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THE LONG-RUN DYNAMICS OF THE LABOR SHARE IN JAPAN

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The structural transformation started in Japan during the last decades of the past century and the institutional adjustments that followed have significantly reshaped personal and functional income distribution patterns. In this paper we investigate the long-term drivers of the share of output accruing to labor in Japan. Our contribution lies in extending the theoretical SK schedule model by Bentotila and Saint-Paul to multiple inputs and in providing new empirical evidence on Japan over the period 1970–2012. Results indicate that low-knowledge-intensive market services were mainly responsible for the decline in the labor share in Japan over the four decades considered. This was related to technological change and, more importantly, to labor and product market structural and institutional features. These drivers could have significantly contributed to reducing the bargaining power of labor vis-à-vis employers and, consequently, the labor share.

JEL Codes: E25, J30, L11, O14

Keywords: Japan, labor share, mark-up, non-regular work

1. INTRODUCTION

The Japanese capitalistic model has undergone major transformations during the last decades as a result of the pressure posed by many interrelated factors. Labor markets underwent massive changes along three main dimensions: (i) the decline of the lifetime employment system (Ono, 2010; Kawaguchi and Ueno, 2013); (ii) the growth in non-regular work (Asano *et al.*, 2013; OECD, 2017a); and (iii) the huge increase of women in the labor force (Inoue *et al.*, 2016). On the product market side, both domestic and international forces reshaped the structural features of markets in terms of concentration, exposure to competitive pressures and market power, giving rise to profit and mark-up patterns that significantly differ across

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sectors (Fukao and Nishioka, 2017). Such extensive transformations contributed to reshaping social and economic inequalities in Japan, traditionally considered as a relatively equitable market economy. In this paper, we focus on the evolutions of functional income distribution, a perspective of analysis that has recently regained importance in the economic research agenda (Krueger, 1999; Atkinson, 2009). The welfare implications of the decline of the labor share have also been extensively considered (Zeira, 1998; Blanchard and Giavazzi, 2003). In particular, due to capital income and profits being more unequally distributed than labor income, the negative association between labor share and personal income inequality has been extensively documented (Schlenker and Schmid, 2015). Moreover, the well-known heterogeneity in marginal propensity to consumption at different income levels explains why the trend in the labor share is crucial in determining domestic demand patterns. These reasons make the analysis of the dynamics of the labor share in Japan particularly interesting, since in the last decades the country has experienced a long period of stagnation, coupled with an unprecedented increase in economic inequalities (Minami, 2008; Funabashi and Kushner, 2015).

An extensive literature on the drivers of the labor share has developed in the last two decades. Its decline has first of all been connected to changes in the production function, in terms of capital augmenting technological change and capital deepening (Piketty, 2014; Piketty and Zucman, 2014; Karabarbounis and Neiman, 2014) and of increasing substitutability of labor with capital (Bentolila and Saint-Paul, 2003; Antràs, 2004). To this regard, the consideration of different types of labor and capital has provided additional and useful insights, as the overall effect of technological change on the labor share crucially depends on the interplay between levels of substitutability of different types of capital and labor and on their relative remunerations (Karaborbonis and Neuman, 2014). A second group of drivers of the labor share relates to globalization. Classical trade theories predict that developed countries specialize in capital-intensive industries and this drives the labor share downwards, provided that the elasticity of substitution is lower than one (European Commission, 2007). However, differences in the elasticity of substitution of heterogeneous types of labor (high/low-skilled) can significantly alter the impact of openness of markets on the overall labor share (Guscina, 2006; ILO, 2011). The relocation of production abroad through FDI, outsourcing or imports of intermediate inputs has also been explored in terms of changes in labor demand, wage elasticity and bargaining power of labor (Harrison, 2002; Jaumotte and Tytell, 2007). The interplay of all these factors originates many possible outcomes and the impact of the various trajectories of globalization on the labor share is ultimately an empirical matter (see Guerriero and Sen, 2012). A third set of explanations is related to market imperfections. When remunerations do not mirror workers' marginal productivity, the extent to which emerging rents accrue to capital or labor depends on the institutional settings that shape the bargaining power of workers vis-a-vis employers (Blanchard and Giavazzi, 2003). The existing literature has emphasized particularly the role of product market competition (Azmat *et al.*, 2012; Barkai, 2019; Autor *et al.*, 2017a, 2017b) and labor market institutions (Bentotila and Sain-Paul, 2003; European Commission, 2007; Bental and Demougin, 2010; OECD, 2012).

We add to this literature by analyzing the long-run pattern and drivers of the labor share in Japan, on which research has so far been rather limited (see Wakita, 2006; Agnese and Sala, 2011; Takeuchi, 2005). As it is shown in the following Section, Japan is one of the economies where the decline of the labor share has been more pronounced, being mainly concentrated in specific segments of the tertiary sector. The possible reasons behind such trends explored here—production factors heterogeneity and labor/product market institutional features—shed some new light on aspects that might be of a more general interest.

Our paper contributes to the existing knowledge on different fronts. First, in terms of theory, we propose an original extension to more than two inputs of the seminal model by Bentotila and Saint-Paul (2003), based on the SK (labor share/capital) schedule. This enables us investigate the degree of substitutability of different types of capital and work and its impact on the labor share (henceforth, S_L). In particular, we distinguish between information technology—IT—and non-IT capital and between regular (i.e. permanent) and non-regular labor (see Section 5 for details on the definitions). Separating out different types of capital is crucial to account for the impact of new digital technologies, identified as one of the main drivers of growth and distributional patters in the last decades (Acemoglu and Autor, 2011; Acemoglu and Restrepo, 2018). As the intensity of new technologies varies remarkably across sectors, such aspects are particularly important in detailed industry level analysis like ours. Existing research on these aspects is not extensive, but provides meaningful insights. Bassanini and Manfredi (2002) distinguish between the impact of ICT and non-ICT capital intensity and find that only the latter has a relatively stable negative effect on the labor share; ICT capital has a modest and weakly significant positive effect only in some econometric specifications. On the contrary, O'Mahony *et al.* (2019a, 2019b) find that ICT capital is the only driver of capital/labor substitution and its negative effect on the labor share differs across sectors. Another stream of the literature focused on tangible/intangible capital, providing mixed results (see Perugini *et al.,* 2017; Fukao *et al.,* 2019; O'Mahony *et al.*, 2019b). As for labor heterogeneity, in view of the specific features of the Japanese labor market, we focus on the duality between standard (or regular) and non-standard (or non-regular) employment. The idea of investigating how the decline in traditional forms of employment has shaped the labor share has received limited attention, despite having been one of the most pervasive and inequality-enhancing labor market developments of the last decades (see, for example, Blanchard and Landier, 2002; Boeri and Garibaldi, 2007; Perugini and Pompei, 2017).

Our study is also the first to provide long-run evidence on S_L dynamics and drivers in Japan (from 1970 to 2012) and with such a detailed industry breakdown (84 market sectors). This allows for proper accounting for differences in technology as well as in labor market (union density, non-regular employment) and product market features (mark-ups) (see Section 3.2).

Our results indicate, in the first instance, that the dynamic of the labor share in Japan differed remarkably across industries and that the low-knowledge-intensive market services were mainly responsible of its decline. This aggregate has gained importance in the Japanese economy over time, accounting in the most recent years for almost half of total hours worked, and has developed specific features (i.e. high

Figure 1. Labor share in the market economy and income inequality (top 1% share of income) in Japan

Source: Authors' elaborations of JIP database for the labor share and WWID data for top 1% income share. [Colour figure can be viewed at wileyonlinelibrary.com]

incidence of non-regular work and increasing market concentration) that proved particularly relevant for our analysis. Generally speaking, distinguishing different forms of capital was a rewarding choice, as we find that while non-IT capital intensity decreases the labor share across all sectors, IT capital emerges as complementary to labor in some industry aggregates. As for non-regular work, its detrimental effect on the labor share seems mainly concentrated in the low-knowledge intensive services, where this type of labor has high substitutability with regular work. Our evidence also suggests that globalization forces play an ancillary role and that stronger unions reduce S_L. Lastly, market power emerges as one of the main drivers of the labor share.

The rest of the paper is organized as follows. In Section 2 we describe, in a comparative perspective, the basic trends in the labor share in Japan over the period considered. Section 3 provides the theoretical basis of our analysis and Section 4 the empirical model and the econometric methods. In Section 5 we illustrate the dataset and some preliminary descriptive statistics. Section 6 is devoted to the presentation and discussion of econometric results. Section 7 concludes.

2. Trends in Japan's Labor Share: Some Preliminary Facts

Figure 1 (left panel) shows that, compared to the mid 1970s, the Japanese labor share (S_L) in the whole market economy experienced a decrease of approximately ten percentage points, mainly as a result of the first wave of decline that took place until the end of the 1980s.[1] A second wave followed from the late 1990s to the outburst of the 2007–2008 global crisis. The right panel of Figure 1 confirms

[1]As explained in detail in section 5, the labor share is the ratio of nominal total labor compensation to nominal values added. The S_L pattern over time derived from JIP data (version 2009) in Figure 1 is similar to the one obtained with KLEMS (or AMECO) data (see Figure 2), but some differences in levels are observable. They are due to differences in sector composition (much finer industry detail is available in JIP data) and to the method used by JIP for computing the remunerations of all labor types, including self-employed and family work (see Section 5 and Appendix C).

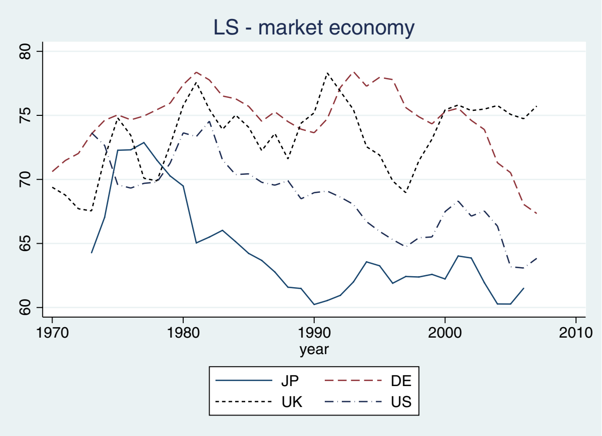

Figure 2. Labor share trends in Japan, the U.S., Germany and the UK
Source: Authors' elaborations of EU-KLEMS and World-KLEMS data. [Colour figure can be viewed at wileyonlinelibrary.com]

that lower levels of the labor share are associated with higher income concentration and inequality, one of the relatively recent features of the Japanese economy that has attracted social and political attention.

Figure 2 illustrates the trend of the labor share of Japan, the U.S. (its usual benchmark) and the two largest European economies. Consistent with extensive comparative evidence (e.g. OECD, 2015; Berger and Wolff, 2017; Schwellnus et al., 2018), Japan shares with the U.S. a remarkable declining labor share trend over the last decades.[2] However, if we look into macro-sectors, some quite interesting distinctive features emerge (see Figure 3). Despite the U.S. and Japan had virtually identical structural change patterns, the dynamics of the labor share diverged completely. In the U.S. the decline of the labor share mainly took place in manufacturing and remained substantially unchanged in services; in Japan the opposite occurred, with a stable trend in manufacturing and a spectacular drop in services.

A finer industry detail uncovers additional relevant information. Figure 4 plots the trend over time of the S_L in Japan with a sectoral breakdown based on the widely used Eurostat industry classification into medium- and medium-high-technology

[2]The labor share is here computed using EU- and World-KLEMS data (versions 2012 and 2016) as the ratio of total compensation (including non-wage labor costs) to gross value added. In line with the literature, it includes the remuneration of the self-employed, which is classified as mixed income in national accounts, assuming that their compensation equals the industry average for employees. Following Bassanini and Manfredi (2012) and O'Mahony *et al.* (2019a and 2019b), we exclude agriculture, mining, refining and petroleum, and real estate activities. The list of industries includes (ISIC Rev. 2): food, beverages, and tobacco (15t16); textiles, textile products, and leather (17t19); wood and products of wood and cork (20); pulp, paper, paper products, and printing (21t22); chemicals (24); rubber and plastics (25); other non-metallic minerals (26); basic metals and fabricated metal (27t28); machinery, NEC (29); electrical and optical equipment (30t33); transport equipment (34t35); manufacturing, NEC (36t37); electricity, gas, and water supply (E); construction (F); wholesale and retail trade (G); hotels and restaurants (H); transport and storage (60t63); post and communications (64); financial intermediation (J); and business services (71t74).

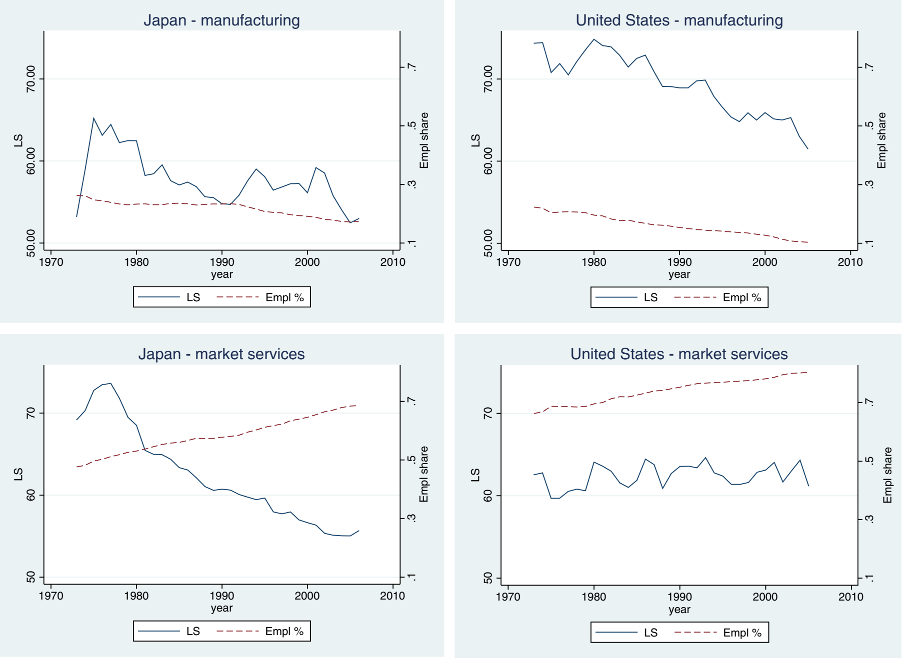

Figure 3. Labor share and employment shares (hours) in manufacturing and services (Japan vs USA)
Source: Authors' elaborations of World-KLEMS data. [Colour figure can be viewed at wileyonlinelibrary.com]

manufacturing sectors (MHM), medium- and medium-low-technology manufacturing sectors (MLM), knowledge-intensive services (KIS), and less-knowledge-intensive services (LKIS) (see Section 5 and Appendix A for further details on the classification).

Within market services, the decline of the labor share in Japan took place almost exclusively in low-knowledge-intensive services, that experienced the largest expansion in terms of employment share, accounting at the end of the period considered for over half of total hours worked (Figure 5). It is therefore apparent that any attempt to explain the pattern of the S_L in Japan should be able to account for industry specificities.

3. Theory: The Extended SK Schedule and Deviations from the Schedule

Our conceptual framework builds on the Bentotila and Saint-Paul (2003) model that postulates a one-to-one relationship between labor share and capital-output ratio (the so-called SK—share-capital—schedule) as long as labor is paid its marginal product. To enable the aims of this paper, in Section 3.1 we propose an extension of the model to more than two production factors: namely, we derive the SK schedule in the presence of two types of capital (IT and non-IT) and the SK schedule with two types of capital and two types of labor (regular

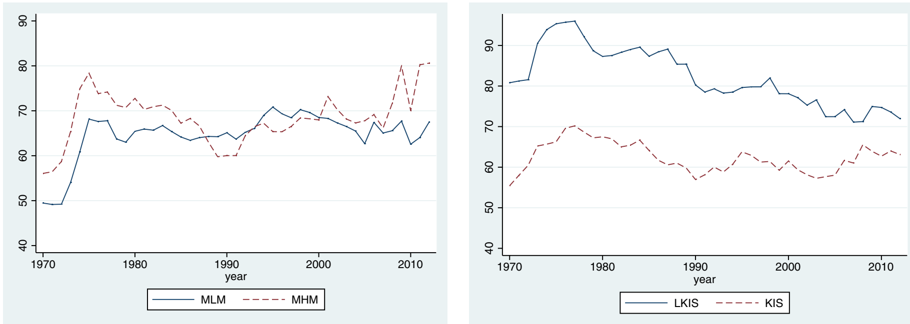

Figure 4. Labor share in macro-sectors of manufacturing and services in Japan.
Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services
Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

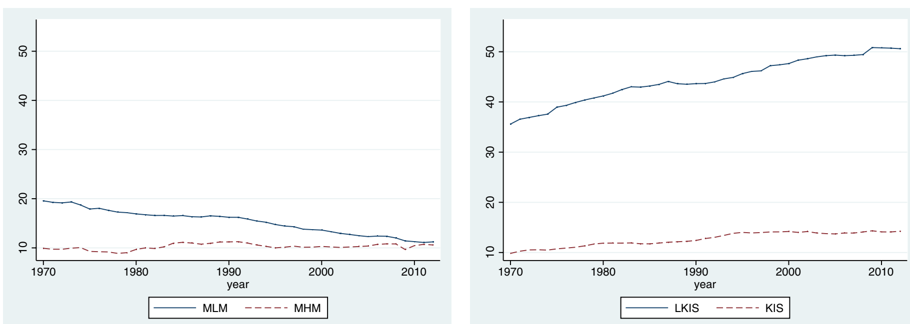

Figure 5. Employment shares in macro-sectors of manufacturing and services (hours worked).
Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services
Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

and non-regular). The latter, linking the S_L of regular workers to all other factors intensity, allows investigating the degree of substitutability between different labor inputs.

In Section 3.2 we discuss the drivers of the departure from the SK schedule relevant to the specific case of Japan and focused in this paper.

3.1. *The SK Schedule in the Presence of Multiple Inputs*

In their baseline model, Bentolila and Saint Paul (2003) show that in the presence of two factors of production (K and L) and under the assumptions competitive markets, constant returns to scale and capital and labor-augmenting technical progress–$Y_i = F(A_iK_i, B_iL_i)$, there is a simple relationship between the labor share in industry i ($S_L^{\,i}$) and the capital–output ratio ($k_i = K_i/Y_i$). This is the so-called SK schedule [$S_L^{\,i} = g(A_ik_i)$]: a unique function g explains the labor share based on observable capital–output ratios, with changes in capital augmenting technological progress shifting the SK schedule. This implies that variations of the S_L across sectors, countries, and over time may be due to different values of the capital–output ratios and different elasticities of substitution between factors. A positive slope of the SK schedule indicates that the elasticity of substitution between capital and labor (σ) is less than one (factor complementarity). Vice-versa, when K and L are substitutes, the SK is downward-sloping, except for the case in which $|\sigma|=1$ (the Cobb-Douglas), in which changes in relative factor intensities are exactly compensated by changes in their relative prices. In this case the labor share is independent of capital intensity.[3]

We now discuss the effects on the SK schedule of changes in the aggregate production function represented by the existence of heterogeneous types of capital and labor. To start with, we assume the following constant return-to-scale production technology in each industry i (suffix i not indicated for the sake of simplicity):

$$Y = Y_{IT}^{\gamma_{IT}} Y_{NIT}^{1-\gamma_{IT}} \tag{1}$$

$$Y_{IT} = \left\{\alpha_{IT} \left(A_{IT} K_{IT}\right)^{\varepsilon_{IT}} + \left(1-\alpha_{IT}\right) \left(B_{IT} L_{IT}\right)^{\varepsilon_{IT}}\right\}^{\frac{1}{\varepsilon_{IT}}} \tag{2}$$

$$Y_{NIT} = \left\{\alpha_{NIT} \left(A_{NIT} K_{NIT}\right)^{\varepsilon_{NIT}} + \left(1-\alpha_{NIT}\right) \left(B_{NIT} L_{NIT}\right)^{\varepsilon_{NIT}}\right\}^{\frac{1}{\varepsilon_{NIT}}} \tag{3}$$

The production activity of this industry consists of two processes: i) an IT capital-intensive process, in which labor, L_{IT}, and IT capital, K_{IT}, are employed; and ii) a non-IT capital intensive process, in which labor, L_{NIT}, and non-IT capital, K_{NIT}, are employed. In the two processes the elasticities of substitution, $1/(1-\varepsilon_{IT})$ and $1/(1-\varepsilon_{NIT})$ are constant. We assume that ε_{IT} and ε_{NIT} are smaller than 1. We also assume that, as equation (1) shows, elasticity of substitution between the two processes for total production is equal to one. γ_{IT} and $1-\gamma_{IT}$ denote the relative importance of the two processes, with $0 < \gamma_{IT} < 1$.

Let $s_{IT,L}$ and $s_{NIT,L}$ denote labor income share in the IT capital and non-IT capital-intensive process, respectively. As Bentolila and Saint-Paul (2003, equation 10) have shown:

$$s_{IT,L} = 1 - \alpha_{IT} \left(A_{IT} \frac{K_{IT}}{Y_{IT}}\right)^{\varepsilon_{IT}} \tag{4}$$

[3]The elasticity of substitution is an essential concept in many economic spheres, not only for functional income distribution. Despite an extensive literature, many issues remain open especially regarding the identification of its size (Grossman *et al.* 2017). Reviewing this literature is beyond the scope of the paper, but some works provide a comprehensive picture of the existing complexity. Karabarbouins and Neiman (2014) highlight that the estimated value of sigma crucially depends on the nature of data (time series versus cross-section) and can be affected by various factors, such as the existence of a mark-up and the rate of capital-augmenting technology growth. Knoblach *et al.* (2020) add to the possible causes of the heterogeneity of the estimated coefficients the functional form of the estimation equation, technological dynamics, the econometric approach and the level of analysis (country-, industry-, firm-level). Knoblach and Stöckl (2019) provide and extensive literature review on the multitude of technological, non-technological, and institutional drivers of the elasticity of substitution.

$$s_{NIT,L} = 1 - \alpha_{NIT}\left(A_{NIT}\frac{K_{NIT}}{Y_{NIT}}\right)^{\varepsilon_{NIT}} \tag{5}$$

Equation (4) means that when the elasticity of substitution between IT capital and labor is greater than one ($0 < \varepsilon_{IT} < 1$), an increase of K_{IT}/Y_{IT} will reduce the labor income share in the IT capital-intensive process. When elasticity of substitution between IT capital and labor is smaller than one ($\varepsilon_{IT} < 0$), an increase in K_{IT}/Y_{IT} will increase labor income share in the IT capital-intensive process.

Since Y is a Cobb-Douglas function of Y_{IT} and Y_{NIT}, cost shares of IT-intensive and non-IT-intensive processes in the total production cost are γ_{IT} and $1-\gamma_{IT}$, respectively. Therefore, the labor share in the total production process, s_L, is given by:

$$s_L = 1 - \gamma_{IT}\alpha_{IT}\left(A_{IT}\frac{K_{IT}}{Y_{IT}}\right)^{\varepsilon_{IT}} - \left(1-\gamma_{IT}\right)\alpha_{NIT}\left(A_{NIT}\frac{K_{NIT}}{Y_{NIT}}\right)^{\varepsilon_{NIT}} \tag{6}$$

We should note that K_{IT}/Y_{IT} and K_{NIT}/Y_{NIT} are usually unobservable. However, we can rewrite the above equation as follows:

$$s_L = 1 - \gamma_{IT}\alpha_{IT}\left(A_{IT}\frac{K_{IT}}{Y}\right)^{\varepsilon_{IT}}\left(\frac{Y}{Y_{IT}}\right)^{\varepsilon_{IT}} - \left(1-\gamma_{IT}\right)\alpha_{NIT}\left(A_{NIT}\frac{K_{NIT}}{Y}\right)^{\varepsilon_{NIT}}\left(\frac{Y}{Y_{NIT}}\right)^{\varepsilon_{NIT}} \tag{7}$$

where Y_{IT}/Y and Y_{NIT}/Y depend on firms' decision regarding substitution between IT-intensive and non-IT-intensive processes.

As we show in Appendix B, when IT capital cost is relatively lower than non-IT capital cost, firms will expand the IT-intensive process (higher Y_{IT}/Y) in comparison with the non-IT-intensive process (lower Y_{NIT}/Y). Again, Y_{IT}/Y and Y_{NIT}/Y are usually not observable. However, as shown in Appendix B, under our assumptions concerning the production process, Y_{IT}/Y is a continuously differentiable function of K_{IT}/Y and K_{NIT}/Y. This function is strictly increasing for K_{IT}/Y and strictly decreasing for K_{NIT}/Y. Y_{IT}/Y also depends on technology indices A_{IT}, A_{NIT}, B_{IT} and B_{NIT}:

$$\frac{Y_{IT}}{Y} = \theta_{IT}\left(\frac{K_{IT}}{Y}, \frac{K_{NIT}}{Y}, A_{IT}, B_{IT}, A_{NIT}, B_{NIT}\right) \tag{8}$$

In a similar way, we can also prove that Y_{NIT}/Y is a function of the same set of variables:

$$\frac{Y_{NIT}}{Y} = \theta_{NIT}\left(\frac{K_{IT}}{Y}, \frac{K_{NIT}}{Y}, A_{IT}, B_{IT}, A_{NIT}, B_{NIT}\right) \tag{9}$$

Y_{NIT}/Y is a decreasing function of K_{IT}/Y and an increasing function of K_{NIT}/Y.

Substituting the above two equations into equation (7), we obtain:

$$s_L = 1 - \gamma_{IT}\alpha_{IT}\left(A_{IT}\frac{K_{IT}}{Y}\right)^{\varepsilon_{IT}}\theta_{IT}\left(\frac{K_{IT}}{Y},\frac{K_{NIT}}{Y},A_{IT},B_{IT},A_{NIT},B_{NIT}\right)$$
$$- \left(1-\gamma_{IT}\right)\alpha_{NIT}\left(A_{NIT}\frac{K_{NIT}}{Y}\right)^{\varepsilon_{NIT}}\theta_{NIT}\left(\frac{K_{IT}}{Y},\frac{K_{NIT}}{Y},A_{IT},B_{IT},A_{NIT},B_{NIT}\right) \tag{10}$$

A linear approximation of this equation, augmented with factors able to shift the SK schedule (see Section 3.2), is estimated in the empirical sections of the paper (Sections 4, 5 and 6).

Using a similar framework, we can further generalize our model to take into account heterogeneity of workers. We assume that there are four production factors: regular workers, non-regular workers, IT capital and non-IT capital. We also assume that there are three production processes: a non-regular labor-intensive process, in which regular workers $L_{NR,\,R}$ and non-regular workers L_{NR} are used; an IT capital-intensive process, in which regular workers $L_{IT,\,R}$ and IT capital K_{IT} are used; and a non-IT capital-intensive process, in which regular workers $L_{NIT,\,R}$ and non-IT capital K_{NIT} are used. We assume a constant return-to-scale production technology, which is defined by the following equations:

$$Y = Y_{NR}^{\gamma_{NR}}\,Y_{IT}^{\gamma_{IT}}\,Y_{NIT}^{1-\gamma_{NR}-\gamma_{IT}} \tag{11}$$

$$Y_{NR} = \left\{\alpha_{NR}\left(A_{NR}L_{NR}\right)^{\varepsilon_{NR}} + \left(1-\alpha_{NR}\right)\left(B_{NR}L_{NR,R}\right)^{\varepsilon_{NR}}\right\}^{\frac{1}{\varepsilon_{NR}}} \tag{12}$$

$$Y_{IT} = \left\{\alpha_{IT}\left(A_{IT}K_{IT}\right)^{\varepsilon_{IT}} + \left(1-\alpha_{IT}\right)\left(B_{IT}L_{IT,R}\right)^{\varepsilon_{IT}}\right\}^{\frac{1}{\varepsilon_{IT}}} \tag{13}$$

$$Y_{NIT} = \left\{\alpha_{NIT}\left(A_{NIT}K_{NIT}\right)^{\varepsilon_{NIT}} + \left(1-\alpha_{NIT}\right)\left(B_{NIT}L_{NIT,R}\right)^{\varepsilon_{NIT}}\right\}^{\frac{1}{\varepsilon_{NIT}}} \tag{14}$$

In a similar way as the in the case of the three-production-factor model, labor income share of regular workers, s_{RL}, is expressed by the following equation:

$$s_{RL} = 1 - \gamma_{NR}\alpha_{NR}\left(A_{NR}\frac{L_{NR}}{Y}\right)^{\varepsilon_{NR}}\theta_{NR}\left(\frac{K_{IT}}{Y},\frac{K_{NIT}}{Y},\frac{L_{NR}}{Y},A_{NR},B_{NR},A_{IT},B_{IT},A_{NIT},B_{NIT}\right)$$
$$- \gamma_{IT}\alpha_{IT}\left(A_{IT}\frac{K_{IT}}{Y}\right)^{\varepsilon_{IT}}\theta_{IT}\left(\frac{K_{IT}}{Y},\frac{K_{NIT}}{Y},\frac{L_{NR}}{Y},A_{NR},B_{NR},A_{IT},B_{IT},A_{NIT},B_{NIT}\right)$$
$$- \left(1-\gamma_{NR}-\gamma_{IT}\right)\alpha_{NIT}\left(A_{NIT}\frac{K_{NIT}}{Y}\right)^{\varepsilon_{NIT}}\theta_{NIT}\left(\frac{K_{IT}}{Y},\frac{K_{NIT}}{Y},\frac{L_{NR}}{Y},A_{NR},B_{NR},A_{IT},B_{IT},A_{NIT},B_{NIT}\right) \tag{15}$$

3.2. *Departures from the SK Schedule: Product and Labor Market Settings*

The SK relationship is stable as long as the marginal product of labor equals the real wage. Any factor opening a gap between them places the economy *off* the schedule. Given the context of our analysis, we consider here two of the aspects identified by Bentotila and Saint-Paul (2003), related to product and labor markets. The first originates from the relaxation of the assumption of perfectly competitive markets and the existence of a mark-up (μ) of prices over marginal costs. In this case the SK relationship reads $S_L = \mu^{-1} g\,(Ak)$ and any change in the mark-up will generate a move away from the relationship between the labor share and capital intensity, affecting the former in the opposite direction. Some recent contributions have developed this intuition both theoretically and empirically. Azmat *et al.* (2012) show theoretically and empirically how deregulation of product markets in OECD countries, leading to an intensification of competition between firms, is able to counteract the decline of the labor share caused by privatizations. Autor *et al.* (2017a, 2017b) uncover a negative industry-level correlation between concentration and labor share in the U.S. The bulk of their explanation lies in the complementary evidence provided by firm-level data: reallocation processes within industries materialized in the rise of a restricted number of "superstar firms," able to raise revenues without increasing labor costs. Their higher profits explain a remarkable part of the decline in the labor share. De Loecker and Eeckhout (2018) use firms' mark up for a broad set of countries and show that the evolution of the mark-up is inversely related to the labor share. Perugini *et al.* (2017) provide similar microeconomic empirical evidence (higher profit margins negatively affect the labor share) for six EU countries. Lastly, Barkai (2019) finds a negative industry-level relationship between changes in labor share and market concentration for the U.S. He also shows that higher market power translates into higher profits and into a decline in the capital share even larger than in the labor share. All empirical contributions agree in assigning a prominent quantitative impact of market concentration on the labor share dynamics.

The effects of changes in the competition environment cannot be evaluated separately from those in labor market institutions (Checchi and Garcia- Peñalosa, 2008; Jaumotte and Buitron, 2015). An extensive literature agrees that in modern market economies various factors contributed to reduce the power of workers in the last decades, reflected in the decline of workers' unions, in the change of their objective function and in the evolution of employment legislation. Bentotila and Saint-Paul (2003) consider the role of unions in connection with different bargaining models. When negotiations between trade unions and firms follow the "efficient bargaining" model (wages and employment are negotiated at the same time) the real wage paid by firms differs from the marginal product of labor, the gap depending on the strength of the trade unions. The higher their power, the closer is the wage to the marginal product and the higher the labor share: $S_L = 1 - (1 - \delta)\,(Ak)$, where δ is the workers' bargaining power. When negotiations take place on the basis of a "right to manage" model (wages are bargained first, and afterwards firms unilaterally chose the level of employment equalizing marginal product and wage), changes in the bargaining power do not shift the equilibrium away from the SK but move it along the SK, in the direction commanded by the elasticity of substitution between capital and labor. Other labor market institutional settings able to alter the SK relationship are related to employment protection legislation. Again, Bentolila and Saint-Paul (2003) show that higher labor protection raise labor adjustment costs; this increase only partially translates into higher real wages, thereby enhancing their wedge to productivity, and ultimately decreasing the S_L. As already mentioned, in the case of Japan, limiting the focus to permanent employment would offer only a partial view, especially in sectors that departed more significantly from the traditional model based on the dominance of regular jobs and lifetime employment. Non-regular workers are usually less unionized (OECD, 2012) and more weakly represented in negotiations by unions, which tend to favor longer-serving members and to agree to contracts with steep returns to seniority (Booth *et al.*, 2002). This contributes to shaping a dual labor market (Boeri and Garibaldi, 2007) in which the secondary segment of non-regular work is likely to end up in an equilibrium wage that closely approaches the reservation wage. Since, especially in some tasks/sectors, regular and non-regular workers may be highly substitutable, what happens in the low-wage segment of the labor market could affect equilibrium wages in the whole economy by enhancing the outside option for firms and their bargaining power vis-à-vis labor.

4. Empirical Model and Econometric Methods

Following Bentotila and Saint-Paul (2003) in assuming a general multiplicative form of the labor share functions, from equations (10) and (15) we can write:

$$S_L^{it} = g(k_{IT}^{it}; k_{NIT}^{it}; C^{it}) h(Z^{it}) \tag{16}$$

$$S_{RL}^{it} = g(k_{IT}^{it}; k_{NIT}^{it}; l_{NR}^{it}; C^{it}) h(Z^{it}) \tag{17}$$

where superscripts i and t denote sector and year, respectively. The function $g(\cdot)$ describes the labor-share drivers derived from the production function (the SK schedule); $k_{IT}^{it}, k_{NIT}^{it}, l_{NR}^{it}$ correspond to $\frac{K_{IT}^{it}}{Y^{it}}, \frac{K_{NIT}^{it}}{Y^{it}}, \frac{K_{NR}^{it}}{Y^{it}}$, respectively; C^{it} is a measure of technological change that summarizes the effects of all types of technical change not labor-augmenting (A_{IT} and A_{NIT}) in equation (16) and not regular-labor-augmenting (A_{IT}, A_{NIT} and A_{NR}) in equation (17). The separate exponential function $h(\cdot)$ accounts for the other potential factors (Z_{it}) that shift the economy off the SK schedule. They include globalization, mark-ups, and labor-market institutional factors able to shape the relative bargaining power of labor and capital.

Assuming that both $g(\cdot)$ and $h(\cdot)$ are also multiplicative and by taking logs, we can express the labor shares as:

$$\ln S_L^{it} = \beta_{0i} + \beta_0 \ln(C^{it}) + \beta_1 \ln(k_{IT}^{it}) + \beta_2 \ln(k_{NIT}^{it}) + \gamma \ln(Z^{it}) + \vartheta^{it} \tag{18}$$

$$\ln S_{RL}^{it} = \beta_{0i} + \beta_0 \ln(A^{it}) + \beta_1 \ln(k_{IT}^{it}) + \beta_2 \ln(k_{NIT}^{it}) + \beta_3 \ln(l_{NR}^{it}) + \gamma \ln(Z^{it}) + \vartheta^{it} \tag{19}$$

where β_{0i} are sector fixed effects and ϑ^{it} is a residual error term.

As noted by Rincon-Aznar *et al.* (2015) in a similar context, equations (18) and (19) represent static models and their estimated coefficients can be interpreted as long-run elasticities. However, when the time dimension is large, as in our case

(1970–2012), the estimation of a static model may suffer from limitations due to the bias in the coefficients produced by non-stationarity of the time series. The standard approach to address such issues is to rewrite the equations as autoregressive distributed lag processes ARDL(p,q). In the case of equation (18) (the same holds for equation 19, mutatis mutandis), and assuming for simplicity a maximum lag order of one, the model reads:

$$\begin{aligned}\ln S_L^{it} = \alpha_{0i} + \alpha_1 \ln S_L^{it-1} + \alpha_2 \ln (C^{it}) + \alpha_3 \ln (C^{it-1}) + \alpha_4 \ln (k_{IT}^{it}) + \alpha_5 \ln (k_{IT}^{it-1}) \\ + \alpha_6 \ln (k_{NIT}^{it}) + \alpha_7 \ln (k_{NIT}^{it-1}) + \varphi_1 \ln (Z^{it}) + \varphi_2 \ln (Z^{it-1}) + \vartheta^{it}\end{aligned} \tag{20}$$

Equation (20) can be reformulated as an error, or equilibrium, correction model (ECM) as follows:

$$\begin{aligned}\Delta \ln S_L^{it} = \gamma_{0i} + \gamma_1 \Delta \ln (C^{it}) + \gamma_2 \Delta \ln (k_{IT}^{it}) + \gamma_3 \Delta \ln (k_{NIT}^{it}) + \Delta\phi_1 \ln (Z^{it}) + \gamma_4 \ln S_L^{it-1} \\ + \gamma_5 \ln (C^{it-1}) + \gamma_6 \ln (k_{IT}^{it-1}) + \gamma_7 \ln (k_{NIT}^{it-1}) + \Delta\phi_2 \ln (Z^{it-1}) + \vartheta^{it}\end{aligned} \tag{21}$$

Equation (21), and a corresponding equation for the drivers of the labor share of regular workers, is estimated using the augmented mean group (AMG) estimator proposed by Eberhardt and Teal (2010). The estimator is part of the panel time-series literature which emphasizes: (i) possible non-stationarity of the processes; (ii) cross-section dependence, that is, the possible correlation in the disturbances across sectors; and (iii) slope, not just group time-invariant, parameter heterogeneity (Eberhardt, 2013). Like other mean group approaches (Pesaran, 2006; see Hogrefe and Kappler, 2013, for a specific application to the analysis of the labor share), the AMG estimator first estimates N group-specific ordinary least-squares regressions and then averages the estimated coefficients across groups. Cross-sectional dependence is controlled for by the inclusion of a common dynamic effect, which in the AMG is obtained in the first step estimation of a pooled regression model augmented with year dummies, obtained by first difference ordinary least squares. The coefficients on the (differenced) year dummies represent an estimated cross-group average of the evolution of unobservables over time (the common dynamic process). This is included in the group-specific regression model, along with an intercept that captures time-invariant fixed effects. Lastly, the group-specific model parameters are averaged across the panels. By combining the parameters of equation (21) we can derive estimates of the long-run relationships between the explanatory variables and the S_L. As an example, the long-run effect (or co-integration parameter) of IT capital intensity on the labor share corresponds to $\gamma_{ITk}^{L} = -\left(\gamma_6/\gamma_4\right)$, while for non-IT capital intensity is $\gamma_{NITk}^{L} = -\left(\gamma_7/\gamma_4\right)$. The coefficient of the lagged dependent variable (the labor share) γ_4 describes the speed of adjustment towards the long-run equilibrium, and inference on this parameter provides information on the presence of a long-run equilibrium relationship. This is indeed the intuition behind ECM models: following a shock in the economy, if $\gamma_4 \neq 0$ an error correction mechanism exists that drives the economy back into its long-run equilibrium path. This means that co-integration exists between the variables and processes in levels (Eberhardt and Presbitero, 2015).

5. Data and Descriptive Evidence

Our data is entirely extracted from the Japan Industrial Productivity (JIP) database (version 2015), compiled by RIETI (Research Institute of Economy, Trade and Industry) and Hitotsubashi University, Tokyo.[4] The 2015 JIP release covers, for the period 1970–2012, various types of annual data for 108 industries of the Japanese economy. We excluded from our analysis non-market services (JIP codes 84 and 98–108) and other sectors with a labor share significantly exceeding 100 percent, such as private medical, education, research, and hygiene services (JIP codes 80–83) and housing (72) (see Appendix A for all relevant details). The pattern of the labor share described in Figure 1 refers to the total market economy (TME) and is therefore calculated on a total of 91 sectors. The econometric analysis of the total labor share is then restricted to 84 industries (referred to as non-primary market economy—NPME) after having excluded primary sectors (1 to 6—agriculture, and 7—mining). Lastly, the analysis of the drivers of the labor share for subsectors of market services (MSERV) and manufacturing (MAN) is carried out on a total of 78 sectors, after having excluded construction (JIP code 60) and utilities (62–66). Manufacturing and market services industries were reclassified according to the Eurostat classification, as follows: medium- and medium-high-technology manufacturing (MHM – 23 JIP sectors), medium- and medium-low-technology manufacturing (MLM – 29 sectors), knowledge-intensive services (KIS – 12 sectors), less-knowledge-intensive services (LKIS – 14 sectors).[5]

Our main variable, the labor share (S_L), is constructed as the ratio of nominal total labor compensation to nominal value added (at basic prices). The JIP data include in labor compensations the remuneration to any type of work employed; that is, employee compensation and mixed income (for labor supplied by self-employed and family workers). This distinctive feature of the dataset addresses one common issue in empirical S_L studies, that of adjusting the amount of labor compensation for remuneration of non-employees (Gollin, 2002).[6] The methodology used in the JIP database to estimate mixed income is reported in Appendix C. A second distinctive feature of the JIP database is that it supplies labor remuneration by type of workers; this allows properly depicting the existing duality in the Japanese labor market (see Kalantzis *et al.*, 2012; Miyamoto, 2016) between regular (with dependent, full-time, open-ended contracts) and non-regular employment (temporary, part-time, self-employed and family workers) employment. As the number of annual hours worked are available, they have been used for the construction of variables such as the share of non-regular in total employment (L_{NR}/L) and the non-regular labor intensity in value added (l_{NR}). The database also supplies separately the stock of real IT and non-IT capital, used to build the capital

[4]See: https://www.rieti.go.jp/en/database/JIP2015/#01. For a detailed account of the JIP database, see Fukao *et al.* (2007).

[5]The Eurostat classification is obtained by aggregating manufacturing and services based on NACE Rev. 2 (see http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf9). The classification largely overlaps with the one provided by the OECD (see: https://www.oecd.org/sti/ind/48350231.pdf)

[6]For a detailed discussion on aspects related to the measurement of the labor share, see Mućk *et al.* (2018).

intensity variables (k_{IT}; k_{NIT}); the definitions used in the 2015 JIP database correspond to those from EU-KLEMS 2012 of ICT and non-ICT capital (see O'Mahony and Timmer, 2009). Our technological change variable C (TFP) is constructed, starting from the JIP database TFP annual growth rate, as an index that is equal to 100 in the initial year (1970).[7]

Another distinctive feature of our dataset is the availability of the union density (UD) rate by sector, compiled by dividing the total number of union-member workers in each sector by the total number of workers available in the JIP database.[8] Trade openness (Trade) is the ratio of total imports plus total exports to value added. Our proxy for "broad" offshoring (Offshoring), commonly used in the literature since Feenstra and Hanson (1999), is the ratio of imported intermediate input to total intermediate input (see IMF, 2007; Crinò, 2012).

Changes in product market structures of the last decades have stimulated efforts aimed at measuring market power/competition. Within the broad range of methods, the estimation of a mark-up over costs has been largely implemented in aggregate empirical analysis (see Calligaris *et al.*, 2018 and Basu, 2019, for updated reviews). The sectoral level of our data prevents estimating measures of market power based on micro-level information, such as concentration indexes or aggregate measures derived firm price/costs margins (see De Loecker and Warzynski, 2012; De Loecker and Eeckhout, 2017; Traina, 2018). Our measure of mark-up (Mark up) is related to the classical Lerner index of market power and computed as a proxy of the price-cost margin, as suggested by Maimaiti *et al.* (2010). The index is the ratio of the value of output (minus indirect taxes and subsidies) over variable costs (calculated as the sum of labor and intermediate inputs costs), assuming that marginal costs can be approximated by average variable costs (as done, for example, in Cette *et al.*, 2019).[9]

Table 1 summarizes information on the main variables used in our study. All figures are averages over the period 1970–2012, therefore they mainly serve the purpose of highlighting differences across macro-sectors. As already shown in

[7]The available detail of information available in JIP dataset, despite being an important feature of our analysis, is unfortunately not sufficient to capture the variety of possible types of technological change that a recent literature identifies as relevant for the dynamics of the labor share. We refer in particular to the task-based framework proposed by Acemoglu and Restrepo (2018), in which technological change either replaces labor (by automation of existing tasks) or creates new complex tasks (in which labor has a comparative advantage). The two forces have opposite effects on the labor share and their relative strength (endogenized in their dynamic model) determines the long-run equilibrium and prospects for labor. Similarly, according to the model developed by Reijnders *et al.* (2016), the fact that we cannot rely on task-based model and data, and therefore on the decomposition of the process of production at home or abroad, might hinder the correct identification of biases in technical change (and, consequently, its impact on labor demand and on the labor share). Empirical investigations able to account for such aspects should be set as a priority on the research agenda.

[8]Data is provided in the Basic Survey on Labour Unions carried out annually by the Ministry of Labour, Health and Welfare (see: http://www.mhlw.go.jp/english/database/db-l/labour_unions.html). Detailed data are available (in Japanese) at: http://www.mhlw.go.jp/toukei/list/13-23.html

[9]An alternative indicator, more directly related to profitability, can be computed as the ratio of the value of output (minus indirect taxes and subsidies) over total costs. This metric is highly correlated to our mark-up index (coefficient around 0.9 for manufacturing and 0.5 for services). Both indicators have a negative pairwise correlation with the labor share (for the whole market economy, about −0.50 for the mark-up over variable costs and −0.67 for the mark-up over total costs).

TABLE 1
Summary Statistics: Labor share, Factor Intensity, and Other Potential Drivers

	TME	NPME	MAN	MLM	MHM	MSERV	LKIS	KIS
S_L (%)	70.560	71.192	66.293	64.616	68.482	75.201	82.122	62.387
S_{RL} (%)	61.239	62.673	61.967	58.784	65.903	64.453	68.301	57.390
k_{IT}	0.128	0.130	0.116	0.088	0.169	0.140	0.126	0.170
k_{NIT}	1.838	1.697	1.467	1.451	1.825	1.677	1.913	1.224
C (TFP) (1970 = 100)	127.626	129.119	143.288	107.292	188.674	108.577	96.344	122.848
L_{NR}/L (workers) (%)	36.477	30.109	21.377	26.503	13.838	34.355	38.149	20.649
L^h_{NR}/L^h (hours) (%)	30.473	25.149	17.688	22.188	11.003	28.959	32.582	16.230
l_{NR}	0.106	0.078	0.051	0.065	0.037	0.101	0.132	0.037
UD (%)	34.568	36.793	37.648	26.849	51.263	30.634	24.451	37.847
Trade	0.294	0.253	0.639	0.415	0.910	0.084	0.064	0.122
Offshoring	0.081	0.082	0.095	0.103	0.086	0.055	0.039	0.073
Mark-up (1970 = 1)	1.008	1.014	1.041	1.060	1.018	0.963	0.891	1.056

Notes: l_{NR} = (1000 ×) n. hours of non-regular workers/VA. For variables acronyms see Appendix A.

TME: Total Market Economy; NPME: Non-Primary Market Economy; MAN: Manufacturing; MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; MSERV: Market services; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services.

Source: Authors' elaborations of JIP database.

Figures 3 and 4, the level of the labor share differs remarkably between manufacturing and market services, but even more within the latter. The S_L is significantly higher in LKIS, the part of the economy in which the S_L accruing to non-regular workers is higher (on average, 14 percent). This, together with the high shares of non-regular work (L_{NR}/L and L^h_{NR}/L^h) and its high intensity (l_{NR}), suggests that strong substitutability could exist between regular and non-regular workers in LKIS. To some extent a similar pattern emerges in manufacturing for the medium-low technology sectors. A clear dichotomy seems therefore to exist between sectors in which the accumulation of industry- and firm-specific knowledge represents a crucial asset (MHM and KIS) and those in which some job positions are more flexible and experience a higher turnover (MLM and LKIS) because workers' seniority is less important for productivity.

Workers are also more unionized in manufacturing than in services and, within the two macro-sectors, in higher knowledge/technology-intensive industries. This overall duality is also reflected by differences in technology. TFP levels are obviously higher in manufacturing, especially in the medium–high technology sectors: the same holds, but to a lesser extent, for knowledge-intensive industries. Similarly, these sectors are characterized by a relatively high IT capital intensity, whereas MLM and LKIS use traditional capital goods more intensively. The importance of globalization is more obvious in manufacturing where medium–high technology sectors are characterized by higher trade openness and lower levels of offshoring compared to medium–low ones: our proxy variables are therefore fairly able to describe the position of Japan in the international division of labor. As for services, KIS industries show a higher degree of integration in global markets than LKIS, as expected due to the fact that they include, for example, financial and insurance activities. Our proxy for market power confirms the well-known countercyclical nature of the mark-up (Rotemberg and Woodford, 1999), which significantly dropped during the more severe recession episodes around 1973 and 2008 (see Figure 6). After an initial sharp decline, the trend of the mark-up shows a substantial stability from mid-1970s to mid 1990s, with a hump towards the end of the 1980s. At the end of the 1990s an increasing trend starts, until the outburst of the global crisis, when another drop is followed by a new upward trend. This evidence is partially consistent, in terms of trend, with the data for the aggregate level of mark-up provided by DeLoecker and Eeckhout (2018), who reported an increasing trend from 1980 to 2000, followed by a period of stability, a drop at the end of the 2000s and a new increase afterwards. The pattern of our indicator is instead largely consistent with the one by Díez *et al.* (2018), covering the period 1980–2016. It is also matching the evidence provided by Alfonso and Costa (2010) over a time-span largely overlapping with ours (1970–2007), although the magnitude of the changes over time of their indicator seems larger. Our industry breakdown shows that the increase in mark-up is due to the tertiary sector as happened in other developed economies (see Andrews *et al.*, 2018). The trends highlight that while competition in manufacturing (especially medium–high tech) increased, the opposite holds for services, particularly for LKIS. This evidence, coupled with the sharp decrease in self-employment and family work (from 25.5 percent in 1970 to 10 percent in total market services and from 30 percent to 11 percent in LKIS), configures a remarkable process of market concentration especially in those segments that significantly

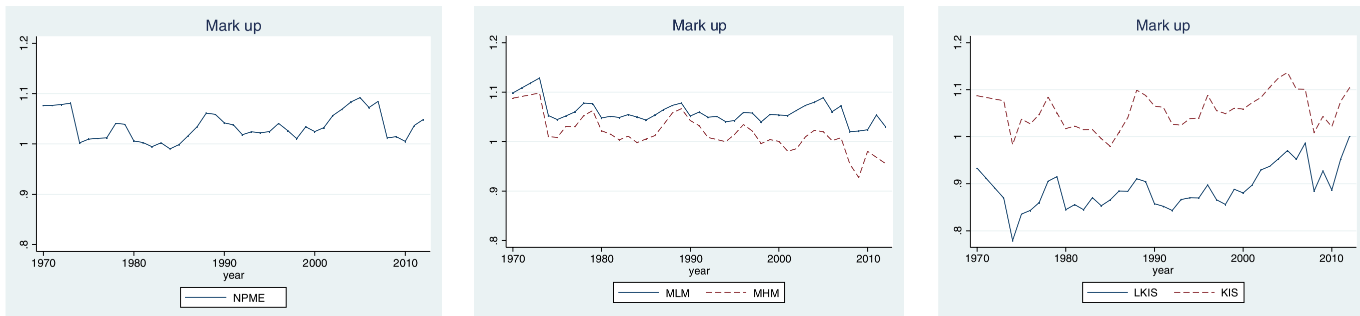

Figure 6. Mark-up (value of output over variable costs) in macro-sectors of manufacturing and services.
Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services
Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 2
Tests for Unit Roots and Cross Sectional Dependence (NPME)

	Unit Root Test		CSD	
	Z (t-bar)	***P*-value**	CD-test	***P*-value**
S_L	1.686	(0.954)	34.10	(0.000)
S_{RL}	1.176	(0.880)	229.61	(0.000)
k_{IT}	1.098	(0.864)	207.14	(0.000)
k_{NIT}	0.056	(0.522)	31.96	(0.000)
C (TFP)	−2.537	(0.006)	26.12	(0.000)
L^h_{NR}/L^h (hours)	0.816	(0.793)	118.79	(0.000)
l_{NR}	−0.606	(0.272)	60.32	(0.000)
UD	−4.597	(0.000)	118.15	(0.000)
Trade	−0.778	(0.218)	127.23	(0.000)
Offshoring	−2.081	(0.019)	207.34	(0.000)
Mark-up	0.340	(0.633)	43.71	(0.000)

Notes: For variables acronyms see Appendix A.
NPME: Non-Primary Market Economy.
Source: Authors' elaborations of JIP database.

increased their employment share over time, such as retail trade (see Matsuura and Motohashi, 2005) and hotels and restaurants (Høj and Wise, 2004).

6. Results

6.1. *The Drivers of the Labor Share: Baseline Model*

Before presenting the results of our estimations we show some tests for cross-sectional dependence (CD) and non-stationarity (Table 2). Cross-sectional dependence is tested using the Pesaran (2004) CD test; in macro panel data it may arise from globally common shocks with heterogeneous impact across panels or be the result of spillover effects (Eberhardt and Teal, 2011). Table 2 shows that the null hypothesis of cross-sectional independence is rejected. The presence of unit roots is tested with the CADF test proposed by Pesaran (2003), designed for heterogeneous panels with cross-sectional dependence (see Lewandowski 2007). Cross-sectional dependence is accounted for by augmenting the standard Dickey-Fuller (DF) or the augmented DF regressions with the cross-section averages of lagged levels and first differences of the individual series. The null hypothesis assumes that all series are non-stationary, and results shown in Table 2 show that it cannot be rejected, the only exceptions being the variables UD and Off. Again as a preliminary step, we run Pedroni's panel cointegration tests, which clearly suggest a rejection of the null hypothesis of no cointegration (Pedroni, 1999).[10]

This is consistent with the evidence provided in the framework of the ECM estimations (Tables 3, 4 and 5). In each model we focus on the long-run coefficients and on the error correction term (the lagged level of the labor share); full ECM

[10]For example, the panel-ADF and the group-ADF (parametric t) statistics are −4.655 and −6.961, respectively, and −4.222 and −5.957 when a linear time trend is included.

TABLE 3
The Drivers of Total Labor Share in Japan, Baseline Model, Non-Primary Market Economy (1970–2012)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
K	−0.132*						
	(0.079)						
k_{IT}		0.046	0.063***	0.063***	0.040	0.048*	0.053*
		(0.081)	(0.020)	(0.023)	(0.025)	(0.026)	(0.031)
k_{NIT}		−0.029**	−0.021**	−0.035***	−0.030***	−0.029***	−0.036***
		−0.014	(0.012)	(0.011)	(0.010)	(0.010)	(0.013)
C (TFP)	−1.146***	−0.728***	0.103	0.073	0.018	0.037	0.054
	(0.209)	(0.186)	(0.074)	(0.075)	(0.075)	(0.075)	(0.079)
Markup			−2.659***	−2.808***	−2.754***	−2.734***	−2.657***
			(0.245)	(0.247)	(0.237)	(0.232)	(0.223)
Trade				−0.027***	−0.024***	−0.024***	−0.021***
				(0.007)	(0.007)	(0.006)	(0.006)
Offshoring					−0.000	−0.001	0.005
					(0.008)	(0.008)	(0.009)
L^h_{NR}/L^h						−0.029*	−0.041**
						(0.016)	(0.020)
UD							−0.097***
							(0.034)
ECM	−0.378***	−0.478***	−0.562***	−0.623***	−0.640***	−0.681***	−0.696***
	(0.023)	(0.024)	(0.034)	(0.034)	(0.034)	(0.036)	(0.034)
RMSE	0.0892	0.0807	0.0366	0.0340	0.0316	0.0292	0.0277
Wald χ^2	389.15	501.15	1075.95	1194.05	1217.46	1246.09	1318.28
Obs	3,528	3,528	3,528	3,528	3,528	3,528	3,528
Groups	3,528	3,528	3,528	3,528	3,528	3,528	3,528

Notes: RMSE is the root mean squared error test (sigma); average long-run coefficients computed from the ECM results; standard errors (in parentheses) computed via the Delta method. For variables acronyms see Appendix A.

$^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

Source: Authors' elaborations of JIP database.

TABLE 4
The Drivers of Total Labor Share in Japan (1970–2012)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	NPME	MAN	MLM	MHM	MSERV	LKIS	KIS
k_{IT}	0.053*	0.059	0.113***	0.044	0.015	0.086*	0.049
	(0.031)	(0.043)	(0.037)	(0.078)	(0.036)	(0.050)	(0.110)
k_{NIT}	−0.036***	−0.065***	−0.048***	−0.052	−0.048**	−0.023	−0.062**
	(0.013)	(0.019)	(0.016)	(0.036)	(0.020)	(0.024)	(0.031)
C (TFP)	0.054	0.151	0.242*	−0.121	−0.008	0.164*	−0.033
	(0.079)	(0.110)	(0.125)	(0.182)	(0.097)	(0.093)	(0.304)
Markup	−2.657***	−3.146***	−3.167***	−3.306***	−1.743***	−1.543***	−1.715***
	(0.223)	(0.237)	(0.315)	(0.351)	(0.308)	(0.125)	(0.324)
Trade	−0.021***	0.008	−0.002	−0.010	−0.013*	−0.015***	−0.025
	(0.006)	(0.013)	(0.015)	(0.020)	(0.007)	(0.005)	(0.020)
Offshoring	0.005	−0.004	−0.006	−0.025	0.027**	0.009	0.051*
	(0.009)	(0.013)	(0.022)	(0.020)	(0.012)	(0.021)	(0.027)
L^{h}_{NR}/L^{h}	−0.041**	−0.013	−0.009	−0.000	−0.080**	−0.168***	−0.019
	(0.020)	(0.025)	(0.030)	(0.050)	(0.039)	(0.063)	(0.046)
UD	−0.097***	−0.117**	−0.069	−0.170**	−0.045	−0.107**	−0.001
	(0.034)	(0.048)	(0.053)	(0.072)	(0.045)	(0.046)	(0.091)
ECM	−0.696***	−0.727***	−0.735***	−0.737***	−0.583***	−0.642***	−0.550***
	(0.034)	(0.036)	(0.044)	(0.056)	(0.067)	(0.108)	(0.067)
RMSE	0.0277	0.0326	0.0327	0.0317	0.0126	0.0093	0.0145
Wald χ^2	1318.28	1635.49	911.17	938.95	402.68	61069.86	226.73
Obs	3,528	2,184	1,218	966	1,092	588	504
Groups	84	52	29	23	26	14	12

Notes: RMSE is the root mean squared error test (sigma); average long-run coefficients computed from the ECM results; standard errors (in parentheses) computed via the Delta method.

NPME: Non-Primary Market Economy; MAN: Manufacturing; MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; MSERV: Market services; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services. For variables acronyms see Appendix A.

$^{***}P < 0.01$, $^{**}P < 0.05$, $^{*}P < 0.1$.

Source: Authors' elaborations of JIP database.

TABLE 5
THE DRIVERS OF REGULAR WORKERS' LABOR SHARE IN JAPAN (1970–2012)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	NPME	MAN	MLM	MHM	MSERV	LKIS	KIS
k_{IT}	0.046	0.062	0.111*	0.086	−0.035	−0.018	0.016
	(0.030)	(0.046)	(0.058)	(0.097)	(0.046)	(0.030)	(0.103)
k_{NIT}	−0.028*	−0.078***	−0.063***	−0.056*	−0.041**	−0.029*	−0.053
	(0.015)	(0.020)	(0.021)	(0.030)	(0.018)	(0.015)	(0.036)
C (TFP)	−0.025	0.060	−0.002	0.191	−0.176	−0.243*	−0.219
	(0.097)	(0.132)	(0.181)	(0.177)	(0.136)	(0.126)	(0.227)
Markup	−2.647***	−3.023***	−3.036***	−3.218***	−1.815***	−1.660***	−1.831***
	(0.221)	(0.244)	(0.319)	(0.384)	(0.271)	(0.341)	(0.402)
Trade	−0.030***	0.001	−0.015	−0.025	−0.010	−0.012*	−0.011
	(0.008)	(0.014)	(0.017)	(0.023)	(0.010)	(0.007)	(0.022)
Offshoring	0.003	−0.012	−0.023	−0.031	0.037**	0.026	0.055*
	(0.011)	(0.014)	(0.024)	(0.020)	(0.016)	(0.017)	(0.033)
l_{NR}	−0.053**	−0.049*	−0.081**	−0.016	−0.052	−0.183**	0.007
	(0.023)	(0.026)	(0.040)	(0.027)	(0.047)	(0.082)	(0.057)
UD	−0.092**	−0.134**	−0.097	−0.209**	−0.027	−0.071	0.049
	(0.037)	(0.054)	(0.072)	(0.093)	(0.063)	(0.054)	(0.105)
ECM	−0.649***	−0.705***	−0.724***	−0.720***	−0.562***	−0.621***	−0.572***
	(0.031)	(0.038)	(0.050)	(0.059)	(0.053)	(0.089)	(0.079)
RMSE	0.0276	0.0307	0.0313	0.0304	0.0141	0.0115	0.0149
Wald χ^2	1325.66	1441.21	835.43	788.84	419.87	3623.56	188.34
Obs	3,528	2,184	1,218	966	1,092	588	504
Groups	84	52	29	23	26	14	12

Notes: RMSE is the root mean squared error test (sigma); average long-run coefficients computed from the ECM results; standard errors (in parentheses) computed via the Delta method.

NPME: Non-Primary Market Economy; MAN: Manufacturing; MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; MSERV: Market services; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services. For variables acronyms see Appendix A.

***$P < 0.01$, **$P < 0.05$, *$P < 0.1$.

Source: Authors' elaborations of JIP database.

results are available on request. In Table 3 we present the baseline model (Non-Primary Market Economy—NPME—84 sectors) starting from a basic estimation that only includes technology and an aggregate measure of capital (column 1). In the following columns (2 to 7) we add step-by-step the other explanatory variables and show how the estimations evolve. In the simplest specification (column 1) the negative and significant coefficient of TFP shows that technological change is capital augmenting, a common finding in the literature (Bentotila and Saint-Paul 2003; O'Mahony *et al.*, 2019a, 2019b; Bassanini and Manfredi, 2012). Similarly, the negative sign of capital intensity identifies capital-labor substitution as a significant driver of the labor share. In column 2 we extend the basic model by distinguishing the effects of IT and non-IT capital intensity; results indicate that capital-labor substitution is driven by non-IT capital, while the coefficient for IT capital is positive, although not statistically significant. Also, the size of the TFP coefficient declines remarkably, possibly due to the fact that the specification of different types of capital better captures embodied technological change. The inclusion of the Mark-up indicator in the model produces interesting consequences on the coefficients of the technological and capital intensity variables. Consistent with ex ante expectations and existing empirical evidence (Barkai, 2019; Azmat *et al.*, 2012; Autor *et al.,* 2017a, 2017b; De Loecker and Eeckhout, 2018; Fukao *et al.*, 2019) we find that higher levels of market power decrease the labor share; we will elaborate more on this outcome later, as it is one of the main findings of our analysis. It is for the moment worth noting that the inclusion of Mark-up renders the coefficient of TFP insignificant. One possibility is that the factors behind the market power and profitability of firms capture dimensions (such as allocative efficiency, organizational innovations and capabilities, etc.) that would otherwise converge into the coefficient of the TFP. The inclusion of the Mark-up variable also renders the coefficient of IT capital intensity significant; this might be due to fact that, due to the inclusion of the new variable, the model is better specified (as also indicated by the sharp drop of the RMSE test) and this allows the effects of the other variables to emerge more clearly. However, the significance of IT capital is not always robust to the inclusion of other variables (columns 4 to 7), hence caution is needed to draw conclusions in favor of complementarity of this type of capital with labor. Our results on capital/labor substitutability are in line with those of Bassanini and Manfredi (2012), who found a negative coefficient for non-IT capital and a weak positive effect of IT-capital; they are instead not consistent with the findings by O'Mahony *et al.* (2019a and 2019b) (negative significant coefficient for ICT-capital intensity only and insignificant effect for non-ICT capital). Overall, also in view of the difficulties with the estimation of such relationships of complementarity/substitutability (see Karabarbounis and Neiman, 2014; Oberfield and Raval, 2014), it is apparent that existing evidence is far from being conclusive and further investigation and effort should be a priority in future research agenda.

The inclusion in the model of the controls for globalization (columns 4 and 5) indicates, in line with the majority of empirical literature (e.g. Elsby *et al.*, 2013; Guerriero and Sen, 2012; Bassanini and Manfredi, 2012; Dao *et al.*, 2017), that higher exposure to international competition measured by trade openness is detrimental for labor. However, offshoring is not found to play any significant negative effect on the labor share, as found in other macro-level studies (see, e.g. Jaumotte and Tytell, 2007; Bassanini and Manfredi, 2012; Lian, 2019).

The extension of the model to labor market variables (share of non-regular labor and union density) offers addition insights. As expected, increasing importance of non-regular work negatively impacts the portion of value added accruing to labor; increasing union density produces a similar effect. These outcomes will be more extensively discussed later, also in view of their heterogeneity across macro-sectors. However, it is important to underline that they add a relevant piece of knowledge to the few empirical studies that attempted to quantify the impact of labor market institutions on the labor share, which produced mixed results. Checchi and Garcia-Penalosa (2008) explored the role of an aggregate level of employment protection legislation (EPL) on a panel of 16 OECD countries over the period 1960–2000 and found a negative effect on the labor share. However, the result is not robust to the inclusion of country dummies. Guerriero and Sen (2012) provide a similar, although not robust, outcome. O'Mahony *et al.* (2019a) report insignificant effects of the same aggregate indicator. More closely related to our research, Deakin *et al.* (2014) analyse the influence of an ample set of policies regulating non-standard employment contracts on LS. They find that stronger protection has a positive effect on LS, but limited to the short run. Ciminelli *et al.* (2018), for 26 advanced economies over the period 1970–2015, report a statistically significant, economically large and robust negative effect of regular work deregulation on the labor share. Damiani *et al.* (2018) show that, for a sample of 9 EU countries (12 market services), legislative innovations favoring the extensive use of temporary contracts negatively affect the labor share. As for union density our results are substantially new, as the majority of the empirical literature found no significant effects of unionization on the labor share (e.g. Checchi and Garcia-Penalosa, 2008; Elsby *et al.*, 2013) or, in some specifications, a positive impact (Damiani *et al.,* 2018). As we discuss in the following sections, our evidence might be explained by the specific features and evolution of the Japanese labor market institutional structure.

Lastly, all specifications provide strong evidence of error correction, as the lagged S_L level variable is highly statistically significant. The size of the coefficient indicates a relatively high speed of adjustment to the long-run equilibrium, which is a common feature in estimates that allow for heterogeneity and between-group dependence (Imbs *et al.,* 2005).

6.2. *The Drivers of the Labor Share: Macro-sector Aggregates*

Table 4 reports the results of the estimation of our empirical model for the macro-industry aggregates. As for technological variables (the SK schedule), the evidence of a high substitutability between labor and non-IT capital, in both manufacturing and services, is clearly confirmed (columns 2 and 5). However, IT capital emerges as complementary to labor in medium–low tech segment of manufacturing (columns 3) and in low-knowledge-intensive services (column 6); the knowledge-intensive segment (KIS) drives the negative sign of the non-IT capital in services (column 7).

While the factors related to globalization seem to offer rather limited insight, the proxy for market power emerges as strongly and steadily significant. The negative sign and the magnitude of the coefficient clearly indicate that when firms are able to produce extra profits, rent-sharing patterns develop in a direction detrimental to work. This does not come as a surprise, given the labor market evolutions already described, which all acted against the bargaining position of labor. Our result is consistent with expectations based on the existing theoretical and empirical literature (Bentotila and Saint-Paul, 2003; Barkai, 2019; Autor *et al.*, 2017b) and provides new corroborating evidence. Unfortunately, due to the nature of our (sector) data, it is not possible to identify which transmission channels are at work. Hence, complementary research efforts are needed to identify the microeconomic mechanisms taking place within the firms, also in view of their possible heterogeneity along the avenue indicated by Autor *et al.* (2017a). In any case, the Mark-up indicator efficiently captures and controls for the economic cycle, highlighting how the counter-cyclical variations of the Mark-up cause pro-cyclical shifts in the labor share (see also Figures 1 and 6).

As regards the labor market variables, the negative effect of non-regular workers found for the whole market economy seems driven by the segment of low-knowledge-intensive services (see columns 5 and 6). This is likely due to the particularly large presence of non-regular workers in LKI services and the consequent effects on wages. Figure 7 shows how, in LKI services, over 30 percent of hours worked (and over 40 percent of workers) in the most recent years are on a non-regular

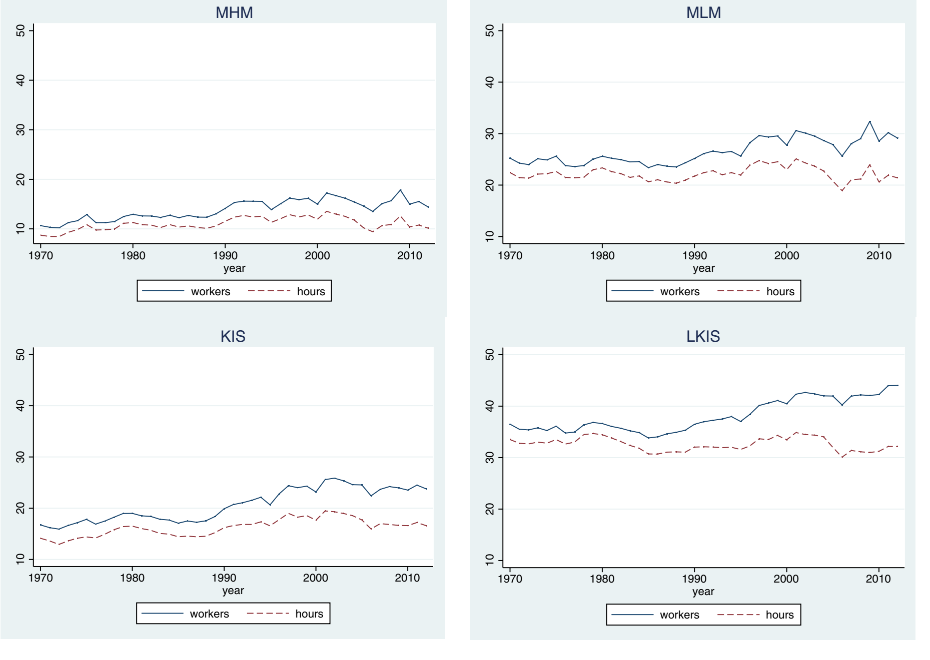

Figure 7. Shares of non-regular work in macro-sectors of manufacturing and services.
Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services
Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

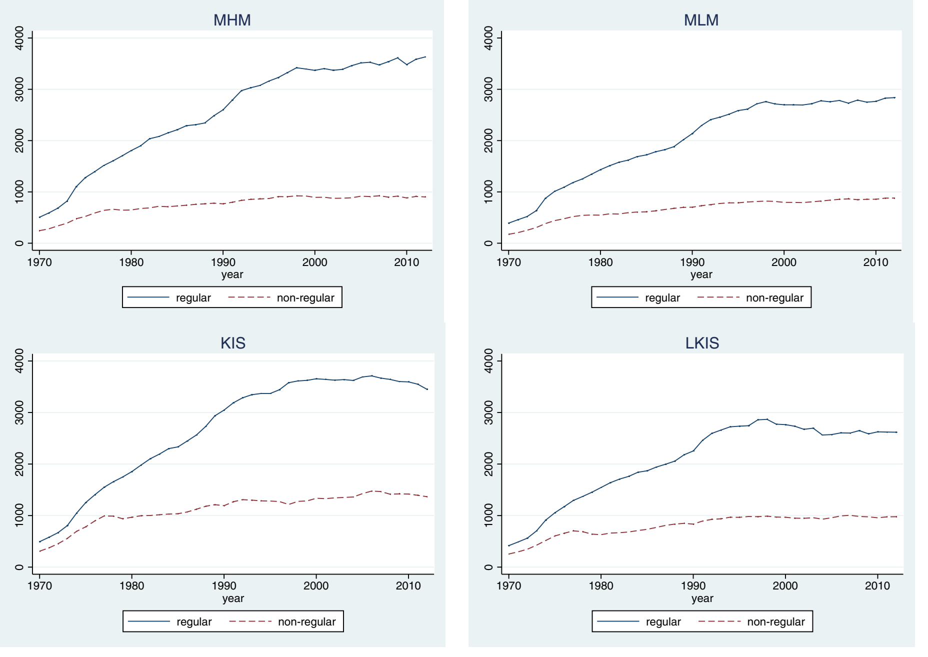

Figure 8. Regular/non-regular hourly wage gap, LKIS services (yen).

Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services

Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

basis; Figure 8 indicates that the wage gap between regular and non-regular workers (as in all other sectors) basically tripled over the period considered (see also OECD, 2017a).

In view of the employment share reached by LKI industries (see Figure 5), it is not surprising that what happens in these sectors affects the labor share of aggregate services and of the total economy. However, it is also possible that, besides this composition effect, the massive presence and availability of non-regular workers in such industries adversely affected the bargaining power of regular workers, if the two types of work have a high rate of substitutability. This is something we test by estimating our second empirical model (see Table 5), but it is already indicated descriptively by the fact that in those sectors in which non-regular work is more intensively used (LKI services and ML manufacturing) the wage rates of regular workers experienced a significantly weaker growth compared to sectors with a lower presence of non-regular workers (see Figure 8). This is probably related to a significant extent to changes on the labor market supply side, namely the massive entrance of women into the labor force, which has been markedly concentrated in LKI services (see Figure 9).

The fact that the strength of unions is detrimental to the labor share is likely to be explained, as already mentioned, by the evolution of labor market settings in Japan in the past decades. Among the features taken as examples of the peculiarity

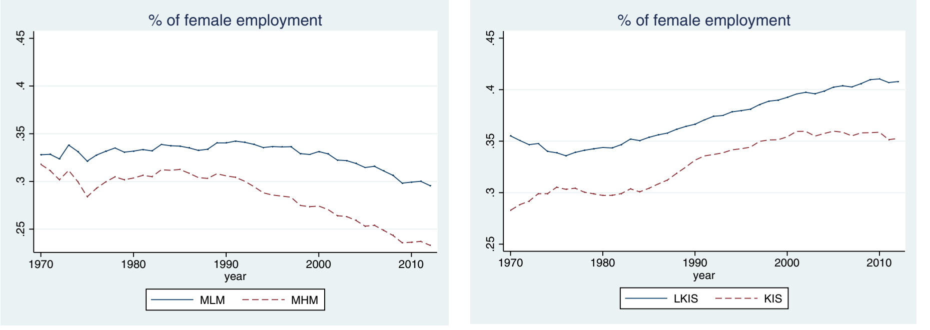

Figure 9. Employment share by gender (hours worked) in macro-sectors of manufacturing and services.

Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services

Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

of the Japanese employment system there are the strong decentralization of the role of unions at the company level and unions' attitudes based on cooperation with the management rather than conflict and antagonism (Fujimura, 2012). Enterprise unions in Japan have primarily been organized around regular employees and the increase in the number of non-regular workers over time has significantly reduced the coverage of the company workforce in negotiations with the management. Despite being now allowed to join some unions and a growing unionization rate, the interests of part-time and contract workers are still largely under-represented (according to the 2010 Basic Survey of Labour Unions they accounted for about 7 percent of total union members in 2009). The negative relationship between union density and labor share might hence be the result of the asymmetric action of unions which, where the technology allows, induces the substitution of regular jobs with less rigid and cheaper labor or with some type of capital. This would be consistent with the explanation provided by Bentotila and Saint-Paul (2003) regarding bargaining models centered on wage levels, which is the case of the *Shunto* system in Japan.[11] This bundle of asymmetric effects generated by the evolution of the bargaining model and by the action of unions could have contributed to shaping non-regular wage and employment levels and, ultimately, the dynamics of the labor share in the direction described by our results.

So far we have discussed which factors emerge as (statistically) significant drivers of the Japanese labor share in the long run; the estimated coefficients are all elasticities, therefore their sizes are directly comparable. A complementary

[11]In the *Shunto* system the annual wage negotiations between enterprise unions and employers take place in spring and involve two key parameters, wage revision and bonuses (see Komiya and Yasui, 1984). Compared to decades ago, the potential of the *Shunto* to revise base wages upwards has declined remarkably (see OECD, 2017b) due to adverse economic conditions driving unions to focus their attention on protecting the existing pay structures and their members' jobs. At the same time, the small room left for wage level negotiations has increasingly taken the form of bonus bargaining, which are used to remunerate non-regular workers to a much more limited extent (Kato, 2016).

interesting question is, however, to what extent each driver actually explains the change in the labor share in the period covered. This depends not only on the size of the coefficient, but also on the extent and direction of the change of the associated variable over the period considered. To quantify the role of each driver in explaining the labor share we follow a simple computational approach used, for example, by O'Mahony *et al.* (2019b). We multiply the estimated coefficient, which measures the per cent change in the labor share associated each 1 percent increase in the associated variable, by the cumulated percentage change of the relevant variable over the period. Panel (a) of Figure 10 summarizes graphically this information for the outcomes reported in Table 4 (when statistically insignificant, the coefficients were set to zero). Due to the large sizes of both the coefficient and the change of the variable over the period 1970–2012, the Mark-up emerges as the main driver of the labor share. However, while the sign of the coefficient is negative for all sector aggregation, the impact on the labor share is positive for manufacturing (where the mark-up declined over time) but negative for services (where market concentration increased) (see Figure 6).[12] According to our estimations, another quantitatively important driver of the labor share over the period considered for MLM and LKIS is represented by increasing IT-capital intensity; however, as already emphasized, the weak significance of the estimated coefficients suggests caution in drawing conclusions. Union density, that has always a negative coefficient and declined in all sectors, is instead one of the factors that counteracted the decline of the labor share (when its impact is statistically significant). The quantitative effect of non-regular labor is quite limited, accounting for less than 1 percent of the decline of the labor share in LKIS, due to the size of its increase in the period considered (slightly less than 4 percent).

6.3. *The Drivers of the Regular Worker's Labor Share*

The results related to the drivers of the total labor share are largely confirmed if we look at the determinants of the labor share of regular workers (S_{RL}) (Table 5). This is not surprising given the close correlation existing between the two dependent variables. The crucial additional information emerging from the table is that the impact of non-regular work on the regular workers' labor share is due to (and driven by) what happens in low-skill/knowledge-intensive sectors. In other words, in ML manufacturing and LKI services substitutability between regular and non-regular workers is high and exceeding the unitary elasticity of substitution (measured by the coefficient estimated for non-regular labor intensity—l_{NR}—as shown in our theoretical specification in Section 3.1). Panel (b) of Figure 10 shows that the impact of this variable on the regular workers' labor share is quantitatively not negligible; the increase in the intensity of non-regular work (hours worked over value added) over the period considered amounts to over 16 percent which,

[12]As an example the Mark-up decreased in medium-low tech manufacturing (MLM) by 2.7 percent from 1970 to 2012. Other things being equal, this decline in mark-up would have increased the labor share by 8.7 percent since the estimated elasticity is −3.1 percent (see column 3 of Table 4). On the contrary, as the Mark-up increased by 7.7 percent in the low knowledge intensity sector (LKIS) and the coefficient (elasticity) amounts to −1.5 percent (see column 6 of Table 3), the Mark-up drove downwards the labor share in the period considered, *ceteris paribus*, by approximately 12 percent.

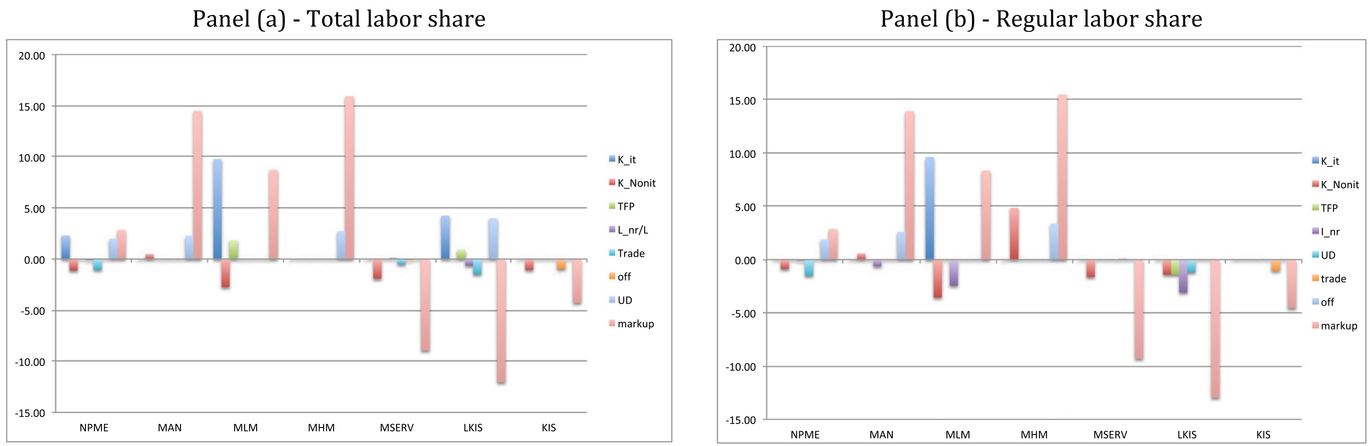

Figure 10. Quantitative impact of the drivers of the labor share (1970–2012) (%).

Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services

Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

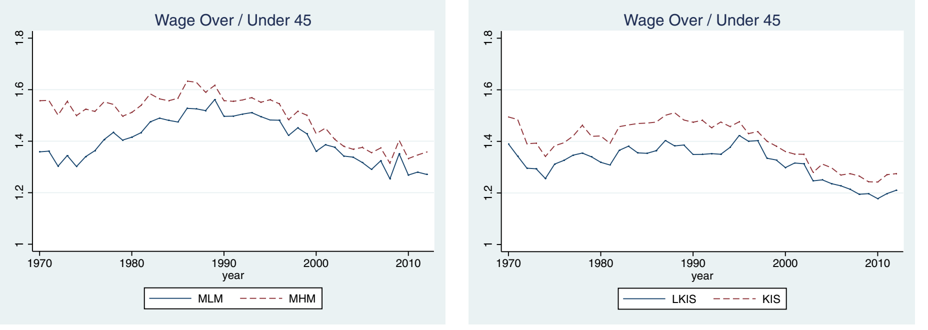

Figure 11. Relative hourly wage of over/under 45-year-old workers.

Notes: MLM: Medium- and medium-low-technology manufacturing; MHM: Medium- and medium-high-technology manufacturing; LKIS: Less-knowledge-intensive services; KIS: Knowledge-intensive services

Source: Authors' elaborations of JIP database. [Colour figure can be viewed at wileyonlinelibrary.com]

combined with an estimated coefficient of −0.18 (column 6 of Table 5), translates into a decline of the labor share of over 3 percent in the period considered, *ceteris paribus*.

This evidence is consistent with contributions emphasizing the importance of human capital and firm-specific knowledge accumulation to firms' performance (e.g. Kleinknecht *et al.*, 2014; Vergeer and Kleinknecht, 2014), which strongly depends on the productive/technological contexts in which they operate. As showed, for example, by Pieroni and Pompei (2008), in high-technology/knowledge-intensive industries, skills and competencies are mainly accumulated at the firm level and are a function of innovation activities. Firms benefit from the tenure of the workforce and both firms and workers have incentives to invest in firm-specific skills, because the employment relationship is expected to last for a long time (Fukao and Otaki, 1993; Wasmer, 2006). In such contexts, labor turnover tends to be lower than when knowledge-related factors play a less crucial role in shaping firms' competitive advantage. This is clearly the case in LKI services and ML manufacturing industries, in which not only the use of non-regular work is more intensive (Table 1 and Figure 7) but also seniority is less important. This can be indirectly grasped from Figure 11, in which we plot the relative hourly wage of workers aged over/under 45 years. In order to reduce the effects of confounding factors, the comparison is between average wages of male, tertiary-educated, regular workers. The diagrams summarize various pieces of information: first, starting from the 1990s, the level of the wage ratio, and hence the importance of seniority, started to decline (see for similar evidence Yamada and Kawaguchi, 2015). This can be explained by the gradual weakening of the so-called lifetime employment system, one of the main distinctive features of Japanese employment relations, based on an implicit firm–employer pact of mutual commitment and loyalty over the entire working life of the employee. In terms of wages, this went hand in hand with a deferred compensation system, strongly seniority-based (*nenkō joretsu*). Despite the real extent of the lifetime employment system being debated (Ono, 2010), there is agreement on the fact that its importance for the Japanese economy started to decline during the 1990s in the context of the prolonged economic recession. The downward trends observed in Figure 11 reflect this decline, which materialized as a reduction in the wage gap between older and younger workers, likely driven by a decrease in seniority and tenured positions. However, what really matters here is that within manufacturing and services, low-knowledge/technology-intensive segments highlight relatively lower levels of the gap, corroborating the idea that in such productive contexts the accumulation of specific knowledge through seniority is less crucial.

7. Discussion and Conclusions

In this paper we investigate the long-term drivers of the share of output accruing to labor in Japan. We contribute to this strand of literature by extending the SK schedule model proposed by Bentotila and Saint-Paul (2003) to multiple inputs, namely different types of capital (IT and non-IT) and labor (regular and non-regular work). On the empirical side, taking advantage of the JIP database, our contribution lies in providing a detailed sector-level analysis of the period 1970–2012, in accounting for the role of heterogeneity of production factors, and in rendering explicit the role of labor market features and of market power. Our error correction model (ECM) allows testing the existence of a long-run relationship and the long-term effects of the potential drivers of the labor share, after having accounted for the heterogeneity of estimated parameters across panels (sectors) and possible correlation in their disturbances (cross-sectional dependence).

Generally speaking, our results suggest that distinguishing different forms of capital is a rewarding choice, since we find that non-IT capital intensity decreases the labor share across all sectors, whereas IT capital emerge as complementary to labor in some industry aggregates. Our outcomes indicate that increasing market power (as measured by the industry-level mark-up) compresses the labor share. Back-of-the-envelope computations suggest that this is the main explanatory variable of the dynamics of the Japanese labor share in the period considered. This evidence deserves attention in follows up of our research. In particular, effort should be devoted to uncover which factors lie behind this effect. In a recent paper Karabarbounis and Neiman (2018) identify three possible explanations of the quantitative relevant portion of valued added share that remains unexplained after having allocated labor and capital remunerations (*factorless income*): (i) economic profits, (ii) unmeasured capital and (iii) deviations of the rental rate of capital from the benchmark rate. Our evidence is in particular compatible with the first two explanations. The existence of market power is directly related to economic profits; however, high levels of mark-up (and profits) might also stem from the existence of intangible capital assets (R&D, patents, copyrights, trademarks, economic competencies, etc.) which shape market power but are difficult to be measured (Corrado *et al.,* 2005 and 2009). Some authors have tried to investigate the role of these types of capital in shaping the labor share: Koh *et al.* (2016) report that intellectual property products (IPP) capital accounts for a large portion of the secular decline in the U.S. labor share; O'Mahony *et al.* (2019b) consider, in their cross-country macro analysis, a broader measure of intangibles (computerized information, innovative property and economic competencies) for the period period 1995–2007. They find that intangible investments related to innovation increase the labor share, while those related to the organization of firms contribute to its decline. At microeconomic level, Perugini *et al.* (2017) find that intangibles raise the income share accruing to workers; Fukao *et al.* (2019) show that expenditures for some types of intangibles (R&D and advertisement) are positively related to the labor share of Japanese manufacturing firms. These types of capital were not considered in our analysis, as JIP data on intangible capital are available only for the second part of our time-span (from 1985 onwards) and our approach was intended to capture long-run relations. Their inclusion in the model is one avenue for future research.

As for labor market settings, higher union density decreases the labor share; non-regular work has a detrimental effect on the labor share for whole market economy, but its role is quantitatively limited. However, when we look at the labor share accruing to regular workers, its role increases significantly. This is due the high substitutability of non-regular with regular labor, especially in low-knowledge intensive services. This is the sector aggregate to be regarded as the main responsible of the decline of the labor share over the period considered. This part of the Japanese economy has been increasing its importance over time, accounting in most recent years for over half of the total hours worked in the country. This is also the labor market segment with the highest intensity of non-regular (and female) employment, which in Japan identifies the secondary pool of the labor market, characterized by a significant wage gap with respect to regular workers and little or no protection. Due to the intrinsic features of such industries, the accumulation of knowledge is relatively less important and regular and non-regular labor are highly substitutable, with consequent effects on equilibrium wages. Low knowledge-intensity services also represent the part of the economy in which the market power of firms increased, while it decreased in manufacturing and stayed virtually the same in the remaining market services. This is partly due to the non-tradable nature of the output produced, but also to the process of concentration that has occurred in the last decades, when large firms in the trade sectors replaced little family business (mom and pop stores), gaining in market power and in bargaining power vis-à-vis labor. This is corroborated by the evidence proposed by our data, particularly the changes in the composition of non-regular labor: similar to the conclusions reached by Kambayashi and Kato (2013), our data shows that the decrease in self-employment and family work was offset by the growth of contract/part-time employment. In LKI services the share of non-regular hours worked remained substantially stable over time at around 33 percent (see Figure 7); however, while in 1970 part-time employment accounted for 3.6 percent of total hours worked and self/family employment for 29.9 percent, in 2012 their shares were 21.2 percent and 10.9 percent, respectively. To sum up, various structural and economic evolutions contributed to the weakening of the position of an increasing number of workers employed in the low-knowledge-intensity service. Such factors contributed to reducing the share of output accruing to labor, with likely negative repercussions for sensitive aspects of the Japanese economy, such as income inequality and aggregate demand.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix A: List of acronyms and abbreviations
Appendix B: IT/non-IT capital cost and IT/non-IT intensive production processes
Appendix C: Estimation of mixed income in the JIP database