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Determinants of the Labor Share

Evidence from a Panel of Firms

ABSTRACT: *This paper analyzes the sources of labor share variations and the general downward trend of the labor share observed recently in most European economies. Using a unique quarterly firm-level panel data set from the Polish business sector for the period 1995–2008, the author quantifies the impacts on the observed variation in labor shares of (1) firms' "demographics," including age as well as entry and exit behavior; (2) selected labor market characteristics, such as newly filled vacancies, labor market tightness, and human capital measures; (3) firm- and sector-level measures of export intensity, competition, and ownership structure; and (4) shifts in the sectoral makeup of gross domestic product. The potential cross-effects among these variables are also tested. The author concludes that while sector-specific factors, changes in the ownership structure, and the accumulation of human capital explain a large fraction of the observed downward trend in the labor share, labor market characteristics, market structures, and firm demographics are robust correlates of labor share changes at high frequency.*

Since 1995, when reliable data on gross domestic product (GDP) and its components became first available, it has been observed in Poland that labor productivity

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rises generally faster than average wages, thus producing a downward trend in the labor income share (Growiec 2009; Kolasa 2008). The fall of the labor share is also subject to cyclical fluctuations, and there have been a few short-lived reversals of the trend, but the finding is nevertheless striking, given the fact that throughout the period, Polish labor shares were already one of the lowest among European countries back in 1995 (Organization for Economic Cooperation and Development [OECD] 2009).

This finding for Poland parallels similar downfalls in the labor share observed in developed countries—in particular in most EU countries (Poland joined the European Union in 2004) though not so much in the United States—which have been recently analyzed and explained by diverse means (Arpaia et al. 2009; Bentolila and Saint-Paul 2003; Bernanke and Gürkaynak 2001; Genre et al. 2009; OECD 2009; Timmer et al. 2003). It is, however, not at all consistent with previous, essentially trendless variations of the labor share in earlier postwar decades (Bernanke and Gürkaynak 2001; Gollin 2002); nor does it accord with the usual macroeconomic paradigm, based on Cobb–Douglas production functions coupled with isoelastic demand curves, which leads to constant monopolistic markups over marginal costs.

Since under Cobb–Douglas technology and constant markups there is no room for trending labor shares,[1] the literature tried to explain this phenomenon as departures from that convenient benchmark. In that respect, both Arpaia et al. (2009) and Bentolila and Saint-Paul (2003) explored departures from Cobb–Douglas technology. Arpaia et al. (2009) proposed to use a nested constant elasticity of substitution (CES) specification with physical capital as well as skilled and unskilled labor, offering a closed-form solution for the labor share as a function of factor stocks and elasticity parameters. Bentolila and Saint-Paul (2003) presented a more general proposition that linked the labor share to the capital–output ratio.

A different line of reasoning emphasizes that if the production function is not Cobb–Douglas, then the labor share may shift if there is capital-augmenting (at least, not purely labor-augmenting) technical change (Bentolila and Saint-Paul 2003; Jones 2005), which is especially vital in the case of investment-specific technical change (e.g., Gordon 1990; Whelan 2003). Empirical evidence suggests that there might be an important link between these phenomena, as the recent drop in the labor share in Europe is strongly correlated with the increase in the GDP share of high-tech, export-oriented sectors as well as sectors that use information and communications technologies (ICT) as general purpose technology (Timmer et al. 2003).

A complementary approach has been taken by de Serres et al. (2002), Genre et al. (2009), Kyyrä and Maliranta (2008), as well as OECD (2009), who applied a shift-share analysis, decomposing the total shift in the labor share into components attributable to labor share shifts within sectors of the economy and the effects of intersectoral reallocation. Indeed, the aggregate perspective might hide important micro-level changes, especially if different sectors of the economy have different rates of technical change and/or different production functions.

Yet another hypothesis relates the shifts in labor shares to changes in labor market characteristics such as the relative bargaining power of employers and employees (Arpaia et al. 2009), labor market tightness (the number of unemployed per vacancy), and new hires per one unemployed person (Brigden and Thomas 2003). The crucial mechanism here is that if wages are not set competitively, or at least with a constant margin over firms' marginal costs, but instead in bargaining processes within labor markets subject to search-matching frictions, variables related to the current state of the labor market might have substantial explanatory power, especially when shorter term movements are concerned. Furthermore, lasting changes in employment policies might also yield lasting shifts in the labor share.

Moreover, there might also be firm-specific idiosyncrasies on top of the aforementioned mechanisms. To capture these, one could track the dependence of labor shares on firm size, age, and—to capture firm turnover—whether the firm is a start-up or a quitter (see also Kyyrä and Maliranta 2008). Firm-level data do not suggest that start-up firms have significantly higher or lower labor shares on average, but they do indicate that the labor share decreases (slowly) with firm age, even if one controls for firm size (which, conditional on survival, generally increases over time, and the labor share increases with firm size). Nevertheless, if being a start-up goes together with a lower labor share and being a quitter goes together with a higher labor share, then at the aggregate level, these micro-level movements should impose downward trends in the labor share in periods of increased firm turnover, and upward trends at less turbulent times. Hence, firm demographics should provide a (partial) explanation for the cyclical movement of the labor share, whereas amplified technical change might lower the labor share not only because part of it tends to increase capital, but also because it strengthens firm competition and "creative destruction."

In Poland, there may also be different effects on top of the above generic findings, because Poland is a transition economy undergoing restructuring, transformation, changes in ownership structure, and real convergence with the European Union. In the period since 1995, for which we have reliable data, the Polish economy has also benefited largely from international technology transfer (Kolasa 2008), partially through foreign direct investment (Olszewski 2009).

Given this background, the objective of the current paper is to quantify the importance of all aforementioned mechanisms in shaping the labor income share. The paper will take advantage of a unique quarterly panel data set concerning individual companies in Poland for the period 1995–2008 and pursue an empirical analysis of four competing driving forces behind the observed labor share movements: (1) firms' "demographics," including age as well as entry and exit behavior—interacting with investment-specific technical change; (2) selected labor market characteristics, such as newly filled vacancies, labor market tightness, and human capital measures; (3) firm- and sector-level measures of export intensity, competition, and ownership structure; and (4) shifts in the sectoral make-up of Polish GDP, as there are inherent intersectoral differences in labor shares. The author also checks what happens if these mechanisms are included jointly, as there might

be some interdependence between them (e.g., there should be more firm turnover in more competitive sectors, etc.).

Dynamics of the Labor Share

In the period 1995–2008, average wages in Poland were rising much more slowly than labor productivity (i.e., value added per worker),[2] parallel to similar developments in numerous other developed and transition countries, in particular in the European Union (OECD 2009; Timmer et al. 2003). The tendency was however subject to additional fluctuations (see Figure 1). In Poland, the largest disparity between the two dynamics was observed from 2001 to 2004. But in the periods 1995–96 and 2007–8, reversals in this tendency were observed. Throughout 1995–2008, labor productivity in the analyzed group of companies increased by 309 percent and the mean wage increased by 256 percent. Total employment in the analyzed group of companies first fell, from about 4.3 million workers in 1995 to about 3.4 million in 2002, and then rose again, reaching about 4.1 million employed in 2008.

Consequently, the labor share (i.e., the ratio of gross remuneration of employees, including the tax wedge on labor, to total value added) fell considerably. Figure 2 illustrates this phenomenon with the distinction of industry, services, and the tradables and nontradables sectors. It turns out that the shifts in the labor share aligned with the underlying business cycle and were recorded by all sectors of the economy almost symmetrically. All the sectors felt the drop in labor shares most strongly in 2001–4.

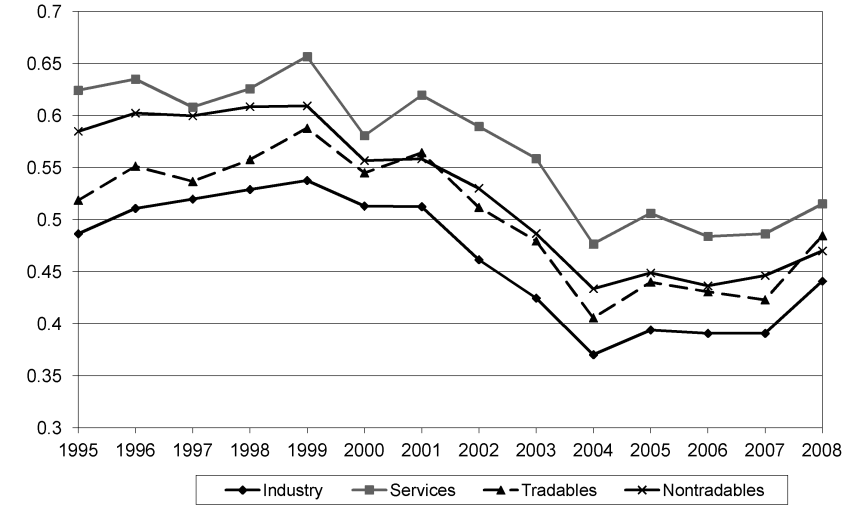
A study by Growiec (2009), closely related to the current one, proceeded to disentangle intrasectoral shifts in the labor share from shifts in the aggregate labor share attributable to intersectoral reallocation. The unit of observation in that study was a two-digit NACE (Nomenclature des Activités Économiques dans la Communauté Européenne) sector. Perhaps the most striking result of that study is that while 44 percent of the total change in labor share throughout the period can be explained by intersectoral components, almost none of its variance can. Reallocation effects—from flows of capital and labor across sectors to the effects of selective restructuring, tilting wage distributions across sectors, and differential, sector-specific productivity growth rates—are much less volatile and hardly correlated with overall labor share shifts at all; they however preserve the same direction of impact, that is, they, too, shift labor shares downward. Some illustrative results of that study are quoted in Table 1.

Despite the intuitive appeal of the results presented in Table 1, they in fact conceal substantial heterogeneity across certain sections of the Polish economy. This is clearly visible in Tables 2 and 3, which provide the results of analogous studies conducted on subsets of sectors. Table 2 presents the decomposition, into the three aforementioned components, of shifts in the labor share within groups of sectors in the period 1995–2008, whereas Table 3 presents the breakdown of their variance. The rows of these two tables denote, respectively:

Figure 1. **Labor Productivity, Wages, and Employment in the Business Sector in Poland**

Source: Firm-level F-01 data (GUS).

Figure 2. **Evolution of the Labor Share in Selected Sectors of the Polish Economy**



Source: Firm-level F-01 data (GUS).

Table 1. **Contributions of Intra- and Intersectoral Shifts to the Total 1995–2008 Drop in the Labor Share in Poland**

	1995–2008	In percent	Variance	In percent
Intrasectoral shifts	–0.0393	55.7470	0.0010459	96.09
Asymmetric wage changes	–0.0199	28.2351	0.0000061	–0.83
Changes in GDP share	–0.0113	16.0179	0.0000479	4.74
Total	–0.0705	100	0.0010874	100

Source: Growiec (2009).

1. $\Delta(w_i L_i / Y_i)$—intrasectoral shifts in the labor share;
2. $\Delta(w_i / w)$—asymmetric wage changes across sectors;
3. $\Delta(Y_i / Y)$—changes in sectoral shares of total value added.

What is particularly interesting in Table 2 is that for subsets of sectors, the components attributable to changes in the sectoral make-up of GDP are large in magnitude, but strongly asymmetric between tradables and nontradables and between manufacturing and services. These components, capturing the effects of reallocation and differential growth rates, exert a strong pressure toward a decrease in labor shares in tradables, mining and manufacturing, but they push toward an increase in labor shares in nontradables and services. The impact of these effects on the labor share in the total economy is small only as a result of their opposing directions of influence across large sections of the economy.

This finding stretches further into the analysis of variance. In Table 3, we see that, as opposed to the total effects presented in Table 1, intersectoral reallocation effects do play an important role in explaining the variance of labor shares in selected sections of the economy. Again, it is especially so in the case of the third component (changes in sectoral shares of total value added).

In conclusion, intersectoral components provide almost no insight into short-run fluctuations of the aggregate labor income share and only a partial explanation to the observed downward trend over the longer run. Disaggregating this result provides some new insights: some intersectoral effects might be large in magnitude but offset themselves by having opposite impacts on selected sections of the economy. The results of such an exercise are nevertheless still unsatisfactory as a final explanation of the dynamics of the labor share. This is why this author thinks it is crucial to analyze the data further and test alternative theories that could explain the observed developments in the labor share at middle-to-high frequencies. A further reason is that sector-level data, analyzed by Growiec (2009), might conceal certain regularities that might turn out to be visible when firm-level data are analyzed.

Table 2. **Decomposing Total Shifts in the Labor Share in 1995–2008 into Three Components: Grouping Sectors**

	Export oriented		Nonexport oriented		Tradables		Nontradables	
	Sum	In percent	Sum	In percent	Sum	In percent	Sum	In percent
$\Delta(w_i L_i/Y_i)$	0.027	–18.72	–0.059	125.66	0.010	–7.68	–0.095	—
$\Delta(w_i/w)$	0.003	–1.94	–0.027	57.10	–0.006	4.49	–0.034	—
$\Delta(Y_i/Y)$	–0.175	120.66	0.039	–82.76	–0.138	103.19	0.133	—
Total	–0.145	100	–0.047	100	–0.134	100	0.005	100

	Mining sector		Manufacturing		Services	
	Sum	In percent	Sum	In percent	Sum	In percent
$\Delta(w_i L_i/Y_i)$	–0.079	18.17	–0.013	8.94	–0.080	–83.67
$\Delta(w_i/w)$	0.027	–6.20	–0.020	13.77	–0.026	–26.99
$\Delta(Y_i/Y)$	–0.381	88.02	–0.112	77.29	0.200	210.66
Total	–0.433	100	–0.145	100	0.095	100

Source: Growiec (2009).

Notes: In the case of nontradables, the total change in the labor share was close to zero, and thus computing percentage contributions made no sense. In the case of services, the percentage contributions of negative components are negative even though they worked along the general trend of labor share decrease. Export-oriented sectors are defined as sectors with more than 20 percent of revenues from exports; sectors producing tradables are defined as sectors with more than 5 percent of revenues from exports.

Table 3. **Variance Decomposition of Labor Share Shifts: Grouping Sectors**

	Export oriented		Nonexport oriented		Tradables		Nontradables	
	σ^2	In percent	σ^2	In percent	σ^2	In percent	σ^2	In percent
$\Delta(w_i L_i / Y_i)$	0.0030	146.74	0.0008	73.14	0.0016	109.88	0.0007	58.70
$\Delta(w_i / w)$	0.0001	0.88	0.0000	–1.70	0.0000	–5.42	0.0000	4.04
$\Delta(Y_i / Y)$	0.0014	–17.25	0.0002	26.61	0.0004	1.94	0.0004	35.84
$\sigma^2(X)$	0.0009	100	0.0013	100	0.0011	100	0.0014	100

	Mining sector		Manufacturing		Services	
	σ^2	In percent	σ^2	In percent	σ^2	In percent
$\Delta(w_i L_i / Y_i)$	0.0025	35.88	0.0009	78.87	0.0014	57.17
$\Delta(w_i / w)$	0.0003	1.49	0.0000	1.06	0.0001	–12.52
$\Delta(Y_i / Y)$	0.0035	79.79	0.0003	20.79	0.0016	57.82
$\sigma^2(X)$	0.0020	100	0.0011	100	0.0023	100

Source: Growiec (2009).

Notes: In the row $\sigma^2(X)$, the total variance of labor share shifts in each particular sector is presented. Percentage contributions include covariances between the components. The values do not add up to 100 percent because this is just a fragmentary view of a decomposition exercise conducted for the whole economy. Export-oriented sectors are defined as sectors with more than 20 percent of revenues from exports; sectors producing tradables are defined as sectors with more than 5 percent of revenues from exports. See Growiec (2009) for details.

Data

Data Sources

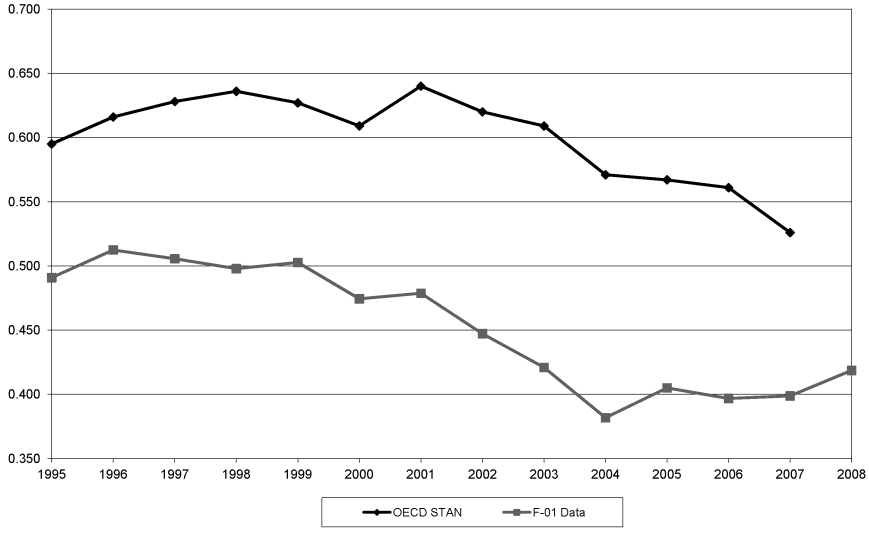
The data used herein are firm-level data from financial reports of companies in Poland, collected by the Polish Central Statistical Office (*Główny Urząd Statystyczny,* GUS), the financial reports of companies in Poland (so-called F-01 forms). These reports are handed in by all firms employing at least fifty persons, with the exception of companies in the agricultural sector (NACE 1–2),[3] firms in the financial intermediation sector (NACE 65), insurance and pension funds (NACE 66), firms providing auxiliary activities related to finance and insurance (NACE 67), households employing workers (NACE 95), and extra-territorial organizations (NACE 99). The sample covers the period 1995–2008, with quarterly frequency. We are not aware of any other data set that would have both quarterly frequency and full coverage of all the eligible individual firms in the economy. This underlies the uniqueness of this data set, which provides crucial insights into firm-level determinants of the labor share along the business cycle. The total number of observations is around 660,000; the sample consists of 35,270 individual firms.

It should be emphasized that because of data availability, several sectors of the economy are either excluded or underrepresented. This applies in particular to sectors dominated by companies having fewer than fifty employees, such as the services and nontradable goods sectors. However, restricting the sample to such firms helps avoid methodological problems related to the need to divide mixed incomes of the self-employed into remuneration of labor and capital. It cannot, however, mitigate the fact that a fraction of employee compensation might be hidden in the "subcontracting" (outside services) category, or in the outsourcing of labor, which is treated as remuneration of capital, if the subcontractor is, for example, self-employed. Unfortunately, one cannot judge the extent to which this might bias the results.

These effects, taken together, lead to a systematic underestimation of the labor share in the total economy (OECD 2009). In the case of Poland, as is visible in Figure 3, the labor share in the total economy, as reported in the STAN (Structural Analysis) database of the Organization for Economic Cooperation and Development (OECD), is on average 8.4 percentage points higher than the one following from micro-level company (F-01) data. Moreover, the labor share fell more sharply in the business sector, especially between 2001 and 2004. The OECD attributes the visible increase in the difference between the labor shares in the nonagricultural business sector to a continued reallocation of workers from industry to services and a marked increase in the agricultural labor income share (OECD 2009).

As far as auxiliary data sources are concerned, the data dealing with skill distributions within sectors of the economy have been obtained from the EU KLEMS database. There are three variables adding up to 100 percent: highly skilled, medium-skilled, and low-skilled labor compensation as a share in total labor compensation.

Figure 3. **Labor Income Share in the Whole Economy (OECD Data) and in the Business Sector** (F-01 data, outliers dropped)



Sources: F-01 (GUS) and OECD STAN data.

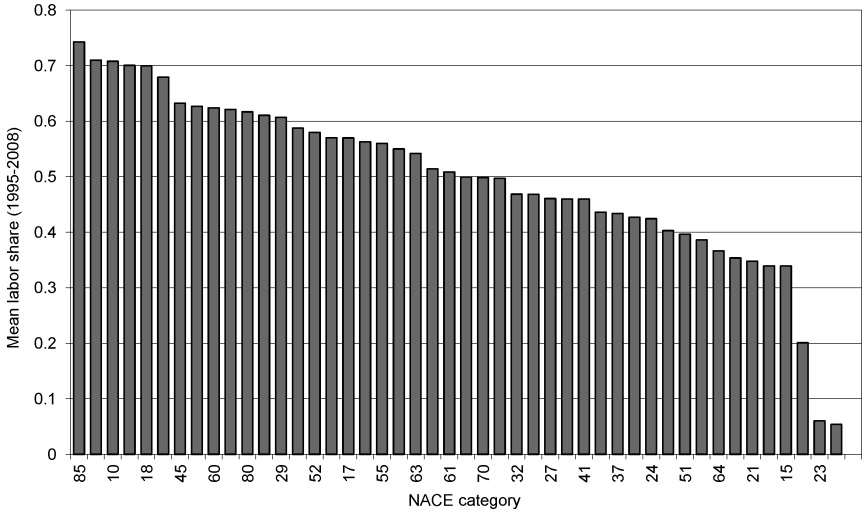
Time series on the number of vacancies, total unemployment, and jobs found, used to compute the measures of labor market tightness and hire ratio, come from Poland's Central Statistical Office (GUS).

Sector-Specific Differences

As we have seen in Figure 2, labor shares have declined throughout the sectors of the Polish economy in a rather uniform fashion. Consequently, the intersectoral dispersion of labor shares was pretty much preserved. However, their distribution (see Figure 4 and Table 4) has substantial variance and is skewed to the right. Sectoral average labor shares vary from as much as 70 percent to 74 percent in the cases of Health and Social Care (NACE 85), Science and R&D (NACE 73), Coal Mining (NACE 10), and Other Service Activities (NACE 93), to 5 percent to 6 percent in the cases of the Tobacco industry (NACE 16) and Coke and Oil Refining (NACE 23).

Hence, it seems that sector-specific effects alone can explain a large share of the cross-sectional variation in labor shares. Since they are fixed over time, however, they are useless for explaining the dynamics of the aggregate labor share, unless significant reallocation of resources between sectors is observed. Such reallocation has already been shown by Growiec (2009), however, to explain a relatively small

Figure 4. **Sector-Specific Average Labor Income Shares** (NACE Rev. 1.1)



Source: F-01 (GUS) data.

Note: The following sectors were dropped because of insufficient data: Oil and Gas Mining (NACE 11), Mining of Metal Ores (NACE 13), Air Transport (NACE 62), and Other Membership Organizations (NACE 91).

fraction of the total shift in labor share in Poland, and none of its short-run dynamics. Furthermore, the intersectoral variation in labor shares can often be explained by differences in more fundamental characteristics of the sectors, such as exposure to international trade, competitiveness, capital intensity, or ownership structure.[4]

Firm Demographics: Firm Age, Entry, and Exit

The firm-level data used in this paper are also a useful tool for disentangling macro-level reallocation and convergence effects from micro-level, firm demographics effects involving firm entry and exit. At face value, these effects do not seem strong in light of the fact that average (employment-weighted) labor shares in both entering and exiting firms have fallen slightly throughout the analyzed period (see Figure 5)—linear trend lines are basically flat and almost entirely overlapping—and that no significant difference between these two mean values could be seen throughout the period 1996–2008. Hence, one may expect no significant labor share effects from the side of firm demographics.

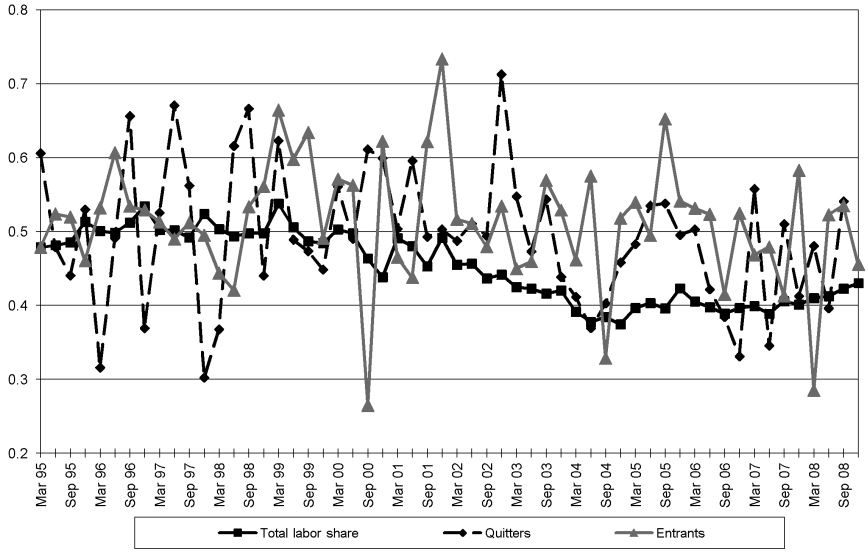
However, it is possible that there exist other factors that make firms enter or exit the sample,[5] such as market competitiveness, firm efficiency, export intensity, having inferior or obsolete technology (in the case of exiting firms), etc. In theory,

Table 4. **Descriptive Statistics of the Distribution of Average Labor Shares Across Sectors of the Polish Economy**

Statistic	Value
Unweighted average	0.497822
Median	0.503947
Standard deviation	0.152783
Kurtosis	1.45058
Skewness	–0.95943
Count	46

Source: Author's computations based on F-01 (GUS) data.

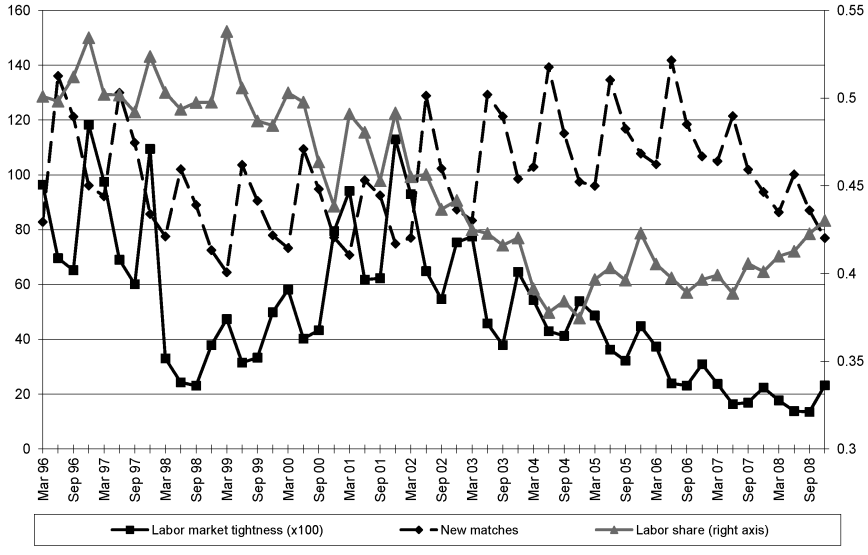
Figure 5. **Labor Income Share Among Entrants and Quitters** (F-01 Data)



Source: F-01 (GUS) data.

these factors might also be correlated with labor share. In such case, one would observe different labor share effects from firm demographics once these interfering mechanisms are controlled for. If nevertheless quitting firms have, conditional on these factors, higher labor shares than the entrants, then firm demographics should exert a robust impact on the labor share, lowering it in periods of high firm turnover, such as downturns and crises, and increasing it in periods of relative stability.

Figure 6. **Labor-Market Tightness, New Matches, and the Labor Market Share**



Source: GUS data.

Furthermore, a simple computation of conditional means shows that labor share decreases with firm age but increases with firm size. However, average size is positively correlated with age, and by construction of the data set, average age within our data set increases with time (the author has no means for controlling firm age prior to 1995, so in this exercise only those that entered the sample after 1995Q1 are included).

Labor Market Characteristics

A further group of potential determinants of the labor share at firm level relates to the overall labor market outlook of the economy. Within the business cycle, variables such as the unemployment rate, number of vacancies, and the number of new hires fluctuate a lot, and might be relevant for the determination of the short-run dynamics of firm-level labor shares. As we see in Figure 6, the years 2001–4, which have witnessed the strongest fall in the labor share throughout the economy, were preceded by a visible rise of labor market tightness (i.e., the number of unemployed people per one vacancy), and then accompanied by a consecutive fall in this variable and a rise in the hire ratio (the number of new hires per one unemployed person). Even though this might not be perfectly visible in Figure 6 to the naked eye, it shall be shown shortly that the interrelation between these three

variables is actually instantaneous, strong, and robust to controlling for a wide range of other variables.[6]

A simple rationale behind a hypothesized causal link between labor market characteristics and the labor share of GDP, partly consistent with this preliminary evidence, is that in periods of high labor market tightness—and thus low bargaining power of the workers—it is easier for firms to lower wages, or at least raise them less than proportionally to rising productivity. This causes the aggregate labor share to fall. In periods when the labor market is not tight and it is difficult for firms to replace workers, it is also more difficult for them to underpay them. Moreover, a low hire ratio suggests either high bargaining power of incumbent workers, usually going together with a high labor share, or a low level of general economic activity (e.g., a recession). Consequently, in the revival period the hire ratio should rise. Whether a rise in the hire ratio is followed by a fall in the labor share depends on the pace of underlying productivity growth.

Unfortunately, there are no firm-level, or even industry-level indicators of unemployment and vacancies. Hence, these variables can only be included in the analysis as aggregates, with no cross-sectional variation.

A different story could be told with respect to the human capital endowment of workers within different sectors of the economy. Other things being equal, a higher share of labor compensation going to highly or medium-skilled workers can be a factor leading to a higher labor share, since their remuneration is generally higher. On the other hand, since skills are usually complementary to more efficient, capital-intensive technologies, a higher share of skilled workers might signal technological superiority, which nowadays—in these times of fast progress in ICT technologies and robotics—usually goes together with a *lower* labor share. As we will see soon, our data confirm the second hypothesis.

Market Structures and Firm Ownership

Market structures can influence labor shares in multiple ways. First of all, there are important intersectoral differences with regard to market concentration (measured, e.g., by the Herfindahl–Hirschman index[7]), openness to international trade, ownership structure, received external donations (e.g., from the state) per unit of value added, and the sector-specific tax wedge on labor income. The time-invariant component of these differences is reflected in sector fixed effects. There is however a significant temporal dimension to these differences. During the period 1995–2008, Poland underwent restructuring, real convergence with the European Union, privatization, inflows of foreign direct investment (FDI), consecutive reductions in tariffs and quotas, and so forth, and increased participation in international trade. Some sectors participated in this change, whereas some remained almost unaffected. It is therefore important to include in the regressions variables capturing market structures at the sectoral level as important potential determinants of the labor share.

It should be expected that state-owned companies, often running relatively old vintages of technology, and also having relatively high levels of unionization and generous remuneration packages, should generally have higher labor shares of value added than privately owned companies do. This discrepancy should be even more visible in the case of foreign owned firms which, on average, operate better (which often means more capital intensive) technologies, are more often export oriented, operate in more competitive markets, and have stronger incentives to manage labor costs.

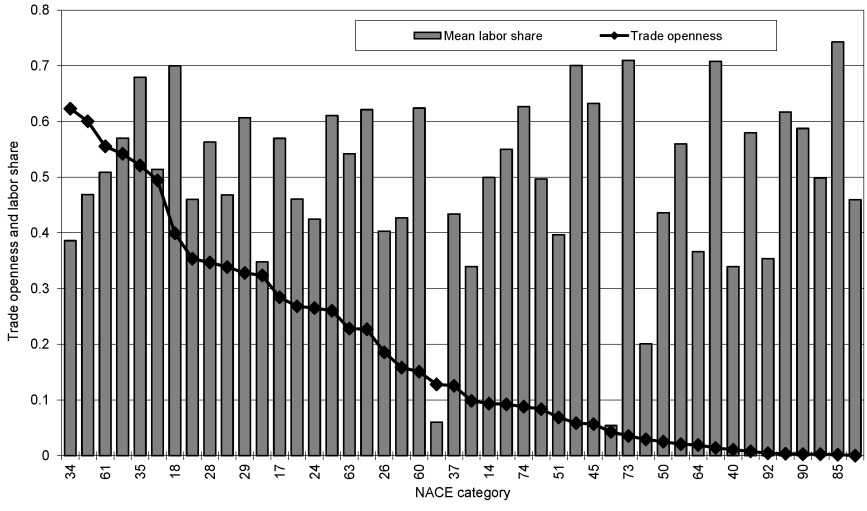
A higher tax wedge on labor income (measured as the ratio of firms' labor tax payments to gross remuneration of their employees) should, on the contrary, go together with a lower labor share because it provides an incentive to substitute workers with capital. It also lowers the bargaining position of workers vis à vis employers, for whom total costs of workers' employment seem very high relative to their productivity. Furthermore, given the transition and posttransition background in the Polish business sector, firms receiving more donations are likely to be those with markedly higher labor shares, and possibly suffering from shortages of up-to-date technology and decreasing demand. They are concentrated mostly in service sectors, and are characterized by particularly high tax wedges on labor.

As far as firms' trade openness (measured as a fraction of total revenues coming from exports) is concerned, it is generally believed that more export-oriented firms are also technologically superior, and operate mostly in capital-intensive manufacturing sectors. Hence, one should expect firms' openness to international trade to go together with lower labor shares. As our results indicate, however, this is not the case in Poland. This somewhat surprising finding can be explained, though, by looking at the sectoral structure of exports within the Polish economy. Figure 7 illustrates that in Poland, the labor share of value added and the export revenue share are hardly correlated at all. Their sector-level correlation coefficient is just 0.08, even though the most export-oriented sectors, Automobile Industry (NACE 34) and Production of Radio, TV, and Telecommunications Devices (NACE 32), have below-average labor shares.

Main Results

To quantify the impacts of all the aforementioned variables on firms' labor shares, three series of nested, hierarchical regressions were run. All these regressions, run to verify the competing hypotheses, were estimated with fixed effects. This choice of estimation method was dictated by the results of Hausman tests, according to which random effects estimators were inconsistent. Furthermore, since random effects turned out to be highly significant, pooled ordinary least squares (OLS) estimators are also inappropriate because of the correlation of firm-specific observables with the error term. Seasonal dummies were also included in all regressions to capture deterministic seasonal variation in salaries and (most importantly) value added.

Figure 7. **Trade Openness and the Labor Market Share Across Sectors** (NACE Rev. 1.1)



Source: F-01 (GUS) data.

Firm Demographics

This paper's first inquiry focused on the impact of firm demographics on the observed changes in the labor share. A series of hierarchic regressions was run to test the robustness of the impact on the labor share of the three principal variables: (1) firm age, (2) the entrant dummy, and (3) the quitter dummy. To have a reliable data set, the sample was limited to firms that entered the sample after 1995Q1, so that their age could be properly defined. This reduces the sample from about 660,000 to about 386,000 observations (from about 35,000 to about 25,000 firms), making the estimates less reliable than those based on the full sample. Proper statistical inference can still be made nevertheless.

Table 5 shows that firm age generally relates negatively to the labor share: older firms of the same size tend to have lower labor shares. As is shown in the Appendix, this result is not robust to the inclusion of time dummies, though. After controlling for pure time effects, firm age affects the labor share positively, not negatively. The addition of a control for firm size does not change either of the results.[8]

It is also found that, controlling for an array of observable characteristics, entrants tend to have less-than-average labor shares, and quitters tend to have more-than-average labor shares.[9] Hence, periods of higher firm turnover should be associated with lower labor shares, if other things are kept equal, in line with intuition. It is the entrants that are most likely to employ new, more capital-intensive technological

Table 5. **The Impact of Firm Age, Entry, and Exit on the Labor Share**

	1 Labor share	2 Labor share	3 Labor share	4 Labor share	5 Labor share	6 Labor share
Quarter 1	0.0347***	0.0348***	0.0348***	0.0348***	0.0329***	0.0306***
	(0.000715)	(0.000715)	(0.000715)	(0.000715)	(0.000704)	(0.000712)
Quarter 2	0.0181***	0.0181***	0.0181***	0.0181***	0.0160***	0.0473***
	(0.000690)	(0.000690)	(0.000690)	(0.000690)	(0.000677)	(0.001000)
Quarter 3	0.0108***	0.0108***	0.0108***	0.0108***	0.00850***	0.0255***
	(0.000682)	(0.000682)	(0.000682)	(0.000681)	(0.000668)	(0.000819)
Firm age	–0.000336***	–0.000334***	–0.000334***	–0.000268***	–0.000414***	5.29e-06
	(2.85e-05)	(2.85e-05)	(2.85e-05)	(2.88e-05)	(2.95e-05)	(3.65e-05)
Quitter	0.00433***	0.00436***	0.00437***	0.00446***	0.00684***	0.00150
	(0.00143)	(0.00143)	(0.00143)	(0.00143)	(0.00140)	(0.00142)
Entrant	–0.00632***	–0.00628***	–0.00626***	–0.00632***	–0.00444***	1.96e-06
	(0.00111)	(0.00111)	(0.00111)	(0.00111)	(0.00109)	(0.00117)
Firm size		3.83e-06***	3.85e-06***	3.84e-06***	3.65e-06***	4.10e-06***
		(2.13e-07)	(2.13e-07)	(2.14e-07)	(2.09e-07)	(2.33e-07)
Mining sector			0.0300**	0.0279*	0.0233	0.0115
			(0.0150)	(0.0150)	(0.0146)	(0.0146)
Manufacturing sector			0.000481	1.82e-05	–0.00301	–0.00343
			(0.00303)	(0.00303)	(0.00297)	(0.00300)
Herfindahl (fixed)			–0.0911***	–0.0975***	–0.133***	–0.0943***
			(0.0256)	(0.0256)	(0.0269)	(0.0271)
Trade openness (fixed, sector)			0.0127	0.0140	0.0137	–0.00935
			(0.0103)	(0.0103)	(0.0107)	(0.0108)
Treasury owned				0.0350***	0.0336***	0.0407***
				(0.00348)	(0.00340)	(0.00355)

(continues)

Table 5 *(Continued)*

	1 Labor share	2 Labor share	3 Labor share	4 Labor share	5 Labor share	6 Labor share
State owned				0.0309***	0.0288***	0.0289***
				(0.00341)	(0.00334)	(0.00338)
Municipality owned				0.0703***	0.0689***	0.0665***
				(0.00729)	(0.00712)	(0.00726)
Foreign owned				–0.0183***	–0.0192***	–0.0186***
				(0.00255)	(0.00250)	(0.00251)
Donations to value added				–0.00224***	0.0439***	0.0522***
				(0.000304)	(0.00417)	(0.00436)
Trade openness					0.000807	0.000914
					(0.000624)	(0.000625)
Trade openness (sector)					0.00453	0.0269***
					(0.00362)	(0.00365)
Labor wedge					–0.00248	–0.000382
					(0.00168)	(0.00169)
Herfindahl					0.0632***	0.0363***
					(0.0116)	(0.0119)
Tightness						0.0165***
						(0.00144)
Matches						–0.000910***
						(2.01e-05)
Constant	0.616***	0.615***	0.615***	0.612***	0.618***	0.682***
	(0.000650)	(0.000651)	(0.00198)	(0.00207)	(0.00207)	(0.00286)
Observations	386,847	386,847	386,847	386,847	385,591	378,562
R^2	0.007	0.008	0.008	0.009	0.010	0.016
Number of firms	24,998	24,998	24,998	24,998	24,920	24,440

Notes: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

vintages, and the quitters who often operate outdated technology. Thus, increased firm turnover should also imply more "creative destruction" and adoption of more capital-intensive production techniques. This fuels consecutive expansions but also amplifies business cycle fluctuations.

However, none of the aforementioned findings are robust to the inclusion of labor market characteristics (labor market tightness, new vacancy–employee matches) as control variables. Once these variables are included as well, the impact of firm demographics becomes insignificant. This result might be due to the cyclical features of firm demographics; indeed, firm turnover is higher in downturns and recessions, and so is labor market tightness, whereas new matches are strongly procyclical.

The signs of coefficients on control variables are in agreement with intuition and empirical evidence. Some of them will be discussed below.

Labor Market Characteristics

It has by now been confirmed that, if labor market characteristics are *not* controlled for, firm demographics seem to play an important role in the determination of firm-level labor share. Let us now pass to the discussion of the importance and robustness of the impacts of labor market characteristics themselves, that is, labor market tightness and newly filled vacancies.

Table 6 indicates that labor market tightness goes together with higher labor shares, and new matches on the labor market go together with lower labor shares. This is in line with the intuition suggesting that the labor share should be higher in periods when the labor market is tight and few new jobs are created: these periods are also the ones when value added is low and, because of wage rigidities and the high bargaining power of existing employees when firms face short-term problems, wages do not follow falling productivity (Blanchard and Katz 1997). Adding lagged values of labor market tightness and new matches does not overturn this result. The coefficient on labor market tightness lagged by one quarter is positive and significant, whereas the coefficient on new matches is negative and significant both in the first and the second lag. This corroborates the author's original findings, implying that the dynamics on the labor market should not interfere visibly with other results obtained here. Hence, this result should be viewed as a robust short-run positive correlation between the labor share, labor market tightness, and the difficulty in forming new employer–employee matches, which is valid irrespective of the choice of control variables, thus supporting the preliminary evidence presented in Figure 6.

In sum, even when controlling for a wide host of auxiliary variables, both labor market characteristics turn out to be highly important for the determination of the short-run labor share at the individual level. In periods when labor market tightness is high, so is the labor share; the number of new employer–employee matches is, however, negatively related to the labor share.

Table 6. **The Impact of Labor Market Tightness and Newly Filled Vacancies on the Labor Share**

	1 Labor share	2 Labor share	3 Labor share	4 Labor share	5 Labor share
Quarter 1	0.0242***	0.0244***	0.00945***	0.00317***	0.00304***
	(0.000530)	(0.000530)	(0.000787)	(0.000874)	(0.000874)
Quarter 2	0.0440***	0.0382***	0.0122***	–0.00190	–0.00201
	(0.000725)	(0.000817)	(0.00145)	(0.00165)	(0.00165)
Quarter 3	0.0251***	0.0211***	0.0174***	–0.00391**	–0.00408**
	(0.000602)	(0.000653)	(0.000738)	(0.00168)	(0.00168)
Tightness	0.0176***	0.00982***	0.0102***	0.00878***	0.00893***
	(0.000830)	(0.000974)	(0.00152)	(0.00162)	(0.00162)
Matches	–0.000915***	–0.000783***	–0.000451***	–0.000367***	–0.000370***
	(1.45e-05)	(1.68e-05)	(3.00e-05)	(3.45e-05)	(3.45e-05)
Medium skilled		–0.00226***	–0.00137***	–0.000798***	–0.000809***
		(0.000261)	(0.000278)	(0.000299)	(0.000299)
Highly skilled		–0.00272***	–0.00173***	–0.00121***	–0.00116***
		(0.000233)	(0.000250)	(0.000273)	(0.000273)
Tightness (lag 1)			0.00443***	0.00721***	0.00739***
			(0.00158)	(0.00192)	(0.00192)
Matches (lag 1)			–0.000450***	–0.000231***	–0.000231***
			(2.91e-05)	(4.19e-05)	(4.19e-05)
Tightness (lag 2)				–0.000559	–0.000462
				(0.00167)	(0.00167)

Matches (lag 2)				–0.000358***	–0.000364***
				(3.15e-05)	(3.15e-05)
Firm size					3.91e-06***
Trade openness					
Labor wedge					
Herfindahl					
Trade openness (fixed, sector)					
Trade openness (sector)					
Herfindahl (fixed)					
Mining sector					
Manufacturing sector					
Treasury owned					
State owned					
Municipality owned					
Foreign owned					
Donations to value added					
Firm age					
Quitter					
Entrant					
Constant	0.712***	0.925***	0.857***	0.818***	0.818***
Observations	618,653	618,653	506,953	426,032	426,032
R^2	0.012	0.012	0.011	0.012	0.013
Number of firms	33,831	33,831	30,732	27,824	27,824

(continues)

Table 6 *(Continued)*

	6 Labor share	7 Labor share	8 Labor share	9 Labor share	10 Labor share
Quarter 1	0.00307***	0.00244***	0.00232***	0.0112***	0.0321***
	(0.000860)	(0.000866)	(0.000865)	(0.00119)	(0.000720)
Quarter 2	0.000534	0.000602	0.000324	0.00770***	0.0420***
	(0.00162)	(0.00162)	(0.00162)	(0.00215)	(0.00106)
Quarter 3	–0.00297*	–0.00291*	–0.00311*	–0.000315	0.0226***
	(0.00165)	(0.00165)	(0.00165)	(0.00222)	(0.000843)
Tightness	0.00944***	0.00909***	0.00855***	0.00615**	0.0135***
	(0.00160)	(0.00161)	(0.00160)	(0.00251)	(0.00146)
Matches	–0.000421***	–0.000435***	–0.000435***	–0.000475***	–0.000734***
	(3.40e-05)	(3.43e-05)	(3.42e-05)	(4.68e-05)	(2.35e-05)
Medium skilled	–0.00101***	–0.00133***	–0.00108***	–0.00222***	–0.00450***
	(0.000294)	(0.000307)	(0.000307)	(0.000488)	(0.000414)
Highly skilled	–0.00149***	–0.00188***	–0.00159***	–0.00320***	–0.00545***
	(0.000269)	(0.000287)	(0.000288)	(0.000499)	(0.000415)
Tightness (lag 1)	0.00743***	0.00810***	0.00780***	0.0129***	
	(0.00189)	(0.00189)	(0.00189)	(0.00295)	
Matches (lag 1)	–0.000206***	–0.000201***	–0.000207***	–0.000168***	
	(4.11e-05)	(4.11e-05)	(4.11e-05)	(5.51e-05)	
Tightness (lag 2)	8.16e-05	7.94e-05	–0.000209	0.00251	
	(0.00165)	(0.00166)	(0.00166)	(0.00259)	
Matches (lag 2)	–0.000303***	–0.000303***	–0.000309***	–0.000285***	
	(3.11e-05)	(3.12e-05)	(3.12e-05)	(4.36e-05)	

Firm size	3.84e-06***	3.83e-06***	3.71e-06***	4.45e-06***	3.96e-06***
Trade openness	0.00450***	0.00393***	0.00429***	0.00352***	0.000872
Labor wedge	0.00272*	0.00299**	0.00232	0.0168***	0.000210
Herfindahl	0.0113	0.0180**	0.0148*	0.0548***	0.0291**
Trade openness (fixed, sector)		–0.0240**	–0.0265***	–0.0277**	0.0102
Trade openness (sector)		0.0323***	0.0348***	0.0340***	0.0271***
Herfindahl (fixed)		–0.0477**	–0.0482**	–0.0715**	–0.0624**
Mining sector		0.00757	0.00520	–0.0203	–0.0124
Manufacturing sector		–0.00614**	–0.00479*	–0.0191***	–0.0311***
Treasury owned			0.0372***	0.0482***	0.0412***
State owned			0.0277***	0.0348***	0.0285***
Municipality owned			0.0430***	0.0987***	0.0661***
Foreign owned			–0.0187***	–0.0161***	–0.0183***
Donations to value added			0.0212***	0.0574***	0.0528***
Firm age				0.000586***	0.000519***
Quitter				0.00809***	0.00222
Entrant					–0.000131
Constant	0.834***	0.869***	0.843***	0.915***	1.112***
Observations	425,245	425,245	425,245	250,141	378,562
R^2	0.014	0.014	0.015	0.016	0.016
Number of firms	27,789	27,789	27,789	19,360	24,440

Note: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Another important group of labor market variables is constituted by the two sectoral human capital measures, taken from EU KLEMS: the share of the remuneration of highly and medium-skilled workers in the total wage bill (the remuneration of low-skilled workers is taken as the reference category). Both these shares are found to be associated with lower labor shares in value added, corroborating the capital-skill complementarity hypothesis (Krusell et al. 2000): wherever newer, more capital-intensive machines are employed, firms are required to hire sufficiently skilled workers to operate them, but these machines become an efficient substitute for low-skilled labor. As a result, the share of pay for highly skilled labor is negatively correlated with the labor share, even when controlling for a number of auxiliary variables. So is the share of medium-skilled-labor pay. These findings suggest that human capital variables can have an impact on the labor share that is (at least partially) independent of labor market characteristics, firm demographics, and market structures. As shown in the Appendix, this result is however not robust to the inclusion of autocorrelated disturbances. Unlike in the cross-section, where firms in sectors with higher shares of remuneration of highly and medium-skilled labor have lower labor shares on average, *upward shifts* in the share of such remuneration are expected to *raise the labor share* rather than decrease it. See the Appendix for more details.

The signs of coefficients on control variables are in agreement with intuition and empirical evidence, just as in the previous subsection. Some of them will be discussed below.

Market Structures

Turning now to the impact of market structures on the labor share, the variables of interest are trade openness (export revenues as a share in total revenues), tax wedge on labor, and the Herfindahl–Hirschman index, measuring concentration in each two-digit NACE industry.

As shown in Table 7, firm-level export orientation is robustly positively related to the firm's labor share in value added. Even though the impact is very modest, it is important to note that the direction of this relationship runs contrary to prior expectations, according to which exporters should generally use more efficient, more capital-intensive technologies. The counterintuitive result is most likely a consequence of two facts. First, in the Polish data there is essentially no correlation between average labor shares and average export revenue shares across sectors (Figure 7). Second, the period of the dramatic drop in the labor share (2001–4) was preceded by a marked fall in foreign demand (due to the Russian crisis), which in turn decreased export shares in a large fraction of firms. The latter point is particularly important because the parameters in the equations have been identified by running fixed effects regressions.

Scarce signs of partial correctness of the prior (opposite) hypothesis could nevertheless be found in regression (5), which included the sector-specific average of the trade openness measure as well as its cross-time average (i.e., a sector-specific

Table 7. **The Impact of Market Structures on the Labor Share**

	1 Labor share	2 Labor share	3 Labor share	4 Labor share	5 Labor share	6 Labor share	7 Labor share	8 Labor share
Quarter 1	0.0245***	0.0245***	0.0245***	0.0245***	0.0246***	0.0224***	0.0225***	0.0321***
	(0.000502)	(0.000502)	(0.000502)	(0.000502)	(0.000504)	(0.000520)	(0.000520)	(0.000720)
Quarter 2	0.00869***	0.00869***	0.00868***	0.00872***	0.00881***	0.0432***	0.0358***	0.0420***
	(0.000493)	(0.000493)	(0.000493)	(0.000493)	(0.000494)	(0.000713)	(0.000812)	(0.00106)
Quarter 3	0.00407***	0.00407***	0.00405***	0.00409***	0.00413***	0.0238***	0.0188***	0.0226***
	(0.000491)	(0.000491)	(0.000491)	(0.000491)	(0.000491)	(0.000592)	(0.000647)	(0.000843)
Trade openness	0.00121**	0.00119**	0.00116**	0.00139**	0.00145**	0.00178***	0.00181***	0.000872
	(0.000564)	(0.000564)	(0.000564)	(0.000564)	(0.000564)	(0.000573)	(0.000573)	(0.000625)
Labor wedge	–0.000518	–0.000515	–0.000725	–0.00221**	–0.00239**	–0.00292***	–0.00542***	0.000210
	(0.00109)	(0.00109)	(0.00109)	(0.00109)	(0.00109)	(0.00112)	(0.00113)	(0.00169)
Herfindahl	0.0400***	0.0384***	0.0328***	0.0293***	0.0387***	0.0164**	0.00716	0.0291**
	(0.00608)	(0.00609)	(0.00609)	(0.00610)	(0.00644)	(0.00721)	(0.00724)	(0.0119)
Mining sector		0.0303***	0.0184**	0.0153*	0.0234***	0.0158*	0.00513	–0.0124
		(0.00866)	(0.00867)	(0.00867)	(0.00880)	(0.00905)	(0.00908)	(0.0147)
Manufacturing sector		0.00698***	0.00650***	0.00656***	0.00397*	0.00299	–0.0146***	–0.0311***
		(0.00195)	(0.00195)	(0.00195)	(0.00222)	(0.00229)	(0.00248)	(0.00354)
Firm size			3.78e-06***	3.67e-06***	3.68e-06***	3.91e-06***	3.82e-06***	3.96e-06***
			(1.66e-07)	(1.66e-07)	(1.66e-07)	(1.80e-07)	(1.80e-07)	(2.33e-07)

(continues)

Table 7 *(Continued)*

	1 Labor share	2 Labor share	3 Labor share	4 Labor share	5 Labor share	6 Labor share	7 Labor share	8 Labor share
Treasury owned				0.0283***	0.0280***	0.0339***	0.0327***	0.0412***
				(0.00184)	(0.00185)	(0.00205)	(0.00205)	(0.00355)
State owned				0.0244***	0.0240***	0.0257***	0.0227***	0.0285***
				(0.00195)	(0.00195)	(0.00206)	(0.00206)	(0.00338)
Municipality owned				0.0450***	0.0449***	0.0393***	0.0369***	0.0661***
				(0.00436)	(0.00436)	(0.00465)	(0.00465)	(0.00726)
Foreign owned				–0.0225***	–0.0224***	–0.0201***	–0.0193***	–0.0183***
				(0.00174)	(0.00174)	(0.00180)	(0.00180)	(0.00251)
Donations to value added				0.0220***	0.0220***	0.0210***	0.0212***	0.0528***
				(0.00216)	(0.00216)	(0.00248)	(0.00248)	(0.00436)
Trade openness (sector)					–0.00716***	0.0231***	0.0311***	0.0271***
					(0.00265)	(0.00276)	(0.00279)	(0.00365)
Trade openness (fixed, sector)					0.0269***	–0.00382	0.000146	0.0102
					(0.00779)	(0.00807)	(0.00810)	(0.0109)
Herfindahl (fixed)					–0.102***	–0.0731***	–0.0524***	–0.0624**
					(0.0189)	(0.0197)	(0.0198)	(0.0272)
Tightness						0.0193***	0.00960***	0.0135***
						(0.000829)	(0.000976)	(0.00146)

Matches						–0.000940***	–0.000774***	–0.000734***
						(1.44e-05)	(1.68e-05)	(2.35e-05)
Medium skilled							–0.00286***	–0.00450***
							(0.000268)	(0.000414)
Highly skilled							–0.00350***	–0.00545***
							(0.000245)	(0.000415)
Firm age								0.000519***
								(5.09e-05)
Quitter								0.00222
								(0.00142)
Entrant								–0.000131
								(0.00117)
Constant	0.646***	0.642***	0.641***	0.639***	0.640***	0.710***	0.990***	1.112***
	(0.000472)	(0.00128)	(0.00128)	(0.00135)	(0.00148)	(0.00203)	(0.0245)	(0.0382)
Observations	659,559	659,559	659,559	659,559	659,559	616,958	616,958	378,562
R^2	0.004	0.005	0.005	0.007	0.007	0.015	0.015	0.016
Number of firms	35,270	35,270	35,270	35,270	35,270	33,752	33,752	24,440

Note: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

effect). In such a case, the coefficient on sector-specific, as opposed to firm-specific, trade openness becomes negative, significant, and higher in absolute value than the firm-specific one. This effect might be spurious, though: addition of further conditioning variables overturns this result.

Consistent with prior expectations, tax wedge on labor is also found to be negatively related to the labor share, but this relationship is weak and not robust to certain choices of conditioning variables.

As far as market concentration is concerned, it is shown to have a positive impact on the labor share, so that more concentrated industries have higher labor shares on average. This is in line with intuition since such industries are dominated by large firms, which are usually highly unionized, so the power of workers to bargain for higher wages should be high as well. Given this context, the next result might be quite puzzling: the coefficient on the cross-time average of each sector's Herfindahl–Hirschman index is also found to be negative and significant, and larger in magnitude than the positive coefficient of the time-specific value of this index. One interpretation could be that an increase in competitiveness (fall in concentration) should be associated with a consecutive fall in the labor share, but that the cross-section relationship works in the opposite direction. Within a given sector, in periods when competitiveness is high, the labor share should be markedly lower than in periods when competitiveness is low, but this effect does not work across sectors.

Control Variables

Finally, a few comments are necessary regarding the results obtained for the conditioning variables, which were included in numerous regressions in Tables 5, 6, and 7. The signs of the relevant coefficients are in line with expectations based on earlier literature.

- *Firm size* is robustly positively correlated with labor share: larger firms have a larger labor share.
- The *proportion of received donations to value added* is robustly positively correlated with labor share: firms that obtain relatively more donations also have higher labor shares. This agrees with the interpretation that in Poland, donations are usually directed to firms that use outdated, labor-intensive technologies and have a hard time surviving in competitive markets.
- *Ownership* still plays an important role in Poland: state-owned, treasury-owned, and municipality-owned companies record significantly higher labor shares than private companies, whereas domestic private companies record significantly higher labor shares than foreign ones. This could be due to the fact that private and foreign firms are less unionized and have a better bargaining position in the wage-setting process.

- There is a significant difference in the labor shares of *mining, manufacturing,* and *services.* The mining- and manufacturing-sector dummies are included in the regressions, while the service sector serves as a reference category. Two results were obtained. Firstly, labor share is generally larger in mining than in services, but the dummy becomes insignificant when one includes human capital variables in the regression. This means that most of this difference could be captured by the differences in skill intensity between mining and services. Secondly, labor share seems larger in manufacturing than in services in the whole sample, but it becomes insignificant once labor market tightness and new matches are included in the regression, and becomes decidedly negative when one also adds human capital variables. Hence, the apparent result of labor share being higher in manufacturing than in services is explained by labor market characteristics and human capital variables in more than 100 percent.
- There are significant differences in the labor share across *quarters of the year.* Quarter 4 (October–December) was used as the reference category, and included dummies for the three other quarters in the regressions. In all the regression specifications, labor share is significantly higher in first quarters than in fourth quarters of a year. The same applies, roughly speaking, to second and third quarters as well, but in those cases the result is not robust to including lagged labor market characteristics in the regressions.

Conclusion

This paper analyzes the firm-level determinants of the labor share using a unique, quarterly firm-level panel data set from the Polish business sector for the years 1995–2008. The objective of the paper is to identify which economic variables are responsible for the short-run dynamics of the labor share. This task is complementary to the one undertaken in Growiec (2009), where the aggregate shift in the labor share in Poland was decomposed into contributions attributable to the intersectoral reallocation of production, asymmetric changes in wages, and intrasectoral shifts in the labor share. The results of that study indicated that around 44 percent of the total shift in labor share could be attributed to intersectoral reallocation, but almost no variance could.

This paper scrutinizes the intrasectoral shifts in more detail, identifying the impacts of changes in general labor market characteristics, firm demographics, market structures, and human capital variables. The data set makes it possible to draw precise conclusions on the relative importance of particular variables in explaining the variability of labor shares across firms and time.

The conclusion is that while sector-specific factors and changes in the ownership structure explain a large fraction of the observed downward trend in the labor share, labor market characteristics and firm demographics are robust correlates of

labor share changes at high frequency. The results are robust to the inclusion of time dummies in the regressions beside firm firm-specific fixed effects and to allowing for autocorrelation of the disturbance term. They are therefore not driven by cross-correlations across the business cycle, nor are they artifacts of the construction of the data set. Instead, the author can confidently claim that he has identified genuine determinants of the labor share across companies.

Notes

1. To be more precise: Cobb–Douglas production functions, coupled with isoelastic demand curves, lead to *stationary* monopolistic markups over marginal costs. If the considered model includes stochastic fluctuations, price rigidities, etc., then markups may vary in the short run; in any case, *systematic* departures from the deterministic steady-state value are ruled out.

2. Generally, throughout the whole article, the issue is productivity per worker, not per hour worked. Of course, it would be interesting to know the latter measure as well, since hours worked per person may vary largely across firms, sectors, and time. Such information is not available in the firm-level data set, however.

3. Throughout the article, the abbreviation NACE refers to NACE Rev. 1.1.

4. Even when these measurable differences across sectors and firms are accounted for, there are still statistically significant sector-specfic fixed effects that capture some latent characteristics of the underlying technology and markets. This has been confirmed in a series of auxiliary regressions, available upon request.

5. Please note that firms may enter the sample in two ways. First, they can be start-ups with more than fifty employees from the very beginning; second, they can be firms that existed before actually entering the sample but were included in it only once their size exceeded the threshold of fifty employees. There is no way to distinguish between these two alternatives, so they are treated jointly.

6. What remains hidden beneath Figure 6 is the accompanying fall in labor market participation. During 2000–4, in the aftermath of the Russian crisis, many persons shifted from employment or unemployment to professional inactivity, in large part through early retirement. This movement lowered unemployment, and thus also lowered labor market tightness.

7. The Herfindahl–Hirschman index, apart from being a measure of market concentration, can also be viewed as a proxy for the competitiveness of a sector. An alternative proxy measure of the competitiveness of a sector is the Lerner index (Lerner 1934), defined as $1 - TC/TR$, where TC is total costs and TR is total revenues within the sector. However, empirical results of the current study obtained when the Lerner index was taken as an independent variable instead of the Herfindahl index were relatively much less robust and more volatile than the current ones, indicating measurement error and/or collinearity problems. Finally, one could also estimate sector-specific markups directly, which, for Polish data, has been done by Gradzewicz and Hagemejer (2007). It is instructive that they did not find any clear-cut positive correlation between their estimated markups and the Herfindahl–Hirschman index. This led them to the conclusion that intersectoral heterogeneity of markups may result from other factors (level of product differentiation, price regulations, etc.) that are not included in indices of concentration.

8. The apparent negative result presented in the main table might thus be spurious and driven by the simultaneous decline in the labor share and rise in average firm age in the data set. See the Appendix for more details.

9. This effect is robust to the inclusion of time dummies.

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Appendix: Robustness Checks

Results of the regressions presented in the main text could be questioned on the premises of a possible omission of variables and endogeneity biases. To ascertain that the main findings are not driven by spurious effects, a series of robustness checks was run. The results of these checks are presented below.

Including Time Dummies

The first robustness check consists in including time dummies in the regressions to eliminate the impact of business cycle correlations on the labor share. Since there is also a control for firm-level fixed effects, only the genuine impacts of variables with both cross-sectional and intertemporal variability remain. The impacts of labor market tightness and new employer–employee matches on the labor share are thus unaccounted for, as these variables are available only as time series.

Results of this robustness check are presented in Table A1. In this table, we redo the series of regressions focused on firm demographics, but this time with time dummies. Comparing Table A1 to Table 5, reveals the following important difference: the sign of the coefficient on firm age has changed from negative to positive. It is now found that after controlling for pure time effects, firm age affects the labor share positively. This holds true even when firm size is controlled for as well. The author concludes that the apparent negative result presented in the main table might be spurious and primarily as a result of the simultaneous decline in the labor share and rise in average firm age in the data set. The latter regularity is due to the fact that there was no information regarding the age of firms already present the data set in the first quarter of 1995; such firms therefore had to be excluded from the data set.

Other results presented in Table A1 are robust to the inclusion of time dummies.

Allowing for Autocorrelated Residuals

Another robustness check of the results involves allowing the residuals of the panel regressions to be autocorrelated. Indeed, numerous mechanisms depicted in the analyses could be inherently persistent. This applies in particular to the labor share process itself: employment and wages are indeed frequently found in the literature to be sticky and to adjust to changing economic environments only with a lag. Hence, omitting the possibility of autocorrelation in residuals makes our estimates susceptible to inconsistency.

Table A1. **The Impact of Firm Demographics, Market Structures, and Ownership on the Labor Share. Regressions Including Both Fixed Effects and Time Dummies**

	(1) Labor share	(2) Labor share	(3) Labor share	(4) Labor share	(5) Labor share
Firm age	0.00207***	0.00204***	0.00204***	0.00201***	0.00261***
	(0.000122)	(0.000122)	(0.000122)	(0.000122)	(0.000120)
Quitter	0.000969	0.000960	0.000968	0.000922	0.00433***
	(0.00145)	(0.00145)	(0.00145)	(0.00145)	(0.00143)
Entrant	–0.00393***	–0.00376***	–0.00376***	–0.00351***	–0.00220*
	(0.00117)	(0.00117)	(0.00117)	(0.00117)	(0.00115)
Firm size		3.81e-06***	3.83e-06***	3.85e-06***	3.65e-06***
		(2.12e-07)	(2.12e-07)	(2.12e-07)	(2.08e-07)
Mining sector			0.0217	0.0186	0.0136
			(0.0149)	(0.0149)	(0.0145)
Manufacturing sector			–0.000171	–0.000747	–0.00323
			(0.00301)	(0.00301)	(0.00295)
Herfindahl (fixed)			–0.0865***	–0.0928***	–0.0907***
			(0.0254)	(0.0254)	(0.0268)
Trade openness (fixed, sector)			0.0119	0.0132	–0.0128
			(0.0103)	(0.0103)	(0.0107)
Treasury owned				0.0411***	0.0385***
				(0.00348)	(0.00341)
State owned				0.0302***	0.0269***
				(0.00340)	(0.00332)

(continues)

Table A1 *(Continued)*

	(1) Labor share	(2) Labor share	(3) Labor share	(4) Labor share	(5) Labor share
Municipality owned				0.0664***	0.0630***
				(0.00725)	(0.00708)
Foreign owned				–0.0169***	–0.0175***
				(0.00253)	(0.00248)
Donations to value added				–0.00214***	0.0472***
				(0.000302)	(0.00415)
Trade openness					0.000761
					(0.000621)
Trade openness (sector)					0.0309***
					(0.00366)
Labor wedge					0.00495***
					(0.00172)
Herfindahl					0.0219*
					(0.0116)
Constant	0.549***	0.549***	0.550***	0.549***	0.528***
	(0.00430)	(0.00430)	(0.00469)	(0.00472)	(0.00464)
Time dummies	Yes	Yes	Yes	Yes	Yes
Observations	386,847	386,847	386,847	386,847	385,591
R^2	0.018	0.019	0.019	0.020	0.021
Number of firms	24,998	24,998	24,998	24,998	24,920

Note: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table A2 documents that when residuals are allowed to have an AR(1) structure, their autocorrelation coefficient is estimated to be around 0.152–0.154 and statistically significant at the 1 percent confidence level. This change does not, however, overturn the principal results obtained in Tables 5–7.

Table A2 is a revised version of Table 6. The only difference is that the exogenous disturbances are now allowed to be AR(1). There are two important differences between the results reported in these two tables. First, the coefficients in Table A2 are generally more precisely estimated and thus more often statistically significant. Second, and more importantly, the signs on the shares of remuneration of highly skilled and medium-skilled labor have now reversed from negative to positive. Including time-series autocorrelation into the analysis leads to the conclusion that, unlike in the cross-section, where firms in sectors with higher shares of remuneration of highly and medium-skilled labor have lower labor shares on average, *upward shifts* in the share of such remuneration are expected to *raise the labor share,* not decrease it.

Including the Ratio of Capital Assets to Value Added

Another important robustness check of the principal results is the inclusion of the ratio of capital assets to value added in the regressions. This was not done in the main analyses because: (1) the F-01 data set has information on firms' capital stocks only from 2002 onward, and (2) the reliability of the capital data is somewhat lower than of other data in the set. The first limitation reduces the data set by about one-third, while the requirement that capital stocks be positive and less than 10,000 times the firms' value added reduces the data set by a few further tens of thousands of observations.

To check the validity of the main results, the regressions from Table 7 were nevertheless rerun on the reduced data set, including the capital to value added (K/Y) ratio as an additional conditioning variable. The results are contained in Table A3, which shows that in the data, the K/Y ratio is robustly positively related to the firm-level labor share. This stands in sharp contrast to the negative coefficient obtained by Bentolila and Saint-Paul (2003) in a log-log specification for one- and two-digit industry-level data from twelve OECD countries for the period 1970–95.

Other coefficients are however little affected by the inclusion of the K/Y ratio, which corroborates their robustness. Some coefficients are somewhat less precisely estimated in Table A3, because of a marked reduction of the size of the data set, but their signs are generally robust. Comparing Table A3 to Table 7, one can see that the coefficient on the Herfindahl–Hirschman index has become much larger after the inclusion of the K/Y ratio, indicating that these two variables might be strongly interrelated. Trade openness and the labor tax wedge have, in turn, become much less important for the determination of the labor share and at this point are generally insignificant (but have the same sign).

Table A2. **The Impact of Labor Market Characteristics, Firm Demographics, Market Structures, and Ownership on the Labor Share. Regressions with AR(1) Residuals**

	(1) Labor share	(2) Labor share	(3) Labor share	(4) Labor share	(5) Labor share
Quarter 1	0.0341***	0.0229***	0.00594***	0.000598	0.000378
	(0.000508)	(0.000505)	(0.000747)	(0.000829)	(0.000830)
Quarter 2	0.0318***	0.0401***	0.0150***	0.00158	0.00116
	(0.000756)	(0.000820)	(0.00144)	(0.00164)	(0.00164)
Quarter 3	0.0193***	0.0211***	0.0172***	–0.00198	–0.00222
	(0.000589)	(0.000623)	(0.000708)	(0.00165)	(0.00165)
Tightness	0.0341***	0.0179***	0.0150***	0.0132***	0.0132***
	(0.000932)	(0.00103)	(0.00147)	(0.00160)	(0.00160)
Matches	–0.000284***	–0.000856***	–0.000536***	–0.000532***	–0.000527***
	(1.57e-05)	(1.79e-05)	(3.11e-05)	(3.39e-05)	(3.39e-05)
Medium skilled		0.00773***	0.00738***	0.00833***	0.00828***
		(5.39e-05)	(5.81e-05)	(6.77e-05)	(6.80e-05)
Highly skilled		0.00566***	0.00566***	0.00659***	0.00662***
		(7.18e-05)	(8.15e-05)	(9.63e-05)	(9.65e-05)
Tightness (lag 1)			0.00920***	0.00830***	0.00849***
			(0.00152)	(0.00177)	(0.00177)
Matches (lag 1)			–0.000422***	–0.000196***	–0.000197***
			(2.98e-05)	(3.95e-05)	(3.95e-05)
Tightness (lag 2)				0.00448***	0.00450***
				(0.00164)	(0.00165)
Matches (lag 2)				–0.000314***	–0.000322***
				(3.21e-05)	(3.22e-05)

Firm size					3.48e-06***
Trade openness					0.00507***
Labor wedge					0.00458***
Herfindahl					0.0374***
Trade openness (sector)					
Trade openness (fixed, sector)					
Herfindahl (fixed)					
Mining sector					
Manufacturing sector					
Treasury owned					
State owned					
Municipality owned					
Foreign owned					
Donations to value added					
Firm age					
Quitter					
Entrant					
Constant	0.658***	0.0290***	0.0694***	–0.00581	–0.00614
Residual autocorrelation	0.152	0.152	0.152	0.154	0.153
Observations	582,813	582,813	474,933	397,274	397,274
Number of firms	31,624	31,624	28,366	25,282	25,282

(continues)

Table A2 *(Continued)*

	(6) Labor share	(7) Labor share	(8) Labor share	(9) Labor share
Quarter 1	–0.000495	–0.000509	0.00775***	0.0300***
	(0.000836)	(0.000836)	(0.00116)	(0.000700)
Quarter 2	0.00120	0.000779	0.00911***	0.0465***
	(0.00164)	(0.00164)	(0.00219)	(0.00109)
Quarter 3	–0.00234	–0.00282*	0.000889	0.0241***
	(0.00165)	(0.00165)	(0.00223)	(0.000827)
Tightness	0.0133***	0.0127***	0.00933***	0.0152***
	(0.00160)	(0.00160)	(0.00260)	(0.00160)
Matches	–0.000560***	–0.000554***	–0.000617***	–0.000893***
	(3.41e-05)	(3.41e-05)	(4.71e-05)	(2.47e-05)
Medium skilled	0.00821***	0.00816***	0.00772***	0.00700***
	(7.14e-05)	(7.20e-05)	(0.000111)	(8.40e-05)
Highly skilled	0.00670***	0.00672***	0.00658***	0.00566***
	(9.79e-05)	(9.82e-05)	(0.000172)	(0.000128)
Tightness (lag 1)	0.00949***	0.00913***	0.0104***	
	(0.00178)	(0.00178)	(0.00287)	
Matches (lag 1)	–0.000197***	–0.000194***	–0.000185***	
	(3.95e-05)	(3.95e-05)	(5.35e-05)	
Tightness (lag 2)	0.00551***	0.00504***	0.00556**	
	(0.00165)	(0.00165)	(0.00267)	
Matches (lag 2)	–0.000334***	–0.000344***	–0.000296***	
	(3.22e-05)	(3.22e-05)	(4.48e-05)	

Firm size	3.50e-06***	3.40e-06***	4.78e-06***	4.19e-06***
Trade openness	0.00469***	0.00497***	0.00432***	0.00399***
Labor wedge	0.00503***	0.00452***	0.0247***	0.00987***
Herfindahl	0.0522***	0.0483***	0.0928***	0.0712***
Trade openness (sector)	0.0199***	0.0216***	0.0256***	0.0201***
Trade openness (fixed, sector)	–0.0182*	–0.0180*	–0.0272*	0.000504
Herfindahl (fixed)	–0.119***	–0.121***	–0.159***	–0.138***
Mining sector	0.0137	0.0119	0.0236	0.00571
Manufacturing sector	0.0178***	0.0184***	0.0138***	0.00499
Treasury owned		0.0375***	0.0496***	0.0425***
State owned		0.0314***	0.0357***	0.0314***
Municipality owned		0.0566***	0.111***	0.0629***
Foreign owned		–0.0163***	–0.0114***	–0.0154***
Donations to value added		0.0218***	0.0556***	0.0538***
Firm age			4.36e-05	–0.000115**
Quitter			0.00519**	0.00227
Entrant				0.0591***
Constant	–0.00660	–0.00787	–0.00895	0.0480***
Residual autocorrelation	0.153	0.152	0.131	0.131
Observations	397,274	397,274	230,669	353,861
Number of firms	25,282	25,282	17,371	22,585

Note: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table A3. **The Impact of Labor Market Characteristics, Firm Demographics, Market Structures, and Ownership on the Labor Share: Regressions with an Explicit Inclusion of the Ratio of Capital Assets to Value Added**

	[1] Labor share	[2] Labor share	[3] Labor share	[4] Labor share	[5] Labor share	[6] Labor share	[7] Labor share	[8] Labor share
Quarter 1	0.0151***	0.0151***	0.0152***	0.0154***	0.0155***	0.0134***	0.0141***	0.0215***
	(0.000865)	(0.000865)	(0.000865)	(0.000865)	(0.000869)	(0.000871)	(0.000876)	(0.00112)
Quarter 2	0.00183*	0.00184*	0.00185*	0.00199**	0.00221**	0.0219***	0.0191***	0.0248***
	(0.000992)	(0.000992)	(0.000992)	(0.000992)	(0.000993)	(0.00134)	(0.00140)	(0.00169)
Quarter 3	0.000400	0.000413	0.000398	0.000489	0.000773	0.0113***	0.00910***	0.0134***
	(0.000991)	(0.000991)	(0.000991)	(0.000991)	(0.000991)	(0.00107)	(0.00111)	(0.00149)
Trade openness	0.00290	0.00284	0.00255	0.00261	0.00237	0.00398*	0.00409*	0.00447
	(0.00236)	(0.00236)	(0.00236)	(0.00235)	(0.00236)	(0.00236)	(0.00236)	(0.00272)
Labor wedge	–0.000773	–0.000788	–0.000887	–0.00134	–0.00141	–0.00281	–0.00276	0.0323***
	(0.00437)	(0.00437)	(0.00437)	(0.00437)	(0.00437)	(0.00437)	(0.00437)	(0.00673)
Herfindahl	0.225***	0.228***	0.226***	0.216***	0.322***	0.259***	0.253***	0.268***
	(0.0212)	(0.0216)	(0.0216)	(0.0216)	(0.0248)	(0.0249)	(0.0250)	(0.0316)
K/Y ratio	0.000326***	0.000326***	0.000328***	0.000327***	0.000328***	0.000323***	0.000324***	0.000383***
	(2.02e-05)	(2.02e-05)	(2.01e-05)	(2.01e-05)	(2.01e-05)	(2.01e-05)	(2.01e-05)	(2.64e-05)
Mining sector		–0.0285	–0.0441**	–0.0405**	0.00184	–0.00349	–0.0193	–0.0356
		(0.0198)	(0.0199)	(0.0199)	(0.0205)	(0.0204)	(0.0206)	(0.0297)
Manufacturing sector		0.00865**	0.00798*	0.00810**	0.00611	0.00648	–0.0123**	–0.0201***
		(0.00408)	(0.00408)	(0.00408)	(0.00471)	(0.00471)	(0.00534)	(0.00661)
Firm size			1.15e-05***	1.14e-05***	1.13e-05***	1.17e-05***	1.16e-05***	1.64e-05***
			(1.18e-06)	(1.18e-06)	(1.18e-06)	(1.18e-06)	(1.18e-06)	(2.07e-06)
Treasury owned				0.0221***	0.0225***	0.0170***	0.0166***	0.0299***
				(0.00601)	(0.00601)	(0.00601)	(0.00601)	(0.00966)

State owned	0.0290***	0.0282***	0.0218***	0.0214***	0.0243***
	(0.00536)	(0.00536)	(0.00536)	(0.00536)	(0.00726)
Municipality owned	0.0512***	0.0518***	0.0472***	0.0478***	0.0768***
	(0.0109)	(0.0109)	(0.0109)	(0.0109)	(0.0150)
Foreign owned	–0.00951**	–0.00926**	–0.00731*	–0.00724*	–0.00708
	(0.00379)	(0.00379)	(0.00378)	(0.00378)	(0.00467)
Donations to value added	0.0672***	0.0663***	0.0673***	0.0674***	0.0893***
	(0.00692)	(0.00692)	(0.00691)	(0.00691)	(0.00883)
Trade openness (sector)		0.00418	0.0256***	0.0268***	0.0245***
		(0.00503)	(0.00510)	(0.00510)	(0.00605)
Trade openness (fixed, sector)		0.0214	–0.00207	0.00839	0.00536
		(0.0168)	(0.0168)	(0.0169)	(0.0205)
Herfindahl (fixed)		–0.354***	–0.299***	–0.282***	–0.264***
		(0.0406)	(0.0406)	(0.0408)	(0.0501)
Tightness			0.0277***	0.0156***	0.0380***
			(0.00175)	(0.00240)	(0.00762)
Matches			–0.000544***	–0.000491***	–0.000429***
			(2.91e-05)	(3.00e-05)	(5.01e-05)
Medium skilled				–0.00278***	–0.00265***
				(0.000600)	(0.000769)

(continues)

Table A3 *(Continued)*

	[1] Labor share	[2] Labor share	[3] Labor share	[4] Labor share	[5] Labor share	[6] Labor share	[7] Labor share	[8] Labor share
Highly skilled							–0.00354***	–0.00374***
							(0.000591)	(0.000762)
Firm age								0.000970***
								(0.000232)
Quitter								0.0152***
								(0.00276)
Entrant								0.00328*
								(0.00193)
Constant	0.602***	0.597***	0.594***	0.590***	0.595***	0.635***	0.924***	0.861***
	(0.00126)	(0.00275)	(0.00276)	(0.00292)	(0.00320)	(0.00435)	(0.0569)	(0.0720)
Observations	201,575	201,575	201,575	201,575	201,575	201,575	201,575	146,462
R^2	0.006	0.006	0.006	0.007	0.008	0.011	0.012	0.014
Number of firms	22,754	22,754	22,754	22,754	22,754	22,754	22,754	17,698

Note: Standard errors are shown in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

One interesting exception is that after controlling for the *K*/*Y* ratio, entrants have above-average, rather than below-average, labor shares. This discrepancy in the results is driven by the large differences in capital intensity between these two groups of firms: on average, entrants into the data set have capital intensities almost twice as high those of incumbent firms.