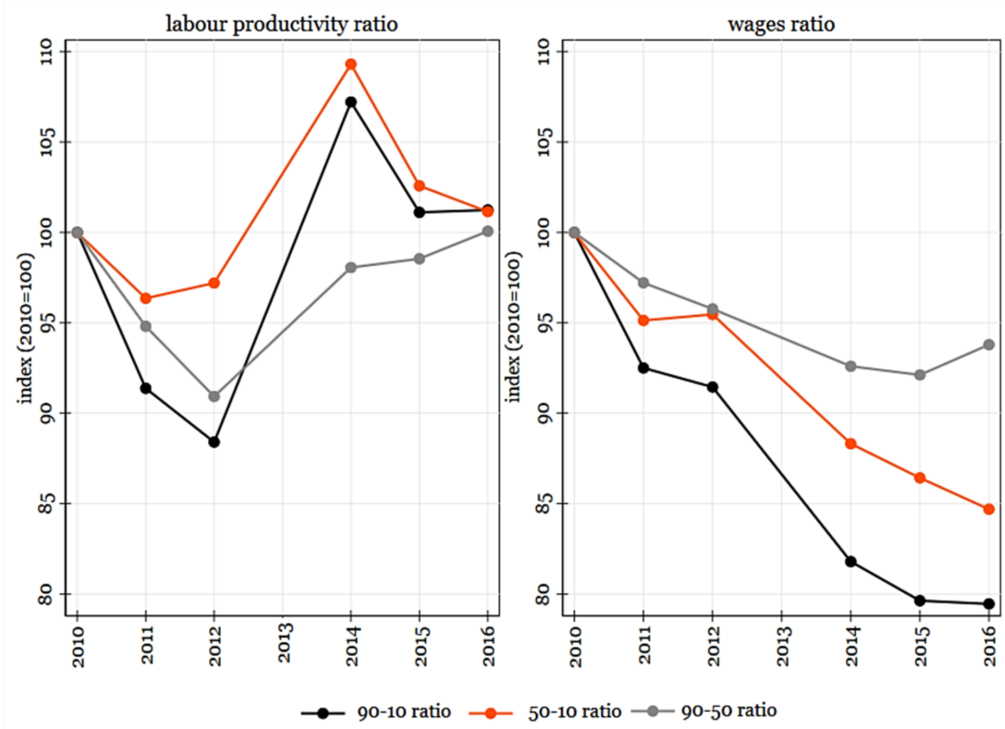

Figure 7a. 90-10/90-50 and 50-10 ratios for labour productivity (left panel) and wages (right). Indexes with base year in 2010 (2010=100). Note: no observations for year 2013. Source: our elaboration on ENDEI (MINCyT & MTEySS).

An alternative way to analyse how wages and productivity evolved at different points of their distributions consists in comparing the previous ratios for wages and productivity in different ranges. Figure 7b presents three panels. The left plot shows the evolution of the 90-10 ratio (indexes) for wages and productivity, separately treated. It shows the different pattern of these variables in each interdecile range. While productivity dispersion increased initially, and then narrowed at the end of the period to values closed to the initial ones, the wage gap steadily declined during 2010-2016. These differences appear in similar way in the middle panel, which refers to the 50-10 ratios. Finally, for the right plot, although the 90-50 wage ratio does not follow the same trend than the productivity ratio, both measures show a minor fluctuation over the period, by less than a 10% in both cases.

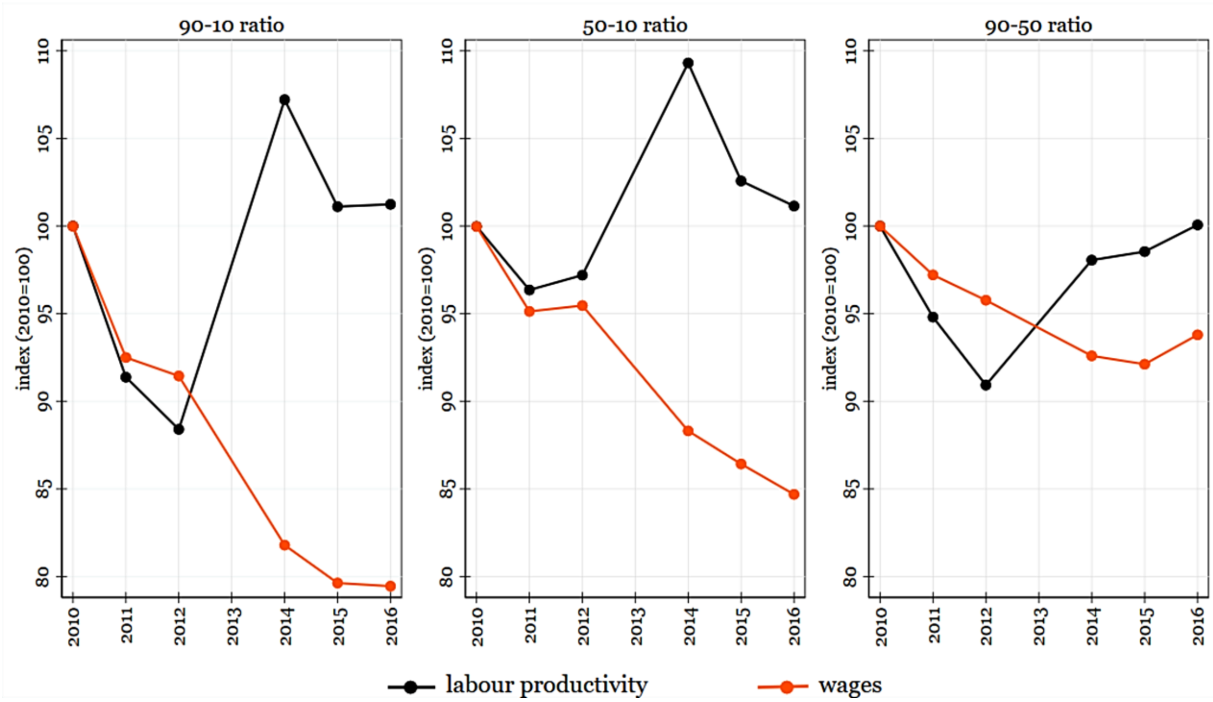

Figure 7b. Wage/productivity 90-10/90-50/50-10 ratios. Note: no observations for year 2013. Source: our elaboration on ENDEI (MINCyT & MTEySS).

From both figures we can infer that the evolution of wages and productivity is very uneven. While productivity gaps show upturns and downturns (especially in the upper part of their distribution), all the wage gaps shrink between 2010 and 2016. Moreover, productive heterogeneity reveal significantly larger than wage inequality, not only in terms of their relative values, but also considering their distinctive evolution. This results are consistent with the findings from Barrera Insua and Fernandez Massi (2013), about the wage standardisation and the persistence of productivity dispersion.[18]

c. Exporting composition by Pavitt classes

The last descriptive analysis refers to the exporting condition in the manufacturing sector. Based on our database, table 3 presents two statistics. The first column indicates the share of exporting firms for each Pavitt class. According this ratio, firms in the science-based (SB) class and the specialised suppliers (SS) class show the highest propensity to export, as almost 50% of the firms in these classes report exports. The second column displays the share of each Pavitt class within the exporting firms' group. This evidence reveals a marked heterogeneity among exporting firms, largely represented by the supplier-dominated class (43.7%) followed by the scale-intensive class (24.2%). Conversely, while the specialised supplier and

[18] By discussing the link between wage setting regimes -as collective bargaining and minimum wage- and wage inequality, Marshall (2013) relates the wage standardization with the overriding role of acceleration inflation in guiding wage bargaining in Argentina.

the science-based industries show the best exporting performance, they represent a small fraction of the overall exporting group. Thus, under the concepts of "quality of specialization" and "quality of exports" (Hidalgo et al., 2007; Dosi et al., 2022), and taking account that SB and SS classes are firms characterised by higher technological intensity and complexity, this structure among exporting firms is a sign of a weak specialization strategy.

Table 3. Exporting firms by Pavitt taxonomy. Argentina (2010-2016)

Pavitt Class	Share of exporting firms per class	Pavit share of exporting firms
SD. Supplier-dominated	21.3%	43.7%
SI. Scale-intensive	29.7%	24.2%
SS. Specialised suppliers	48.0%	13.5%
SB. Science-based	49.3%	18.6%

Note: to be consistent with later estimates, we excluded the following sectors which are not identified in the microdata at a firm level: ISIC Code Rev.3 No. 16,23 & 3410. Source: our elaboration on ENDEI (MINCyT & MTEySS).

5. Empirical strategy

Figures 8a and 8b are scatter-fit plots that show how the conditional quantile regression estimates fit our data at the industry level or by Pavitt classes. The thin black lines display quantile estimates, and the dashed red line plots the standard pooled OLS estimate. The scatter plots for the wage-productivity pairs show the pronounced heterogeneity and the presence of outliers both in wage and productivity levels among manufacturing firms, a condition that promotes the adoption of this regression method (Koenker & Hallock, 2001). The dispersion is higher in the supplier-dominated class, while on the contrary, the science-based industries report a better adjustment to the data.

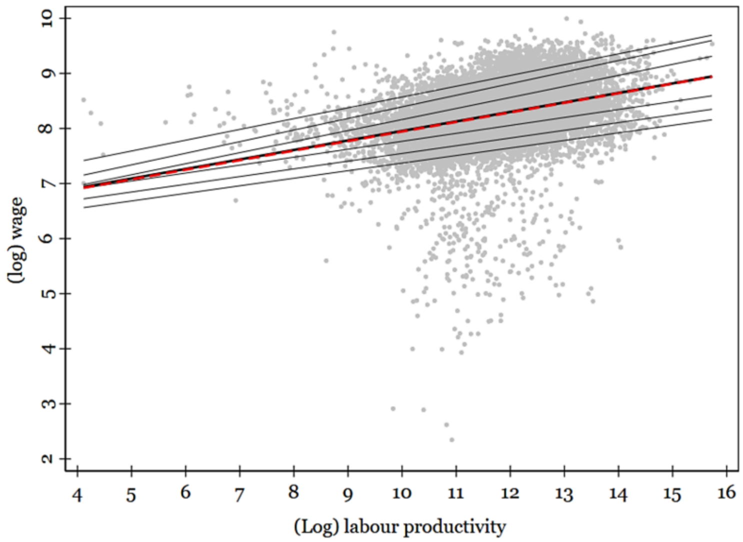

Figure 8a. Scatter plot and quantile regression (QR) fit. Baseline model. All sectors. Note: QR lines in thin black for 0.05, 0.1, 0.25, 0.5, 0.75 0.9 0.95 quantiles and OLS regression line in red dashed line. Source: our elaboration on ENDEI (MINCyT & MTEySS).

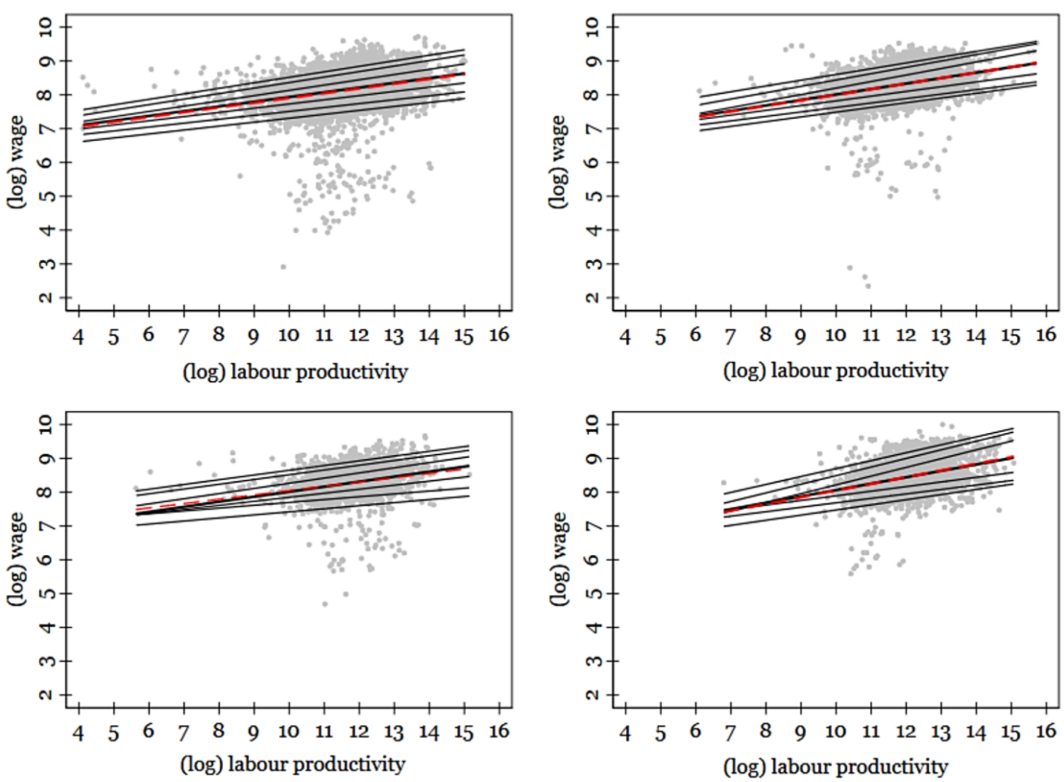

Figure 8b. Scatter plot and quantile regression (QR) fit. Baseline model by Pavitt taxonomy. Source: our elaboration on ENDEI (MINCyT & MTEySS).

Our empirical strategy is to evaluate the wage-productivity linkage at different wage levels, in line with Dosi et al., 2020, in order to understand of the gains from productivity are transferred to wages. Thus, we base our econometric estimates on the methodology of conditional QR (Koenker & Bassett, 1978) (see equations 1a and 1b):

$$y_{it} = Q_{\tau}(w \vee x) = x'b(\tau) \qquad (1a)$$

$$b_t \equiv argmin_b E[\rho_t(w_i - x_i'b)] \quad \text{with} \quad \rho(u) = \begin{Bmatrix} \tau|u| & for \;\; u \geq 0 \\ (\tau - 1)|u| & for \;\; u < 0 \end{Bmatrix} \qquad (1b)$$

Where y_{it} represents the response variable and Q_{τ} stands for the τ th conditional quantile of the dependent variable, given x_{it} (the vector of covariates). The τ th quantile solves a minimization problem by linear programming, as defined in 1b.

Considering that we apply the quantile regression (QR) model as the basic empirical strategy, it is important to underline that our research perspective here refers to the study - at a firm level- of the elasticities or semi-elasticities of labour productivity and other relevant variables on different points of the wage distribution. This excludes from the analysis any implication of causality.

We set up two different models, depending on the wage equation structure:

On the one hand, the QR baseline model seeks to detect the basic link between the level of productivity and the level of wages, and is estimated over the following expression (equation 2):

$$w_{it} = \alpha + \beta_{\tau}\pi_{it} + y_t + \epsilon_{\tau it}. \qquad (2)$$

Where w_{it} is the (log) real average wage for the firm i at the time t, deflated by local consumer price index (CPI) (2010=100); π_{it} stands for the (log) labour productivity, proxied by the (log) real value added per worker, deflated by producer price index (PPI) (2010=100); y_t is a vector that includes year dummies, in order to capture seemingly unrelated macroeconomic shocks; β_{τ} is the coefficient for productivity and standard error vector, respectively.[19]

On the other hand, the second QR model includes a set of variables related to the firm, its internal structure and commercial performance (see equation 3), in order to account for the linkages between these determinants and the level of wages.

$$w_{it} = \alpha + \beta_{\tau 1}\pi_{it} + \beta_{\tau 2}exporter + \beta_{\tau 3}foreign + \beta_{\tau 4}age + \beta_{\tau 5}y_t + \epsilon_{\tau it} \qquad (3)$$

Where, in addition to w_{it} and π_{it}, we identify other co-variates potentially affecting the wage level. The variable *exporter*, equals one if the firm reports exporting condition, following the evidence that

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[19] We performed estimates for this baseline model considering one-year lagged productivity levels. We confirmed it as a strongly autocorrelated and persistent variable. Therefore, we find it appropriate to perform this model in a contemporaneous way. The results of these estimates are available upon request.

acknowledges wage premiums for those firms that export their products (Munch & Skaksen, 2008; Klein et al., 2013; Brambilla et al., 2017).[20] Firm ownership structure, expressed in the variable $foreign$, equals one if the firm has at least 1% of its foreign-owned share capital. For Argentinean industry, Schorr (2021) shows that multinational firms pay higher wages. Age (age indicates if the firm is 10 years old or more in the market), capturing the differential pay that firms with more experience have (Brown & Medoff, 2003; Coad, 2010),[21] and size proxied by the (log) employment. For the latter, there is no expectation regarding the sign of the coefficients. In fact, one can find mixed evidence in the literature (Sayago, 2015; Cobb & Lin, 2017; Bloom et al., 2018). Finally, we control for macroeconomic shocks with the inclusion of year dummies in y_t.

In order to examine the nature of the pass-through between productivity and wages, we run each QR model at sectoral level over the pooled data from both waves of the database (2010-2012 and 2014-2016). In addition, we estimate regressions for the .05, .10, .25, .5, .75, .9, .95 quantiles of the conditional wage level distribution. The sectoral disaggregation level for the QR estimates is set on both the 2-digit ISIC code and the Pavitt classes. In the first case, we evaluate if the wage-productivity nexus reveals any increasing/decreasing pattern at different points of the wage distribution. To this end, we introduce violin plots for each quantile of the conditional wage distribution. Each plot includes the median, the interquartile ranges, and the kernel density distribution of the coefficient estimates. This graphical tool allows to synthesize both the kernel density distribution at 2-digits sector and the quantile distribution of the dependent variable (Dosi et al., 2020).[22]

In the second case, we adopt the Pavitt classes to explore the different nexus at different industry types. This is done by QR coefficients at each class level. Moreover, as an additional exercise, we briefly introduce the results of an alternative version of the model with control variables where we include the (log) of the skill ratio (defined as the ratio between the share of workers with professional skills and the share of those with more basic skills), in addition to the variables specified in the equation 3.[23]

In the next section, we present the main descriptive statistics and present the results of the estimates.

6. Results

a. Wage-productivity link under the baseline model

Table 4 shows regression results for the baseline model (equation no. 1). From the significance of all quantile regression coefficients, we confirm a positive pass-through between the level of labour productivity and the level of wages in Argentine manufacturing firms, regardless of technological class or productive sector. Most of the interquartile results show that this nexus follows an increasing path along the intra-industry wage distribution. In supplier-dominated and science-based classes, the interquantile

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[20] All dummy variables are associated to each survey wave, reflecting two different possible conditions.
[21] A slight difference arises in the estimation for the second survey wave (2014-2016), where this condition is defined for 9 or above years old.
[22] A previous application of the violin plots for standard OLS across narrowly defined sectors can be found in Dosi et al. (2015).
[23] Since this variable presents an important number of missing cases, it does not allow estimates at 2-digit levels with seven quantiles. Then, this alternative model is incorporated as an appendix.

regressions confirm increasing paths at the different parts of the distribution, while in scale-intensive and specialised suppliers' classes the median interquartile range [0.25-0.75] and the interdecile range [0.10-0.90] report upward trends.

Table 4. Quantile coefficients for (log) productivity. Baseline model. Pavitt taxonomy

		quantile regressions (**)							interquantile regressions (***)		
	OLS	5	10	25	50	75	90	95	βi, 95 -βi, 05	βi, 90 -βi, 10	βi, 75 -βi, 25
All industry	0.162	0.128	0.133	0.139	0.163	0.188	0.195	0.182	0.054	0.062	0.049
Supplier-dominated	0.140	0.114	0.113	0.122	0.139	0.156	0.163	0.163	0.050	0.050	0.033
Scale-intensive (SI)	0.164	0.138	0.130	0.140	0.161	0.193	0.188	0.170	0.032	0.057	0.053
Specialised suppliers (SS)	0.126	0.076	0.081	0.120	0.149	0.155	0.143	0.141	0.066	0.062	0.035
Science-based (SB)	0.201	0.149	0.132	0.142	0.192	0.263	0.260	0.239	0.090	0.127	0.121

Note: (1) For reasons of statistical confidentiality, ISIC code 3410 is not included as is not identified in the original database. (2) Quantile coefficients reported all statistically significant (3) Interquantile coefficients reported all statistically significant, except for q95-q05 in SI and SS classes. Source: our elaboration on ENDEI (MINCyT & MTEySS).

An exploration of the branch level (2-ISIC code level) reports significant coefficients for these elasticities for the majority of cases (95% of the estimates, as is shown in table A3 and figures A1 and A2 in the Appendix).

Figure 9 plots the distributions of the quantile regression coefficients by Pavitt classes. As in the previous table, we can observe the increasing pattern of the pass-through in this baseline model, which translates in higher wage-productivity links among firms with the higher wage levels. In addition, technological classes differ in the level of such coefficients which are by far higher in the SB and SI classes, while SD record the lowest coefficients also for the upper quantiles of the wage conditional distribution.

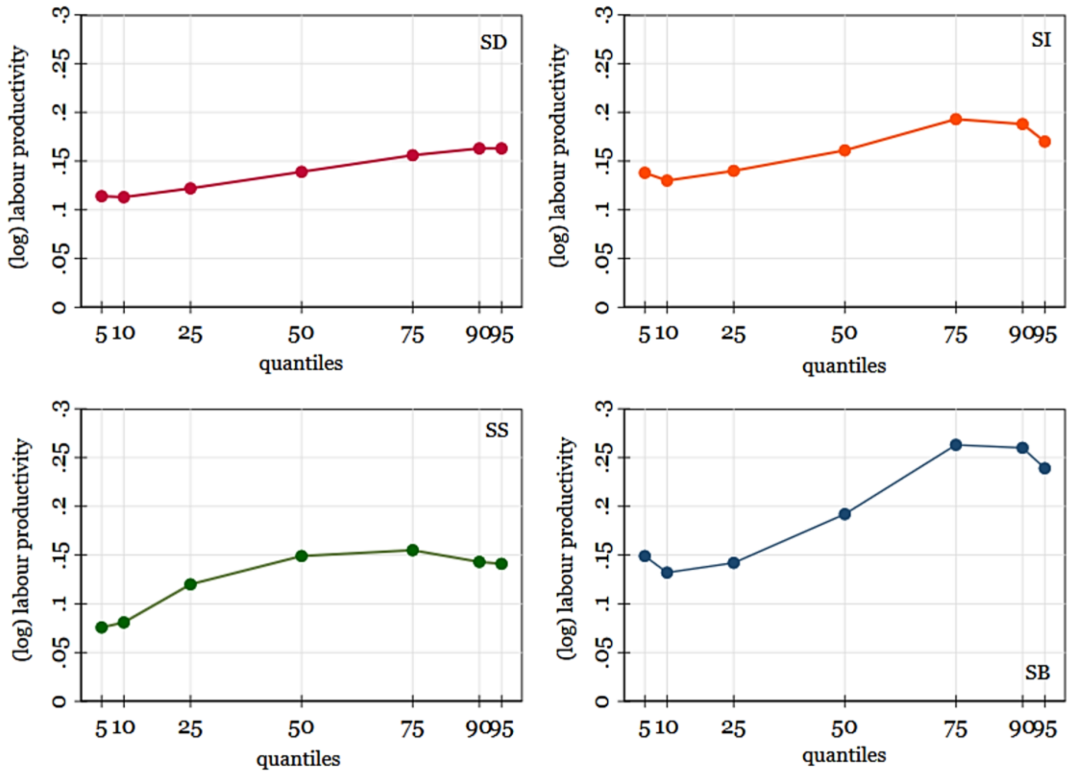

Figure 9. Wage-productivity nexus by Pavitt taxonomy. Baseline model. Source: our elaboration on ENDEI (MINCyT & MTEySS).

A powerful resource to display the wage-productivity nexus, both at different productive sectors and wage levels, is the violin plot in figure 10. This plot presents quantile regression estimates from the baseline model, combining both the kernel density distribution at the two-digit industrial sector (in the vertical dimension) and the quantile distribution of the dependent variable (in the horizontal one). From the figure, we can distinguish the clear increasing pattern that the wage-productivity link displays. At the lower quantiles of the conditional wage distribution, we observe the lowest productivity coefficients, wherein a 10% increase in labour productivity links with a 1.3% increase in wage levels at the 5th quantile and a 1.4% increase at the first quartile. In the upper tail of the distribution, this nexus reveals to be higher, reaching the 2% increase in wage levels when a 10% increase in productivity occurs.

To test interquantile differences, in addition to the interquantile regressions, we run two non-parametric tests. First, with the Kruskal-Wallis test, we evaluated the median differences across the distributions of the .05 to .95 quantiles estimated (Kruskal & Wallis, 1952). Second, we performed the Dunn's test (Bonferroni adjustment) to conduct multiple pairwise comparisons for stochastic dominance or median differences (Dinno, 2015). From the results of the first test, we confirmed the existence of median differences in quantile estimates, while from the second one, we verified that medians at the 75th, 90th and 95th are statistically higher than the medians at the 5th and 10th quantiles.

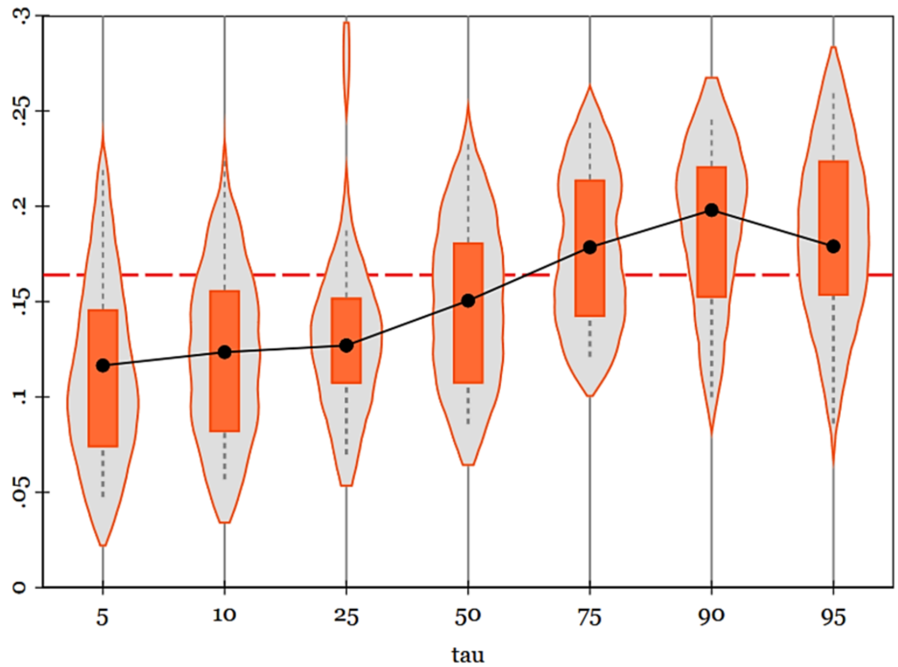

Figure 10. Distribution of QR coefficients for (log) productivity. QR Baseline model. Note: QR estimation of Eq.(2) for each ISIC 2-digits' sector in ENDEI database. Violins report boxplots and kernel densities to both sides of the boxplot. Horizontal dashed line reports the median of the distribution of OLS estimates. Pseudo R2 for the median (all sectors) is 0.069. Source: our elaboration on ENDEI (MINCyT & MTEySS).

b. Wage-productivity link. Model with control variables

The estimates obtained from the model with control variables reveal that the inclusion of dummies related to firms' characteristics (export and foreign ownership status and firm's age and size) causes a decline in the pass-through between wage and productivity levels as expected. In fact, the quantile regression coefficients in the baseline model at the industry level range from .13 to .20 (for the 5^{th} and 90^{th} quantiles, respectively), while table 5 shows that the coefficients in the model with control variables range from .11 to .13 (for the respective quantiles). Considering Pavitt taxonomy, the reduction in the pass-through coefficient applies to every class.

In addition, this model delivers an interquantile trend flatter than the baseline model. We tested the upward trend at different parts of the conditional wage distribution by performing interquantile regressions at the industry level and in every Pavitt class. In the first case, we confirmed that the coefficients at the upper quantiles of the distribution (75^{th} and 90^{th} quantiles) show higher pass-through than those at the lower quantiles (10^{th} and 25^{th}, respectively). It happens in the science-based class, while in the supplier-dominated group, we verified an increasing path for the 5^{th} – 95^{th} and 10^{th} -90^{th} ranges. Finally, scale-intensive and specialised suppliers' industries reveal a wage-productivity nexus that are relatively constant at different quantiles.

Table 5. Quantile coefficients for (log) productivity. Model with control variables. Pavitt taxonomy

		quantile regressions (**)							interquantile regressions (***)		
	OLS	5	10	25	50	75	90	95	βi, 95 -βi, 05	βi, 90 -βi, 10	βi, 75 -βi, 25
All industry	0.115	0.109	0.112	0.110	0.120	0.121	0.128	0.122	0.054	0.062	0.049
Supplier-dominated (SD)	0.104	0.091	0.097	0.101	0.103	0.110	0.118	0.121	0.050	0.050	0.033
Scale-intensive (SI) (*)	0.111	0.122	0.116	0.111	0.108	0.122	0.108	0.097	0.032	0.057	0.053
Specialised suppliers (SS)	0.074	0.056	0.068	0.074	0.096	0.097	0.091	0.095	0.066	0.062	0.035
Science-Based (SB)	0.126	0.109	0.105	0.099	0.114	0.135	0.161	0.152	0.090	0.127	0.121

Note: (1) For reasons of statistical confidentiality, ISIC code 3410 is not included as is not identified in the original database. (2) Quantile coefficients reported all statistically significant (3) Interquantile coefficients for q95-q05 reported statistically significant only in SD class; for q90-q10 in all industry, SD and SB regressions; and for q75-q25 in all industry and SB.
Source: own elaboration on ENDEI (MINCyT & MTEySS).

Figure 11 displays the wage-productivity pass-through for each Pavitt class estimated in the model with control variables. In the left bottom panel, the science-based industries reveal an upward trend for the conditional wage distribution, the same as supplier-dominated industries. Conversely, scale-intensive and specialised suppliers do not show significant differences in this nexus at different points of the distribution.[24] Also, the estimation of the alternative version of the model with control variables -where we include the (log) of the skill ratio in addition to the variables specified in this model- reveals that results do not change significantly (see figures A3 and A4 in the Appendix).

[24] Gómez (2020b) estimates wage-innovation premia in manufacturing firms considering a productive structure based on factorial intensity for the period 2010-2012. She finds that wage dispersion is significantly lower than productive heterogeneity and both are significantly lower than technological heterogeneity

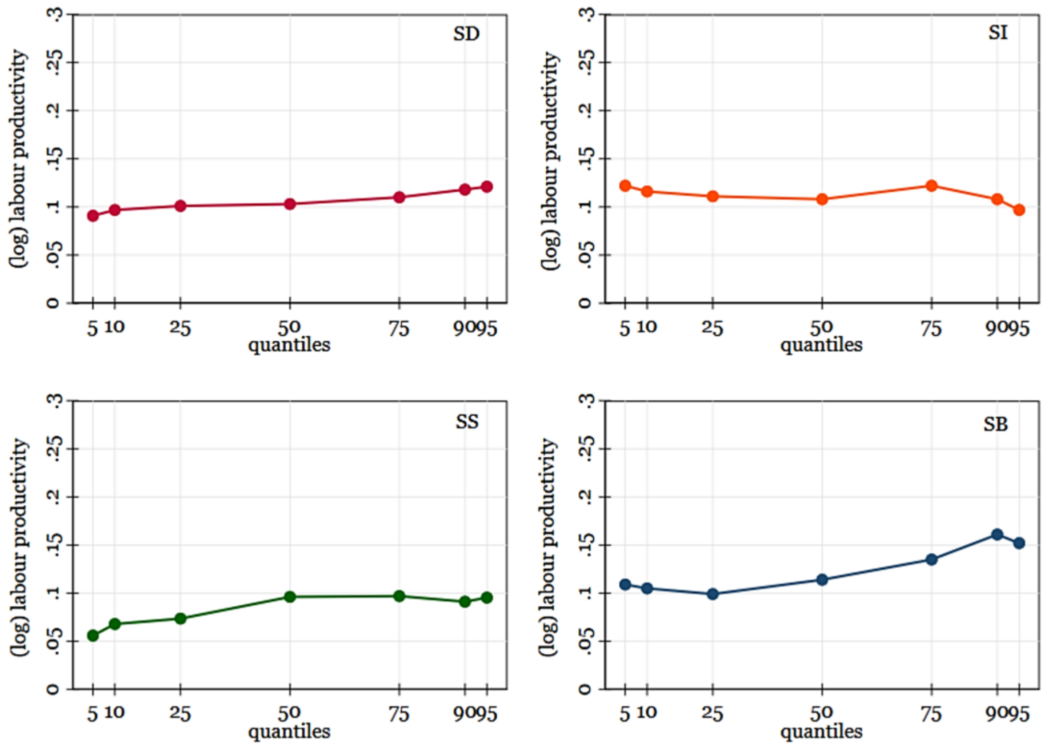

Figure 11. Wage-productivity nexus by Pavitt taxonomy. Model with control variables. Source: our elaboration on ENDEI (MINCyT & MTEySS).

The mild increasing pattern in the wage-productivity link for the model with control variables is not confirmed at the 2-digits level of disaggregation. The violin plot in figure 12 reveals that there are no significant differences among the pass-through at different wage levels. As in the baseline model, we tested this result by performing the Kruskal-Wallis and Dunn's test over the estimates of the model with control variables. Conversely, in this model, we could not find significant median differences across the distributions of the .05 to .95 quantiles estimated. As a result, a deeper level of disaggregation among firms results in a relatively constant wage-productivity nexus.

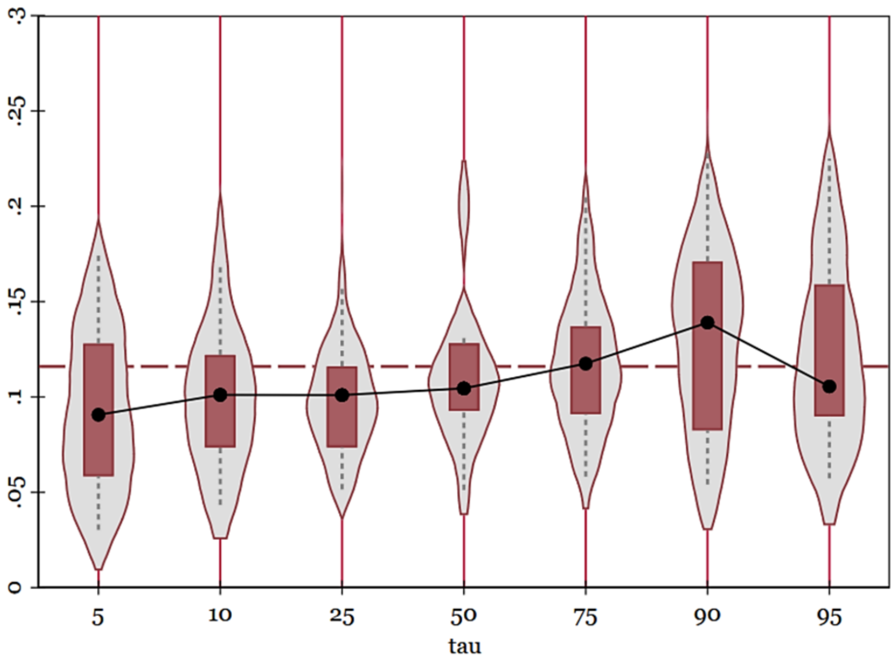

Figure 12. Distribution of QR coefficients for (log) productivity Model with control variables. Note: QR estimation of Eq. (3) for each ISIC 2-digits' sector in ENDEI database. Pseudo R2 for the median (all sectors) is 0.075. Source: own elaboration on ENDEI (MINCyT & MTEySS).

Finally, to identify how the control variables relate to wage levels, we plotted the quantile regression coefficients over the conditional wage distribution in figure 13. Estimates are positive and significant in every variable, revealing a positive connection with wages at the seven quantiles of its conditional distribution. From the four panels, foreign ownership shows the highest pass-through with wages that express a wage premium in firms with foreign capital composition, drawing a significant increasing pattern between the 25th and 75th quantiles of the wage distribution.[25] The rest of the firms' characteristics (exporter status, age and size) result in significant wage premia that decline slightly at higher wage levels.

[25] For each of the control variables, we applied interquantile regression to test the significance of the differences between coefficients in the upper and the lower tail of the distribution.

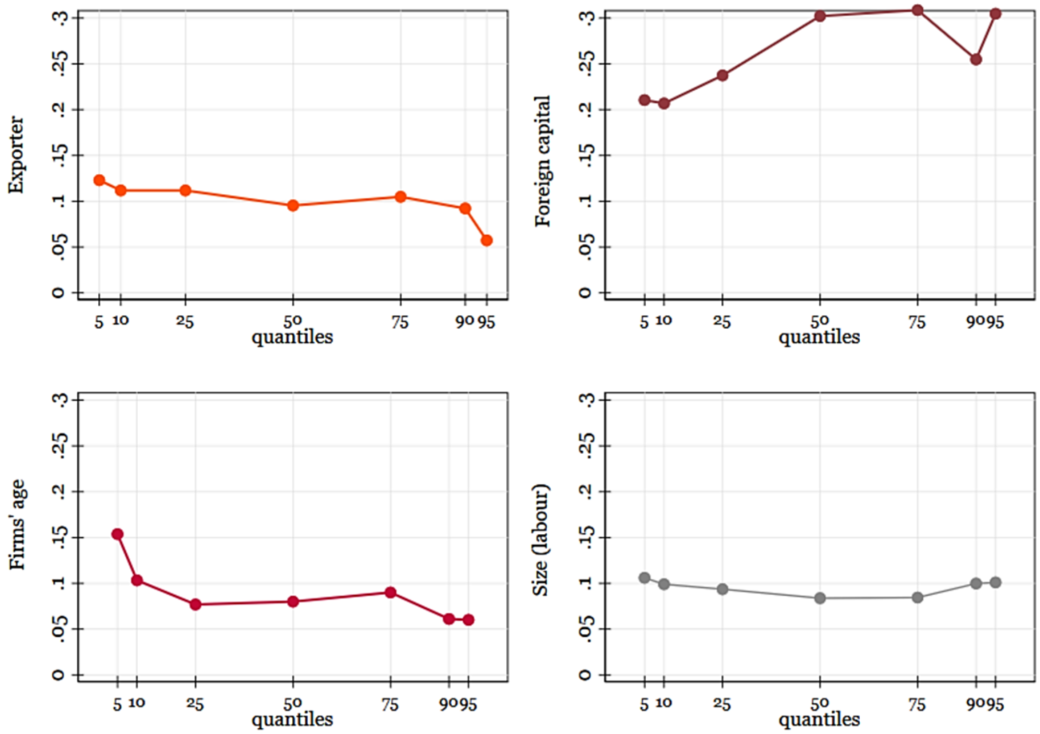

Figure 13. QR coefficients for other covariates. Model with control variables. Note: Quantile coefficients reported all statistically significant. Source: own elaboration on ENDEI (MINCyT & MTEySS).

7. Concluding remarks

Following a structuralist and distributional firm-level approach employing a dataset for the 2010–2016 period, we studied how wages are linked to productivity in the Argentinean manufacturing industry. The distributional perspective allowed us to examine the pass-through at different levels of the conditional wage distribution. The structuralist approach—through the use of the Pavitt taxonomy—made it possible to identify how the pass-through differs according to techno-productive characteristics of firms. Overall, the empirical analysis is meant to detect the ensuing wage bargaining process at the firm-level and the extent to which techno-organizational capabilities, here mapped by Pavitt classes, influence the distribution of the gains from productivity.

The investigation confirms the existence of a positive pass-through between productivity and wage levels in the manufacturing industry, both for a baseline model and a model including the most relevant control variables. The analysis conducted on 2-ISIC code levels and Pavitt classes confirms the findings, yet the pass-through report quite low values, ranging between [0.06 and 0.26], consistently with other estimates from developing countries. More complex Pavitt classes, particularly SB, show higher values, even doubled when compared to SD. In addition, the slight increasing path found in the baseline model is smoothed when inserting the controls.

From our findings, we draw some conclusions. Firstly, the wage-productivity pass-through is positive in all specifications and fairly uniform across the conditional wage distribution when including control variables. It shows dramatically low values when compared to advanced countries (Stansbury & Summers, 2017) and significantly lower values than unitary ones. Secondly, natural resource-intensive branches and basic manufacturing production—associated with SD and SI classes—show a significant weight in sectoral and technological composition. The structural composition affects the results, given that, particularly the most widespread SD firms, tend to transfer less gains. As previously discussed, the extant productive structure provides little room for structural change and negatively impacts not only the generation of value in terms of productivity growth but also its distribution, leading to a middle-income trap. Thirdly, foreign-owned enterprises present, although small, an increasing pass-through over the conditional wage distribution, the only firm characteristic, in affecting the patterns, while age, size and exporting status do not modulate the pass-through along the distribution of wages.

Some future directions emerge from this analysis. Among them, a detailed study of trade union wages by branch and their influence on the wages-productivity link, as well as the role of specialisation in production and exports as a conditioning factor for sustainable development.

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Appendix

Table A1. Manufacturing sector in the Argentinean economy

ISIC Code 1-Digit	GDP Share	Registered Labour Share (private sector)
Manufacturing sector	17.6%	19.8%
Wholesale and retail trade, accomodation and food services	17.4%	21.8%
Community and human health and education services	15.7%	17.9%
Real estate & business	11.4%	14.5%
Public administration and defence	8.3%	-
Agriculture, forestry & fishing	7.4%	5.7%
Transport, storage & communication	6.8%	8.7%
Construction	5.3%	6.9%
Financial	4.2%	2.5%
Mining	4.1%	1.2%
Utilities	1.7%	1.0%
Total	100.0%	100.0%

Note: Shares estimated on 2008-2018 current prices data. Source: our elaboration on INDEC & MTEySS.

Table A2. Collective bargaining agreements by economic sector. Argentina (2004-2018)

Private Sector	% of colective agreements
Manufacturing	33.8%
Transport	20.8%
Services	15.7%
Utilities	9.6%
Wholesale and retail trade	7.4%
Financial	5.7%
Mining	3.3%
Construction	2.1%
Agriculture	1.6%
Total	100.0%

Note: total collective bargaining agreements in 2004-2018.
Source: our elaboration on MTEySS data.

Table A3. Median of the distributions at 2-ISIC code levels

Manufacturing sectors		ISIC Code	Median coefficients accross sectors	Pseudo R2 (median)
Pavitt Taxonomy	All	-	0.163	0.070
SD. Supplier-dominated	Food products and beverages	15	0.141	0.066
	Textiles	17	0.102	0.039
	Wearing apparel and footwear	18	0.086	0.048
	Leather and leather products	19	0.104	0.040
	Wood and wood products	20	0.132	0.062
	Fabricated metal products	28	0.177	0.786
	Furniture	36	0.107	0.064
SI. Scale-intensive	Paper and paper products	21	0.197	0.073
	Printing and Publishing	22	0.235	0.107
	Rubber and plastics products	25	0.160	0.066
	Other non-metallic mineral products	26	0.164	0.762
	Basic metals	27	0.180	0.090
	Trailers, semi-trailers and automobile parts (*)	34	0.100	0.031
SS. Specialised suppliers	Machinery and equipment	29	0.138	0.581
	Other transport equipment	35	0.214	0.090
SB. Science-based	Chemicals and chemical products	24	0.190	0.084
	Radio, TV and communication equipment	32	0.121	0.050
	Medical precision and optical instruments	33	0.181	0.095

Note: All sectors report coefficients statistically significant. (1) For reasons of statistical confidentiality, ISIC code 3410 is not included as is not identified in the original database. Source: our elaboration on ENDEI (MINCyT & MTEySS).

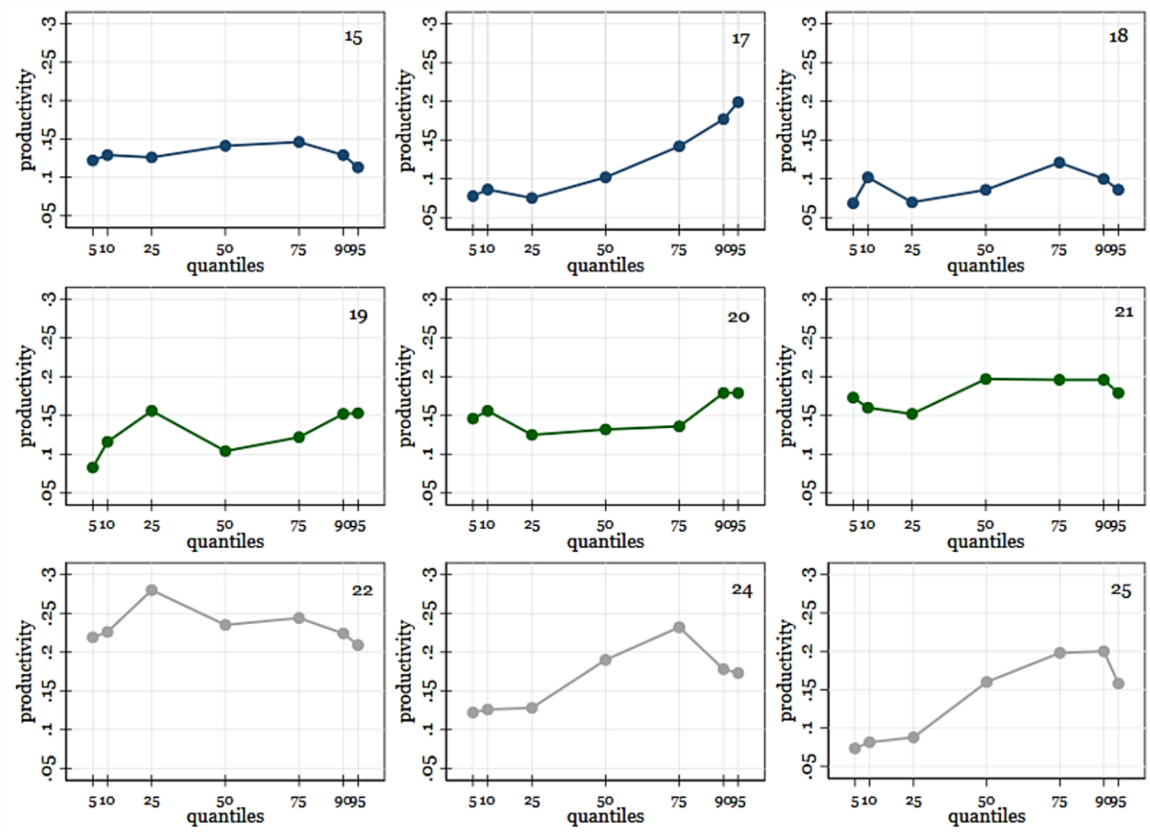

Figure A1. Distribution of QR coefficients at 2-ISIC code levels. Baseline model. Note: (1) 15=Food & beverages; 19=Leather products; 22=Printing & publishing; 17=Textiles; 20=Wood products; 24=Chemical products; 18=Wearing apparel; 21=Paper products; 25=Rubber & plastic. (2) 99% of coefficients are statistically significant. Source: our elaboration on ENDEI (MINCyT & MTEySS).

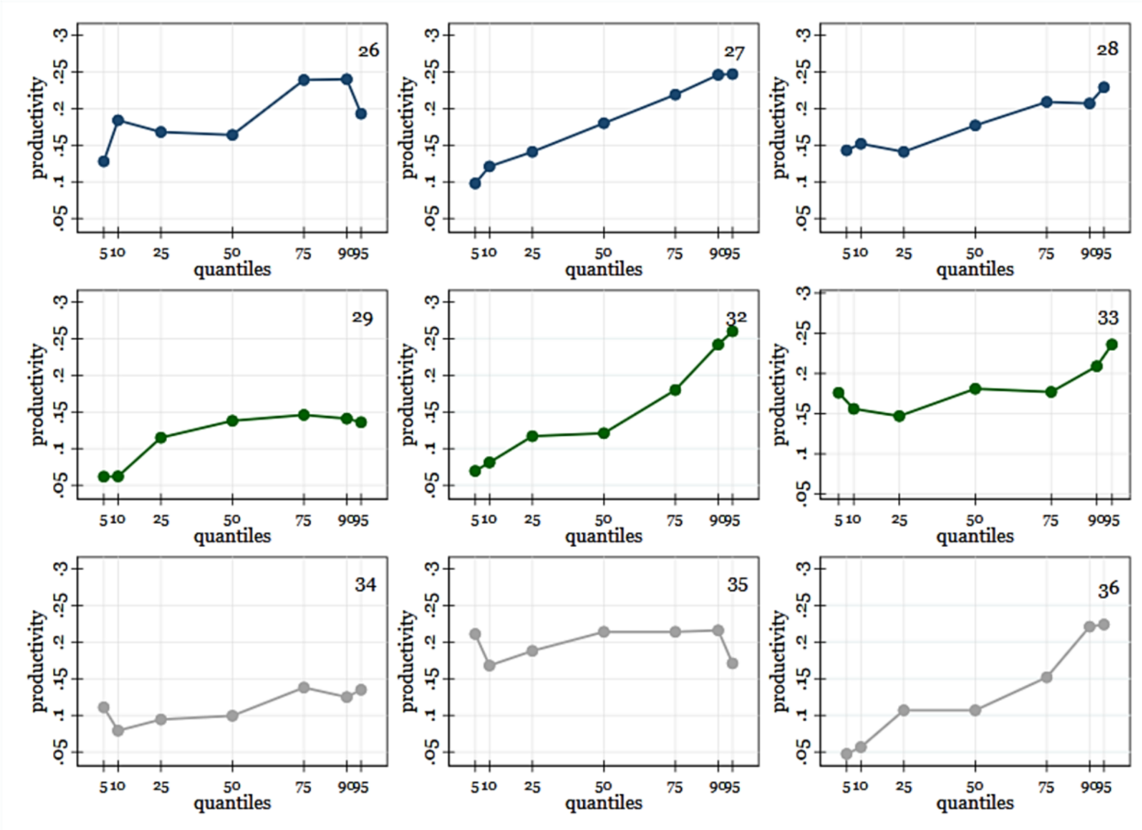

Figure A2. Distribution of QR coefficients at 2-ISIC code levels. Baseline model. Note: (1) 26=Other mineral products; 29=Machinery & equipment; 34=Trailers & autoparts; 27=Basic metals; 32=Radio, TV, & communication; 35=Other transport Equipment; 28=Fabricated metal products; 33=Medical & optical instruments; 36=Furniture. (2) 95% of coefficients are statistically significant. Source: our elaboration on ENDEI (MINCyT & MTEySS).

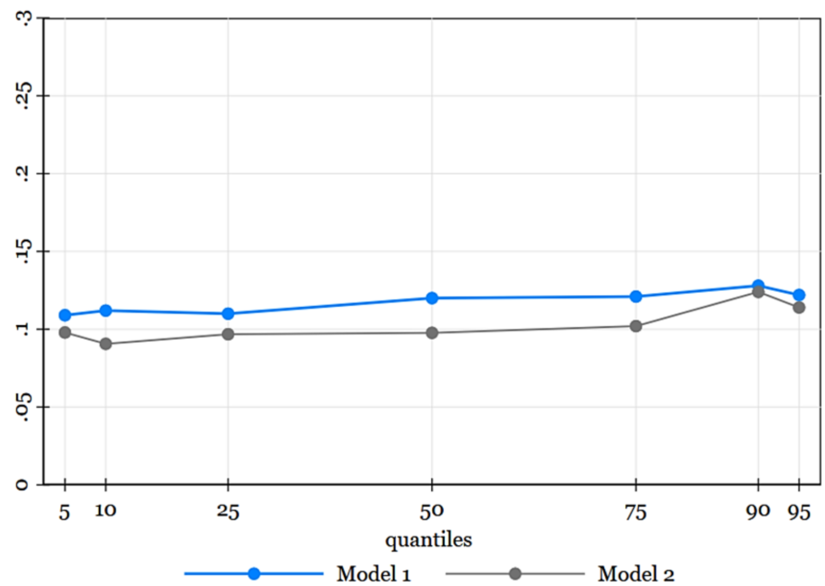

Figure A3. QR coefficients. (Log) labour productivity. Model (1)= standard model with control variables from Eq.(3). Model (2)= including the human capital proxy (log of skill ratio). Source: own elaboration on ENDEI (MINCyT & MTEy SS).

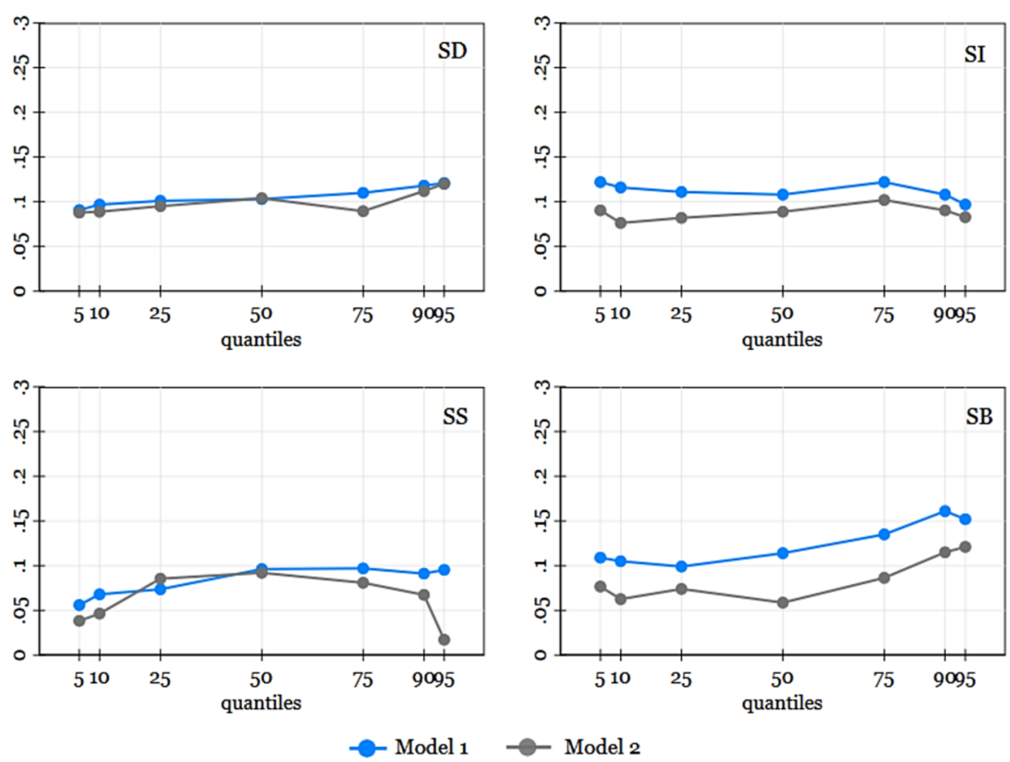

Figure A4. QR coefficients. (Log) labour productivity by Pavitt taxonomy. Model (1)= standard model with control variables from Eq.(3). Model (2)=including the human capital proxy (log of skill ratio). Source: own elaboration on ENDEI (MINCyT & MTEySS).