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Determinants of the Labor Share: Evidence from a Panel of Firms

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Abstract

This paper analyzes the sources of labor share variations and its general downward trend, observed recently in most European economies. Using a unique quarterly firm-level panel dataset from the Polish enterprise sector in the period 1995–2008, we quantify the impacts on the observed variation in labor shares of (i) firms' "demographics" including firms' age as well as their entry and exit behavior, (ii) selected labor market characteristics such as newly filled vacancies, labor market tightness, and human capital measures, (iii) firm- and sector-level measures of export intensity, competition, and ownership structure, and (iv) shifts in the sectoral make-up of GDP. We also test the potential cross-effects among these variables. We conclude 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.

Keywords and Phrases: labor share, firm-level data, sectoral composition, labor market tightness, firm demographics

JEL Classification Numbers: D33, E25

Non-technical summary

Since 1995, when reliable data on GDP and its components became first available, we observe in Poland that labor productivity rises generally faster than average wages, thus producing a downward trend in the labor income share (see e.g. Kolasa, 2008; Growiec, 2009). 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 one of the lowest among European (modern EU) countries already back in 1995.

This finding for Poland parallels similar downfalls in the labor share observed in developed countries, in particular in most EU countries (though not so much in the US), which have been recently analyzed and explained by diverse means (Bernanke and Gürkaynak, 2001; Bentolila and St. Paul, 2003; Timmer et al., 2003; Arpaia et al., 2009; Genre et al., 2009; OECD, 2009). It is however not at all in agreement with previous, essentially trendless variations of the labor share in earlier post-war decades (Bernanke and Gürkaynak, 2001; Gollin, 2002), and neither does it accord with the usual macroeconomic paradigm, based on Cobb–Douglas production functions, coupled with isoelastic demand curves, leading to constant monopolistic markups over marginal costs, and leaving no room for trending labor shares.

Given this background, the objective of the current paper is to quantify the importance of selected economic mechanisms in shaping the labor income share. We shall take advantage of our unique quarterly panel dataset of individual enterprises, from Poland in 1995–2008, and pursue an empirical analysis of four competing driving forces behind the observed labor share movements: (i) firms' "demographics" including firms' age as well as their entry and exit behavior – interacting with investment-specific technical change; (ii) selected labor market characteristics such as newly filled vacancies, labor market tightness, and human capital measures, (iii) firm- and sector-level measures of export intensity, competition, and ownership structure, and (iv) shifts in the sectoral make-up of Polish GDP – as there are inherent intersectoral differences in labor shares. We shall also check 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.)

The task undertaken here is complementary to the one discussed in Growiec (2009), where the aggregate shift in the labor share in Poland has been decomposed into contributions attributable to inter-sectoral reallocation of production, asymmetric changes in wages, and intra-sectoral shifts in the labor share. The results of that study indicated that around 44% of the total shift in labor share could be attributed to inter-sectoral reallocation, but almost no variance could. Here, in contrast, we

scrutinize the intra-sectoral shifts in more detail, identifying the impacts of changes in general labor market characteristics, firm demographics, market structures, and human capital variables. Our dataset enables us to draw precise conclusions on the relative importance of particular variables in explaining the variability of labor shares across firms and time.

We conclude 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. Our results are robust to the inclusion of time dummies in the regressions beside firm 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 our dataset. Instead, we can confidently claim that we have identified genuine determinants of the labor share across enterprises.

1 Introduction

Since 1995, when reliable data on GDP and its components became first available, we observe in Poland that labor productivity rises generally faster than average wages, thus producing a downward trend in the labor income share (Kolasa, 2008; Growiec, 2009). 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 one of the lowest among European (modern EU) countries already back in 1995 (cf. OECD, 2009).

This finding for Poland parallels similar downfalls in the labor share observed in developed countries, in particular in most EU countries (though not so much in the US), which have been recently analyzed and explained by diverse means (Bernanke and Gürkaynak, 2001; Bentolila and St. Paul, 2003; Timmer et al., 2003; Arpaia et al., 2009; Genre et al., 2009; OECD, 2009). It is however not at all in agreement with previous, essentially trendless variations of the labor share in earlier post-war decades (Bernanke and Gürkaynak, 2001; Gollin, 2002), and neither does it accord with the usual macroeconomic paradigm, based on Cobb–Douglas production functions, coupled with isoelastic demand curves, leading 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, Bentolila and St. Paul (2003) as well as Arpaia et al. (2009) explored departures from Cobb–Douglas technology. Arpaia et al. (2009) proposed to use a nested 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 St. Paul (2003) presented a more general proposition which 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 St. Paul, 2003; Jones, 2005), which is especially vital in the case of investment-specific technical change (cf. Gordon, 1990; Whelan, 2003). Empirical evidence suggests that there might be an

[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.

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 hi-tech, export-oriented sectors as well as sectors that use ICT as general purpose technology (Timmer et al., 2003).

A complementary approach has been taken by de Serres et al. (2002), Kyyrä and Maliranta (2008), Genre et al. (2009) 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 idiosyncracies 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). If nevertheless 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 be capital-augmenting, 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 EU. 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 thanks to 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. We shall take advantage of our unique quarterly panel dataset of individual enterprises (from Poland in 1995–2008) and pursue an empirical analysis of four competing driving forces behind the observed labor share movements: (i) firms' "demographics" including firms' age as well as their entry and exit behavior – interacting with investment-specific technical change; (ii) selected labor market characteristics such as newly filled vacancies, labor market tightness, and human capital measures, (iii) firm- and sector-level measures of export intensity, competition, and ownership structure, and (iv) shifts in the sectoral make-up of Polish GDP – as there are inherent intersectoral differences in labor shares. We shall also check 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.)

The remainder of the article is structured as follows. Section 2 presents the broad patterns of labor share dynamics in Poland. Section 3.1 discusses the sources of data used in subsequent analysis. Section 3.2 concentrates on sector-specific differences in labor shares and their potential in explaining the changes in aggregate labor income share. Section 3.3 turns to the labor share impact of entry and exit dynamics. Section 3.4 deals with labor market characteristics. Section 3.5 is dedicated to market structures, and it aims to disentangle the impacts of several measures of capital intensity and competition on the labor share. Section 4 puts all these effects together and presents our principal regression results. Section 5 concludes.

2 Dynamics of the labor share

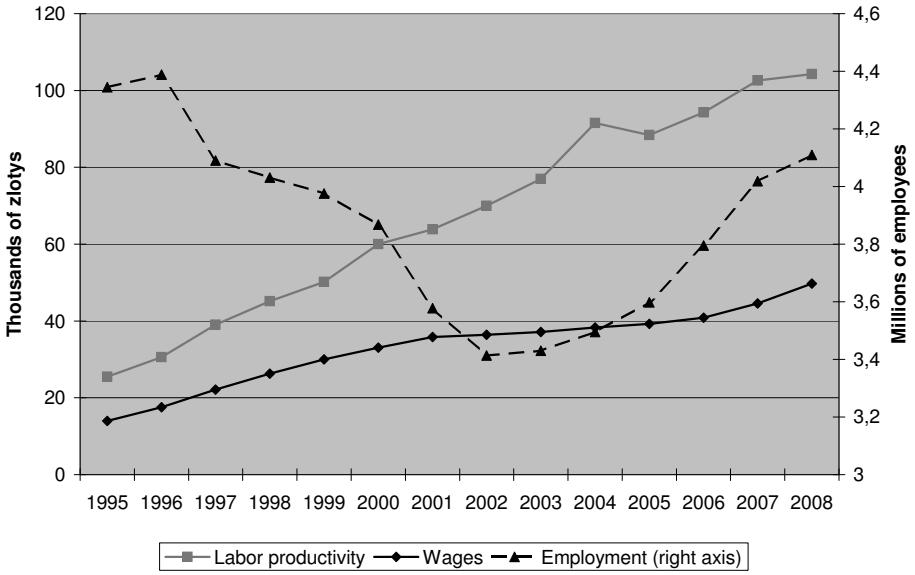
In the period 1995–2008, average wages in Poland were rising much more slowly than labor productivity (i.e., value added per worker),[2] parallel to similar developments in numerous other developed and transition countries, in particular in the European Union (cf. Timmer et al., 2003; OECD, 2009). The tendency was however subject to additional fluctuations on top of that (see Fig. 1). In Poland, the largest disparity between the two dynamics was observed in 2001–2004. In periods 1995–96 and 2007–08, reversals in this tendency were observed, though. Throughout 1995–2008, labor productivity in the analyzed group of enterprises increased by 309% and mean wage increased by 256%. Total employment in the analyzed group of enterprises 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.

In consequence, 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, as well as 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 sectors felt the drop in labor shares most strongly in 2001–04.

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 sector. Perhaps the most striking result of that study is that while some 44% of the total change in labor share throughout the period can be explained by intersectoral components, almost none of its variance could. Reallocation effects – spanning from flows of capital and labor across sectors, to the effects of selective restructuring, tilting wage distributions across sectors, and to 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, i.e. they too shift labor shares downward. Some illustrative results of that study are quoted in Table 1.

[2]Generally, throughout the whole article, we are preoccupied with 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 our firm-level dataset, though, so we are forced to stick to per worker units.

Figure 1: Labor productivity, wages, and employment in the enterprise sector in Poland.



Source: own computations based on 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 %	Variance	In %
Intra-sectoral shifts	-0,0393	55,7470	0,0010459	96,09
Asymm. 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).

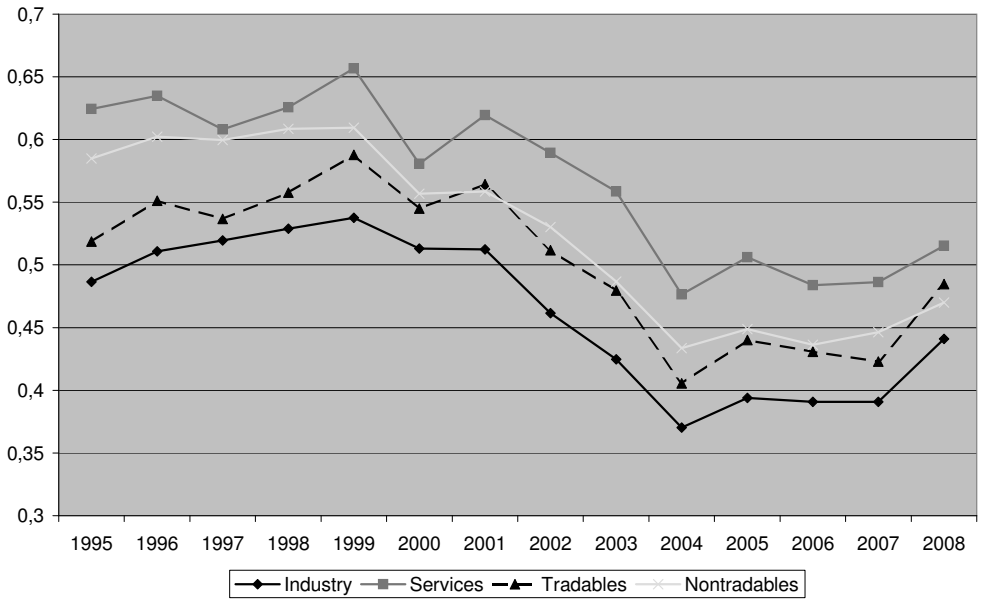
Despite the intuitive appeal of the results presented in Table 1, they in fact conceal substantial heterogeneity across certain sections of the Polish economy. This is clearly visible in Tables 2–3, providing the results of analogous studies conducted on subsets of sectors. Table 2 decomposes shifts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

1. $\Delta \frac{w_i L_i}{Y_i}$ – intra-sectoral shifts in the labor share.

2. $\Delta\frac{w_i}{w}$ – asymmetric wage changes across sectors.

3. $\Delta\frac{Y_i}{Y}$ – changes in sectoral shares of total value added.

Figure 2: Evolution of the labor share in selected sectors of the Polish economy.



Source: own computations based on firm-level F-01 data (GUS).

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 "reallocation and differential growth rates" effects exert a strong pressure towards a decrease in labor shares in tradables, mining and manufacturing, but they push towards 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 due to 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 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).

Table 2: Decomposing total shifts in the labor share in 1995–2008 into three components: grouping sectors.

	Export-oriented		Non-export-oriented		Tradables		Nontradables	
	Sum	In %	Sum	In %	Sum	In %	Sum	In %
$\Delta\frac{w_iL_i}{Y_i}$	0,027	-18,72	-0,059	125,66	0,010	-7,68	-0,095	–
$\Delta\frac{w_i}{w}$	0,003	-1,94	-0,027	57,10	-0,006	4,49	-0,034	–
$\Delta\frac{Y_i}{Y}$	-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 %	Sum	In %	Sum	In %
$\Delta\frac{w_iL_i}{Y_i}$	-0,079	18,17	-0,013	8,94	-0,080	-83,67
$\Delta\frac{w_i}{w}$	0,027	-6,20	-0,020	13,77	-0,026	-26,99
$\Delta\frac{Y_i}{Y}$	-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% of revenues from exports; sectors producing tradables are defined as sectors with more than 5% of revenues from exports.

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 because of having opposite impacts on selected sections of the economy. The results of such exercise are nevertheless still unsatisfactory as a final explanation of the dynamics of the labor share. This is why we think it is crucial to analyze the data further, and test alternative theories which 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 which might turn out to be visible when firm-level data are analyzed.

Table 3: Variance decomposition of labor share shifts: grouping sectors

	Export-oriented		Non-export oriented		Tradables		Nontradables	
	σ^2	In %	σ^2	In %	σ^2	In %	σ^2	In %
$\Delta\frac{w_iL_i}{Y_i}$	0,0030	146,74	0,0008	73,14	0,0016	109,88	0,0007	58,70
$\Delta\frac{w_i}{w}$	0,0001	0,88	0,0000	-1,70	0,0000	-5,42	0,0000	4,04
$\Delta\frac{Y_i}{Y}$	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 %	σ^2	In %	σ^2	In %
$\Delta \frac{w_i L_i}{Y_i}$	0,0025	35,88	0,0009	78,87	0,0014	57,17
$\Delta \frac{w_i}{w}$	0,0003	1,49	0,0000	1,06	0,0001	-12,52
$\Delta \frac{Y_i}{Y}$	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 $\sigma^2(X)$ we presented the total variance of labor share shifts in each particular sector. Percentage contributions include covariances between the components. The values do not sum up to 100%, 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% of revenues from exports; sectors producing tradables are defined as sectors with more than 5% of revenues from exports. See Growiec (2009) for details.

3 Data

3.1 Data sources

The data used herein are firm-level data from financial reports of enterprises in Poland, collected by the Polish Statistical Office (*Główny Urząd Statystyczny*, GUS), the so-called F-01 forms. These reports are handed in by all firms employing at least 50 persons, with the exception of the agricultural sector (NACE 1-2),[3] financial intermediation sector (NACE 65), insurance and pension funds (NACE 66), 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 dataset which would both have a quarterly frequency and full coverage of all eligible individual firms in the economy. This underlies the uniqueness of this dataset in providing the crucial insights with respect to 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.

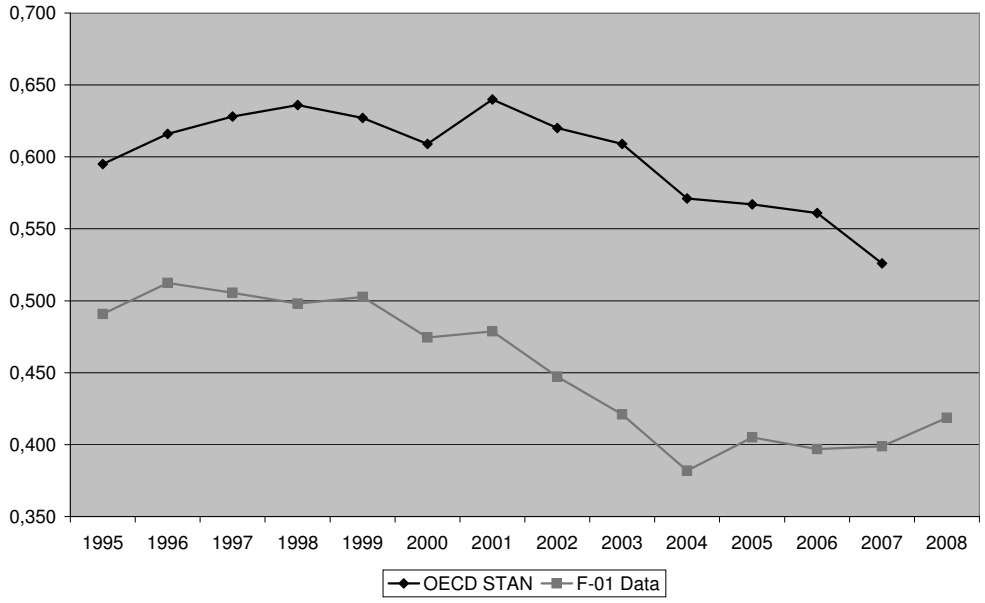
It should be emphasized that due to data availability, several sectors of the economy are either excluded or under-represented. This applies in particular to sectors dominated by enterprises below 50 employees, such as many services and nontradable goods sectors. On the other hand, restricting the sample to such firms helps avoid methodological problems related to the need for dividing mixed incomes of the self-employed into remuneration of labor and capital. It cannot, however, help avoid the fact that a fraction of employee compensation might be hidden in the "subcontracting" (outside services) category, or outsourcing of labor, which is treated as remuneration of capital, if the subcontractor is e.g. self-employed. Unfortunately, one cannot judge the extent to which this might bias our results.

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

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

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. These are three variables, summing up to 100%: high-skilled, medium-skilled, and low-skilled labor compensation as a share in total labor compensation. Time series on the number of vacancies, total unemployment, and jobs found, used to compute our measures of labor market tightness and hire ratio, come from the Polish Statistical Office (GUS).

Figure 3: Labor income share in the whole economy (OECD data) and in the enterprise sector (F-01 data, outliers dropped).



Source: own computations based on F-01 (GUS) as well as OECD STAN data.

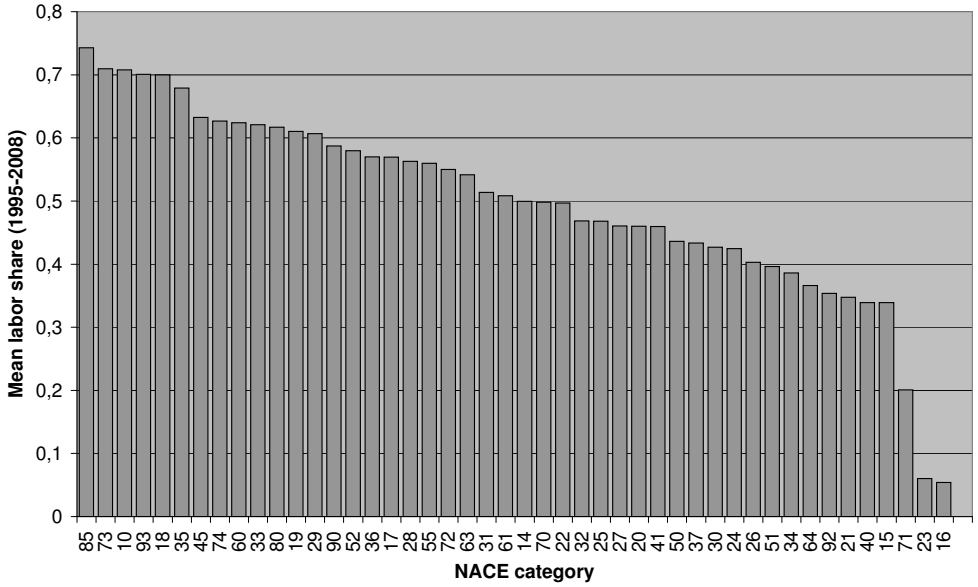
3.2 Sector-specific differences

As we have seen in Figure 2, labor shares have declined throughout the sectors of Polish economy in a rather uniform fashion. In consequence, 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 70–74% 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 5–6% 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 varation 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. This has already been shown by Growiec (2009), however, to explain a relatively small 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 driven down to differences in more fundamental characteristics of the sectors, such as exposure to international trade, competitiveness, capital intensity, or ownership structure.[4]

Figure 4: Sector-specific average labor income shares (NACE Rev. 1.1).



Source: own computations based on F-01 (GUS) data.
Note: we dropped the following sectors due to insufficient data: Oil and Gas Mining (NACE 11), Mining of Metal Ores (NACE 13), Air Transport (NACE 62), and Other Membership Organizations (NACE 91).

Table 4: Descriptive statistics of the distribution of average labor shares across sectors of the Polish economy.

Unweighted average	0,497822
Median	0,503947
Std deviation	0,152783
Kurtosis	1,45058
Skewness	-0,95943
Count	46

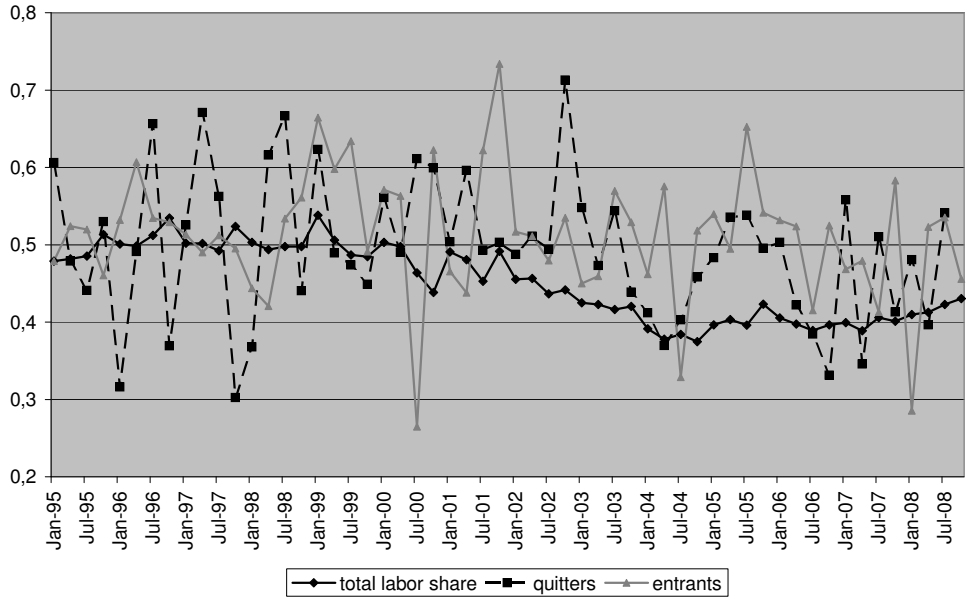
Source: own computations based on F-01 (GUS) data.

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

3.3 Firm demographics: firm age, entry and exit

Our firm-level data 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 the light of the fact that average (employment-weighted) labor shares in both entering and exiting firms have fallen slightly throughout the analyzed period (cf. 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.

Figure 5: Labor income share among entrants and quitters (F-01 data).



Source: own computations based on F-01 (GUS) data.

On the other hand, it is possible that there exist other factors which make firms enter or exit the sample,[5] such as market competitiveness, firm efficiency, export intensity, exiting firms being endowed with inferior or obsolete technology, etc. In principle, these factors might also be correlated with labor share. In such case, we

[5]Please note that firms may enter our sample in two ways. First, they can be start-ups with more than 50 employees from the very beginning; second, they can also be firms which had existed before actually entering the sample, but they were included in it only at the moment when their size exceeded the threshold of 50 employees. There is no way to distinguish between these two alternatives so we have to treat them jointly.

will 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 we should expect firm demographics to 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.

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 dataset, average age within our dataset increases with time (we have no means for controlling firm age prior to 1995, so in this exercise we only include those who entered the sample after 1995Q1).

3.4 Labor market characteristics

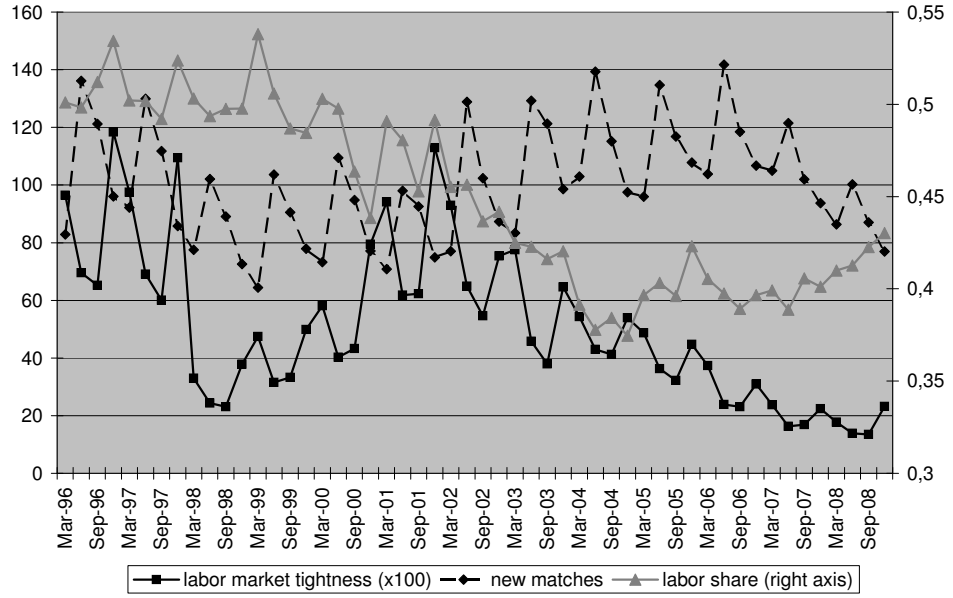
A further group of potential determinants of the labor share at firm level relates to the overall labor market outlook of the economy. Within the business cycle, variables such as the unemployment rate, number of vacancies, and the number of new hires, fluctuate a lot, and might be relevant for the determination of the short-run dynamics of firm-level labor shares. As we see in Figure 6, the years 2001–04 which have witnessed the strongest fall in the labor share throughout the economy, have been preceeded by a visible rise of labor market tightness (i.e. the number of unemployed people per one vacancy, U/V), 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, we shall find 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 a high bargaining power of incumbent workers, usually going

[6]What remains hidden beneath Figure 6 is the accompanying fall in labor market participation. During 2000–04, in the aftermath of the Russian crisis, many persons shifted from employment or unemployment to professional inactivity, in large part via early retirement. This movement lowered unemployment, and thus also lowered labor market tightness.

toghether 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 it is followed by a fall in the labor share, it depends on the pace of underlying productivity growth.

Figure 6: Labor market tightness, new matches, and the labor market share.



Source: own computations based on GUS data.

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 equal, a higher share of labor compensation going to high- 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 the 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.

3.5 Market structures and firm ownership

Market structures can influence labor shares in multiple ways. First of all, there are important intersectoral differences with regards to market concentration (measured e.g. by the Herfindahl–Hirschman index),[7] openness to international trade, ownership structure, received external donations 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, discussed already above. There is however a significant temporal dimension to these differences. In 1995–2008, Poland has been undergoing restructuring, real convergence with the EU, privatization, inflows of FDI, consecutive reductions in tariffs, quotas, etc., and increased participation in international trade. Some sectors have 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 enterprises, 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 in value added than privately owned enterprises. 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.

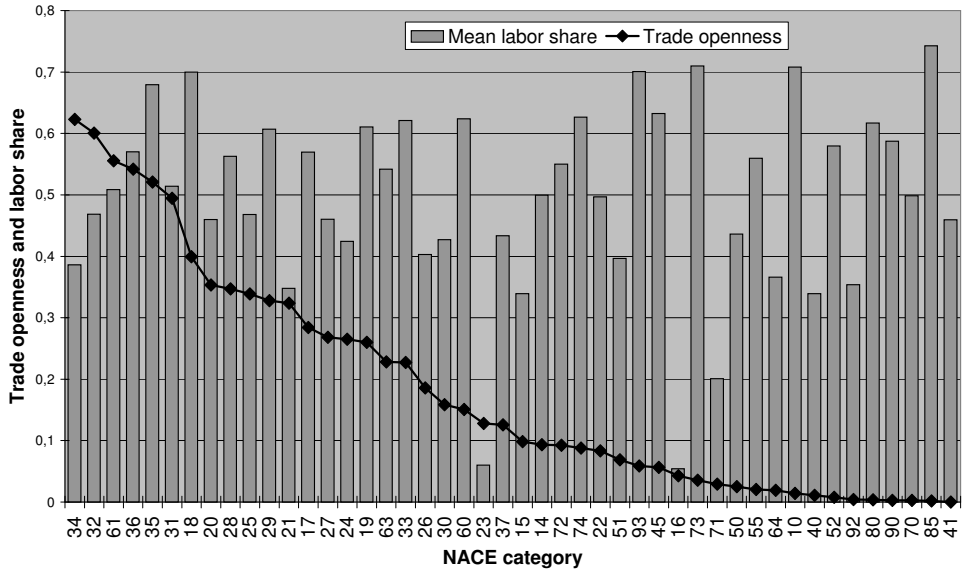
A higher tax wedge on labor income (measured as the ratio of firms' labor tax payments to gross remuneration of their employees) should, on the other hand, go together with a lower labor share because it provides an incentive to substitute workers with capital. It also lowers the bargaining position of workers vis à vis employers, for whom total costs of workers' employment seem very high relative to their productivity.

[7] The Herfindahl–Hirschman index, apart from being a measure of market concentration, can also be viewed as a proxy measure of competitiveness of a sector. An alternative proxy measure of competitiveness of a sector is the Lerner index, 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). An instructive corollary from their study is that they did not find any clear-cut positive correlation between their estimated markups and the Herfindahl index. This led them to the conclusion that intersectoral heterogeneity of markups may result from other factors (level of product differentiation, price regulations, etc.) which are not included in indices of concentration.

Furthermore, given the transition and post-transition background in the Polish enterprise 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 a decreasing demand. They are mostly concentrated 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 adhered 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.

Figure 7: Trade openness and the labor market share across sectors (NACE Rev. 1.1).



Source: own computations based on GUS data.

4 Main results

To quantify the impacts of all aforementioned variables on firms' labor shares, we have run three series of nested, hierarchical regressions. All these regressions, run to verify the competing hypotheses, have been 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 OLS estimators are inappropriate either, because of the correlation of firm-specific observables with the error term. We also included seasonal dummies to all regressions to capture deterministic seasonal variation in salaries and (most importantly) value added.

Let us now proceed to the presentation of our principal results.

4.1 Firm demographics

Our first inquiry focused on the impact of firm demographics on the observed changes in the labor share. We have run a series of hierarchic regressions, so that we could test the robustness of the impact on the labor share of our three principal variables: (i) firm age, (ii) the entrant dummy, and (iii) the quitter dummy. To have a reliable dataset, we limited our sample to firms that entered the sample after 1995Q1, so that their age could be properly defined. This restricts our sample from about 660,000 to about 386,000 observations (from about 35,000 to about 25,000 firms), making our estimates less reliable than those based on full sample. Proper statistical inference can still be made nevertheless.

In Table 5 we see 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: controlling for pure time effects, firm age affects the labor share positively, not negatively; controlling for firm size as well changes neither 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 who are most likely to employ new, more capital-intensive technological vintages, and the quitters who often operate outdated technology, and thus increased

[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 our dataset. See the Appendix for more details.

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

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.

All aforementioned findings are however not 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, and new matches move closely against this rule.

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

Table 5: The impact of firm age, entry and exit on the labor share.

	[1]	[2]	[3]	[4]	[5]	[6]
	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare
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 op. (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)
state owned				0.0309***	0.0288***	0.0289***
				(0.00341)	(0.00334)	(0.00338)
commune 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/VA				-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	386847	386847	386847	386847	385591	378562
R-squared	0.007	0.008	0.008	0.009	0.010	0.016
Number of idn	24998	24998	24998	24998	24920	24440

4.2 Labor market characteristics

We have by now 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 importance and robustness of the impacts of labor market characteristics – that is, labor market tightness, and newly filled vacancies – themselves.

In Table 6 we see 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 which suggests 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, due to wage rigidities and high bargaining power of insider 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 our 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 to form 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 on the other hand negatively related to the labor share.

Another important group of labor market variables is consituted by our two sectoral human capital measures, taken from EU KLEMS, that is the share of high- and medium-skilled remuneration in the total wage bill (low-skilled remuneration taken as reference category). We find that both these shares are associated with lower labor shares in value added, corroborating the capital–skill complementarity hypothesis (Krusell et al., 2000): wherever a newer, more capital-intensive vintage of machines is employed, its usage requires the firms to hire sufficiently skilled workers to operate it, but then these machines become a more efficient substitute for low-skilled labor. In result, the share of high-skilled labor pay 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 which 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 distur-

Table 6: The impact of labor market tightness and newly filled vacancies on the labor share.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare
quarter 1	0.0242***	0.0244***	0.00945***	0.00317***	0.00304***	0.00307***	0.00244***	0.00232***	0.0112***	0.0321***
	(0.000530)	(0.000530)	(0.000787)	(0.000874)	(0.000874)	(0.000860)	(0.000866)	(0.000865)	(0.00119)	(0.000720)
quarter 2	0.0440***	0.0382***	0.0122***	-0.00190	-0.00201	0.000534	0.000602	0.000324	0.00770***	0.0420***
	(0.000725)	(0.000817)	(0.00145)	(0.00165)	(0.00165)	(0.00162)	(0.00162)	(0.00162)	(0.00215)	(0.00106)
quarter 3	0.0251***	0.0211***	0.0174***	-0.00391**	-0.00408**	-0.00297*	-0.00291*	-0.00311*	-0.000315	0.0226***
	(0.000602)	(0.000653)	(0.000738)	(0.00168)	(0.00168)	(0.00165)	(0.00165)	(0.00165)	(0.00222)	(0.000843)
tightness	0.0176***	0.00982***	0.0102***	0.00878***	0.00893***	0.00944***	0.00909***	0.00855***	0.00615**	0.0135***
	(0.000830)	(0.000974)	(0.00152)	(0.00162)	(0.00162)	(0.00160)	(0.00161)	(0.00160)	(0.00251)	(0.00146)
matches	-0.000915***	-0.000783***	-0.000451***	-0.000367***	-0.000370***	-0.000421***	-0.000435***	-0.000435***	-0.000475***	-0.000734***
	(1.45e-05)	(1.68e-05)	(3.00e-05)	(3.45e-05)	(3.45e-05)	(3.40e-05)	(3.43e-05)	(3.42e-05)	(4.68e-05)	(2.35e-05)
medium skilled		-0.00226***	-0.00137***	-0.000798***	-0.000809***	-0.00101***	-0.00133***	-0.00108***	-0.00222***	-0.00450***
		(0.000261)	(0.000278)	(0.000299)	(0.000299)	(0.000294)	(0.000307)	(0.000307)	(0.000488)	(0.000414)
high skilled		-0.00272***	-0.00173***	-0.00121***	-0.00116***	-0.00149***	-0.00188***	-0.00159***	-0.00320***	-0.00545***
		(0.000233)	(0.000250)	(0.000273)	(0.000273)	(0.000269)	(0.000287)	(0.000288)	(0.000499)	(0.000415)
tightness(lag 1)			0.00443***	0.00721***	0.00739***	0.00743***	0.00810***	0.00780***	0.0129***	
			(0.00158)	(0.00192)	(0.00192)	(0.00189)	(0.00189)	(0.00189)	(0.00295)	
matches(lag 1)			-0.000450***	-0.000231***	-0.000231***	-0.000206***	-0.000201***	-0.000207***	-0.000168***	
			(2.91e-05)	(4.19e-05)	(4.19e-05)	(4.11e-05)	(4.11e-05)	(4.11e-05)	(5.51e-05)	
tightness(lag 2)				-0.000559	-0.000462	8.16e-05	7.94e-05	-0.000209	0.00251	
				(0.00167)	(0.00167)	(0.00165)	(0.00166)	(0.00166)	(0.00259)	
matches(lag 2)				-0.000358***	-0.000364***	-0.000303***	-0.000303***	-0.000309***	-0.000285***	
				(3.15e-05)	(3.15e-05)	(3.11e-05)	(3.12e-05)	(3.12e-05)	(4.36e-05)	
firm size					3.91e-06***	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 op. (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***
commune owned								0.0430***	0.0987***	0.0661***
foreign owned								-0.0187***	-0.0161***	-0.0183***
donations/VA								0.0212***	0.0574***	0.0528***
firm age									0.000586***	0.000519***
quitter									0.00809***	0.00222
entrant										-0.000131
Constant	0.712***	0.925***	0.857***	0.818***	0.818***	0.834***	0.869***	0.843***	0.915***	1.112***
Observations	618653	618653	506953	426032	426032	425245	425245	425245	250141	378562
R-squared	0.012	0.012	0.011	0.012	0.013	0.014	0.014	0.015	0.016	0.016
Number of idn	33831	33831	30732	27824	27824	27789	27789	27789	19360	24440

bances. We find that whereas in the cross-section, firms in sectors with higher shares of high- and medium-skilled remuneration have on average lower labor shares, *upward shifts* in the share of high- and medium-skilled 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 other empirical evidence, just like in the previous subsection. Some of them will be discussed later on in the paper.

4.3 Market structures

We can now turn to the impact of market structures on the labor share. Our variables of interest now are trade openness (export revenues as a share in total revenues), tax wedge on labor, and the Herfindahl-Hirschman index, measuring concentration in each 2-digit industry.

As shown in Table 7, we find that firm-level export orientation is robustly positively related to its labor share in value added. Even though the impact is very modest, it is important to note that this direction of relationship runs contrary to our 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 we see 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 (2001–04) was proceeded 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 our 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] where we included the sector-specific average of our trade openness measure as well as its cross-time average (i.e., a sector-specific effect). In such 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.

We also find that tax wedge on labor is negatively related to the labor share, in line with our prior expectations, 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, and so the power of workers to bargain higher wages should be high as well. Given this context, our further result might turn out quite puzzling: we also find that the coefficient on the cross-time average of each sector's Herfindahl-Hirschman index is 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.

4.4 Control variables

Finally, we should also comment on the results obtained for our conditioning variables, included in numerous regressions in Tables 5, 6 and 7. The signs of relevant coefficients

Table 7: The impact of market structures on the labor share.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare
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)
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)
commune 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/VA				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 op. (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)
high 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	659559	659559	659559	659559	659559	616958	616958	378562
R-squared	0.004	0.005	0.005	0.007	0.007	0.015	0.015	0.016
Number of idn	35270	35270	35270	35270	35270	33752	33752	24440

are in line with our prior 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: firm which obtain relatively more donations also have higher labor shares. This agrees with the interpretation that in Poland, donations are usually directed to firms which use outdated, labor-intensive technologies, and have hard time surviving in competitive markets.
- Ownership still plays an important role in Poland: state-owned, treasury-owned, and commune-owned companies record significantly higher labor shares than private enterprises, whereas domestic private enterprises 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 labor shares between mining, manufacturing, and services. We included the mining and manufacturing sector dummies in our regressions, keeping the service sector as our reference category. We obtain two results. Firstly, labor share is generally larger in mining than in services, but the dummy becomes insignificant when one includes human capital variables into 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 then becomes insignificant once labor market tightness and new matches are included in the regression, and finally it 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%.
- There are significant differences in the labor share across quarters of the year. We took quarter 4 (October–December) as our reference category, and included dummies for all three other quarters in the regressions. We find that labor share is significantly higher in first quarters than in fourth quarters of the year, in all regression specifications. 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.

5 Conclusion

In the current paper, we have analyzed the firm-level determinants of the labor share. The objective of the paper was to identify, using our unique quarterly firm-level panel dataset from the Polish enterprise sector in 1995–2008, 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 has been decomposed into contributions attributable to inter-sectoral reallocation of production, asymmetric changes in wages, and intra-sectoral shifts in the labor share. The results of that study indicated that around 44% of the total shift in labor share could be attributed to inter-sectoral reallocation, but almost no variance could.

Here we scrutinize the intra-sectoral shifts in more detail, identifying the impacts of changes in general labor market characteristics, firm demographics, market structures, and human capital variables. Our dataset enables us to draw precise conclusions on the relative importance of particular variables in explaining the variability of labor shares across firms and time.

We conclude 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. Our results are robust to the inclusion of time dummies in the regressions beside firm 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 our dataset. Instead, we can confidently claim that we have identified genuine determinants of the labor share across enterprises.

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Appendix. Robustness checks

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

A.1 Including time dummies

Our first robustness check consists in including time dummies in the regressions. By doing so, we eliminate the impact of business-cycle correlations on the labor share. Since we also control for firm-level fixed effects, we remain only with the genuine impacts of variables with both cross-sectional and intertemporal variability. We are thus unable to account for the impacts of labor market tightness and new employer-employee matches on the labor share, as these variables are available only as time series.

Results of this robustness check are presented in Table 8. In this table, we redo the series of regressions focused on firm demographics, but this time with time dummies. As compared to Table 5, we notice the following important difference: the sign of the coefficient on firm age has changed from negative to positive. It is now found that controlling for pure time effects, firm age affects the labor share positively. This holds true even when firm size is controlled for as well. We conclude that the apparent negative result presented in the main table might be spurious and primarily due to the simultaneous decline in the labor share and rise in average firm age in our dataset. The latter regularity is due to the fact that we had no information on the age of firms present our data already in the first quarter of 1995, and thus we had to exclude them from our data.

Other results presented in Table 5 are robust to the inclusion of time dummies.

Table 8: The impact of firm demographics, market structures and ownership on the labor share. Regressions including both fixed effects and time dummies.

	[1]	[2]	[3]	[4]	[5]
	laborshare	laborshare	laborshare	laborshare	laborshare
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 op. (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)
commune owned				0.0664***	0.0630***
				(0.00725)	(0.00708)
foreign owned				-0.0169***	-0.0175***
				(0.00253)	(0.00248)
donations/VA				-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	386847	386847	386847	386847	385591
R-squared	0.018	0.019	0.019	0.020	0.021
Number of idn	24998	24998	24998	24998	24920

A.2 Allowing for autocorrelated residuals

Another robustness check for our results involves allowing the residuals of our 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 9 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 1% confidence level. This change does not, however, overturn the principal results obtained in Tables 5–7.

Table 9 is a revised version of Table 6. The only difference is that we have now allowed our exogenous disturbances to be AR(1). There are two important differences between the results reported in these two tables. First, the coefficients in Table 9 are generally more precisely estimated and thus more often statistically significant. Secondly, and more importantly, the signs on the shares of high-skilled and medium-skilled remuneration have now reversed from negative to positive. By including time-series autocorrelation into our analysis, we can therefore conclude that whereas in the cross-section, firms in sectors with higher shares of high- and medium-skilled remuneration have on average lower labor shares, *upward shifts* in the share of high- and medium-skilled remuneration are expected to *raise the labor share*, not decrease it.

Table 9: The impact of labor market characteristics, firm demographics, market structures and ownership on the labor share. Regressions with AR(1) residuals.

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare
quarter 1	0.0341***	0.0229***	0.00594***	0.000598	0.000378	-0.000495	-0.000509	0.00775***	0.0300***
	(0.000508)	(0.000505)	(0.000747)	(0.000829)	(0.000830)	(0.000836)	(0.000836)	(0.00116)	(0.000700)
quarter 2	0.0318***	0.0401***	0.0150***	0.00158	0.00116	0.00120	0.000779	0.00911***	0.0465***
	(0.000756)	(0.000820)	(0.00144)	(0.00164)	(0.00164)	(0.00164)	(0.00164)	(0.00219)	(0.00109)
quarter 3	0.0193***	0.0211***	0.0172***	-0.00198	-0.00222	-0.00234	-0.00282*	0.000889	0.0241***
	(0.000589)	(0.000623)	(0.000708)	(0.00165)	(0.00165)	(0.00165)	(0.00165)	(0.00223)	(0.000827)
tightness	0.0341***	0.0179***	0.0150***	0.0132***	0.0132***	0.0133***	0.0127***	0.00933***	0.0152***
	(0.000932)	(0.00103)	(0.00147)	(0.00160)	(0.00160)	(0.00160)	(0.00160)	(0.00260)	(0.00160)
matches	-0.000284***	-0.000856***	-0.000536***	-0.000532***	-0.000527***	-0.000560***	-0.000554***	-0.000617***	-0.000893***
	(1.57e-05)	(1.79e-05)	(3.11e-05)	(3.39e-05)	(3.39e-05)	(3.41e-05)	(3.41e-05)	(4.71e-05)	(2.47e-05)
medium skilled		0.00773***	0.00738***	0.00833***	0.00828***	0.00821***	0.00816***	0.00772***	0.00700***
		(5.39e-05)	(5.81e-05)	(6.77e-05)	(6.80e-05)	(7.14e-05)	(7.20e-05)	(0.000111)	(8.40e-05)
high skilled		0.00566***	0.00566***	0.00659***	0.00662***	0.00670***	0.00672***	0.00658***	0.00566***
		(7.18e-05)	(8.15e-05)	(9.63e-05)	(9.65e-05)	(9.79e-05)	(9.82e-05)	(0.000172)	(0.000128)
tightness (lag 1)			0.00920***	0.00830***	0.00849***	0.00949***	0.00913***	0.0104***	
			(0.00152)	(0.00177)	(0.00177)	(0.00178)	(0.00178)	(0.00287)	
matches (lag 1)			-0.000422***	-0.000196***	-0.000197***	-0.000197***	-0.000194***	-0.000185***	
			(2.98e-05)	(3.95e-05)	(3.95e-05)	(3.95e-05)	(3.95e-05)	(5.35e-05)	
tightness (lag 2)				0.00448***	0.00450***	0.00551***	0.00504***	0.00556**	
				(0.00164)	(0.00165)	(0.00165)	(0.00165)	(0.00267)	
matches (lag 2)				-0.000314***	-0.000322***	-0.000334***	-0.000344***	-0.000296***	
				(3.21e-05)	(3.22e-05)	(3.22e-05)	(3.22e-05)	(4.48e-05)	
firm size					3.48e-06***	3.50e-06***	3.40e-06***	4.78e-06***	4.19e-06***
trade openness					0.00507***	0.00469***	0.00497***	0.00432***	0.00399***
labor wedge					0.00458***	0.00503***	0.00452***	0.0247***	0.00987***
herfindahl					0.0374***	0.0522***	0.0483***	0.0928***	0.0712***
trade openness (sector)						0.0199***	0.0216***	0.0256***	0.0201***
trade op. (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***
commune owned							0.0566***	0.111***	0.0629***
foreign owned							-0.0163***	-0.0114***	-0.0154***
donations/VA							0.0218***	0.0556***	0.0538***
firm age								4.36e-05	-0.000115**
quitter								0.00519**	0.00227
entrant									0.0591***
Constant	0.658***	0.0290***	0.0694***	-0.00581	-0.00614	-0.00660	-0.00787	-0.00895	0.0480***
Autocorrelation of eps	0.152	0.152	0.152	0.154	0.153	0.153	0.152	0.131	0.131
Observations	582813	582813	474933	397274	397274	397274	397274	230669	353861
Number of idn	31624	31624	28366	25282	25282	25282	25282	17371	22585

A.3 Including the ratio of capital assets to value added

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

Table 10: 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]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare	laborshare
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)
commune 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/VA				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 op. (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)
high 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	201575	201575	201575	201575	201575	201575	201575	146462
R-squared	0.006	0.006	0.006	0.007	0.008	0.011	0.012	0.014
Number of idn	22754	22754	22754	22754	22754	22754	22754	17698

To check the validity of our main results, we have nevertheless re-run the regressions from Table 7 on the reduced dataset, including the capital to value added (K/Y) ratio as an additional conditioning variable. The results are contained in Table 10. We see there that in our 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) for one- and two-digit industry-level data from 12 OECD countries in the period 1970–95, in a log–log specification.

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 now, due to a marked reduction of the size of our dataset, but their signs are generally robust. Comparing Table 7 to Table 10, we also see that the coefficient on the Herfindahl 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 are now generally insignificant (but have the same sign).

One interesting exception is that after controlling for the K/Y ratio, entrants have above-average, and not below-average, labor shares. This discrepancy in our results is driven by the large differences in capital intensity between these two groups of firms: entrants in our dataset have (on average) almost twice as high capital intensities as incumbent firms.