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Measuring the Labor Share for Poland – Does Heterogeneity of Labor Compensation Matter?

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Abstract

The measurement of the labor share is subject to a bias due to the income of self-employed (the mixed income). The aim of this study is to address this bias using a number of assumptions. We present our results for Poland, where both the self-employed and mixed income have high shares in employment and value added, respectively. In our calculations we account for the differences in socio-demographic characteristics of populations of both employees and self-employees and the differences in tax rates. The latter is our original contribution to the issue of measurement of the labor share. We show that in Poland, the correction of raw labor share with a fraction of mixed income increases labor share by an average of 8-13%, with the most reliable estimates being in a lower part of the range. Moreover, the treatment of the self-employed in agriculture is important. We also show that the corrections applied amplify the upward tendency in the labor share, observed since 2012. There are differences in sectoral labor shares – downward tendencies of labor shares dominate in manufacturing and other industries, whereas upward tendencies dominate in services. The shift-share decomposition revealed that the changing structure of the economy was roughly neutralized by the reallocation effect and the economy-wide movements are generated mostly by the within sector changes of labor shares.

Keywords: labor share, Poland, wage heterogeneity, self-employment, labor tax, shift share

JEL Classification: D24, D33, E01, E25, J31, O40

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1 Introduction

Labor share is a concept that is very useful in a number of fields of economics, spreading from growth theory to income distribution. However, its measurement is subject to a bias due to the income of self-employed (the mixed income). The aim of this study is to address this bias, extracting the labor income from mixed income using a number of assumptions. As in practice the remuneration of labor input of self-employed is hard to measure directly and is not observable, we impute their wages using wages of employees. Importantly, we apply our methods consistently with the national accounts.

In practice, this can be done in many ways, taking into account the characteristics of the industry where a firm is operating, the personal characteristics of the self-employed, and the differences in the tax wedge between employees and self-employed. We show that in Poland, the correction of raw labor share with a fraction of mixed income increses labor share by an average of 8-13%, but the most reliable estimates result in a smaller correction. Moreover, the treatment of the self-employed in agriculture is important, as it is a considerable part of the self-employment in Poland (agriculture accounts for 40% of self-employment in recent years, although declining from almost 70% in 2000, see Figure 1). We also show that the corrections amplify the upward tendency in labor share, visible since 2012.

The value added of the paper is twofold. First, it provides a comparison of the results of different methods accounting for mixed income in the measurement of labor share. Among them the paper offers an original method that explores differences in labor tax rates between employees and self-employed to arrive at a corrected measure of labor compensation for these two groups. Second, most of the discussion in the literature concentrates on the labor share estimates, its trends and sources of labor share changes in advanced countries, while emerging countries seem underrepresented. We are filling this gap and focus on Poland, which is interesting not only due to its lower level of development, but importantly – due to its prevalence of self-employment.

The paper is structured as follows. After the literature review in the next section, Section 3 discusses necessary definitions, sources of data and methods to measure labor share. In Section 4 we will present and discuss the results for Poland. Section 5 concludes.

2 Literature review

Studies on how production factors contribute to the income generated by economic activities have very long tradition within the economic science, coming back to classical economists (like Smith, Ricardo and Marx, but also in the contemporary era – see e.g. Solow, 1958). The popularity of this topic may be explained by the wide range of problems in economics, where labor and capital shares are important variables. For instance, the question of how production factors, labor and capital in particular,

contribute to the product (defined as value added) is crucial for understanding the mechanism of economic growth. On the one hand, factors' shares reflect the choice of production technology (see e.g. Alvarez-Cuadrado et al., 2018; Velasquez, 2023; Karabarbounis and Neiman, 2013) and on the other hand they are informative on how the product is distributed between employees and capital (see e.g. Elsby et al., 2013; Fund et al., 2017). Along with its usefulness in aggregate growth analysis, tracking changes in the remuneration of factors proved to be useful in analyzing structural changes in individual economies like the rise in the market power of producers and regulatory changes of labor markets (especially, the decline in the rate of unionization), see e.g. De Loecker et al. (2020) or Philippon (2019). The changes in the labor shares are sensitive to globalization processes, such as an increased openness of economies, a fragmentation of production, a relocation of labor-intensive production from highly developed to developing countries (off-shoring), stressed e.g. by Elsby et al. (2013). Furthermore, the distribution of income into the remuneration of the production factors gained importance over the last decades as increasing income and wealth inequalities turned out to be a feature of modern economies (see e.g. Stansbury and Summers, 2020; Piketty and Zucman, 2014).

The early empirical research (from late 1890s and early 1900s) found constant labor share (see discussion in Elsby et al., 2013), and it was one of the most important long-run regularities in economics – famous six *'stylized facts'* put forward by Kaldor (1961). The constant labor share had survived till the 1980s and a vast empirical research that followed documented a downward trend in labor share in the developed countries since then (according to Grossman and Oberfield, 2022 more than 12 thousand publications – *sic!* – verifying a hypothesis of a decline in labor share over years 2010 – 2020). Many potential causes of a declining trend in the labor share were identified and empirically tested. The capital-biased technical change, including automation and robotization, leading to an increase in capital intensity and capital productivity, which affects its remuneration, is probably the most often recognized source of the labor share decline (see Karabarbounis and Neiman, 2013; Alvarez-Cuadrado et al., 2018; Autor et al., 2020; Aghion et al., 2019, among others). Other authors point to weakening product market competition and the rise of market power and markups (here, both return to capital and profits, regardless of their source, are considered as a remuneration of capital). As suggested by De Loecker et al. (2020); Philippon (2019); Velasquez (2023) it implies a decline in labor share. (In case of Poland, there has been observed the fall of the aggregate markups over the last decades, despite the rising concentration on the aggregate level, see: Gradzewicz and Mućk, 2023; 2020. Therefore, it might mitigate the decline in labor share or support its rise, under *ceteris paribus* conditions.) Stansbury and Summers (2020) and Glover and Short (2020) found a long-term decrease in employees' negotiating position as an important source of a decrease of labor share. Moreover, certain characteristics of globalization processes, such as a fragmentation of production with a relocation of labor-intensive production to less developed countries put a downward pressure on

labor shares in the advanced economies, see e.g. Elsby et al. (2013); Schwellnus et al. (2018).

However, some studies question a decrease in the labor share, raising methodological problems related to its measurement, data quality and a limited international comparability of results, see Grossman and Oberfield (2022); Cho et al. (2017); Cette et al. (2019). The problem of a correct measurement of labor share is related to a missing income generated by labor input of self-employed in the national accounts, see OECD (2001); Freeman (2011); Krueger (1999). The overall income from the business activity of self-employed is reported in the national accounts jointly as mixed income, and separating out the remuneration of labor is arbitrary, see Grossman and Oberfield (2022). Moreover, the chronic underreporting of the incomes of the self-employed in economic surveys (which are sometimes the basis of compilation of national accounts) could additionally bias the results, as emphasized by e.g. Freeman (2011).

There are also problems with a proper measurement of the capital income. A concept of gross operating surplus (GOS) used in the national accounts as the compensation to capital services is a balancing item in the generation of income and is a mixture of a pure remuneration to capital, profits, production taxes and depreciation – see Gollin, 2002; Bridgman, 2018; IMF, 2017 (the two latter ingredients are usually measured separately). Moreover, Cette et al. (2019) recommends the exclusion of residential housing capital from the estimations, since it is not a part of the productive capital of the economy and its inclusion leads to an overestimation of the capital share. Additionally, calculation of long series of labor share is distorted by changes in the definition of capital. The most notable change was a reclassification of intellectual property rights (Intellectual Property Rights (IPPs) cover: 1) research and development, 2) mineral exploration and evaluation, 3) computer software and databases, and 4) entertainment, literary, and artistic originals) from the intermediate consumption into the investment expenditures introduced by UN (2010) (see Koh et al., 2020, for a discussion). Another example refers to the statistical reclassification of the research and development, and military systems to capital formation in national accounts from 2010 onwards, as required by the ESA2010 (2013).

The measurement problems concern also the boundaries of the national economy aggregate. Apart from the exclusion of residential housing capital, Cette et al. (2019) argues for excluding non-market services (as the remuneration of factors here do not reflect a market valuation) or financial sector, as its most important component of value added (financial intermediation services indirectly measured – FISIM) has a rather vague interpretation. Moreover, Grossman and Oberfield (2022) opts for limiting the scope of the economy to the non-farm business (Bureau of Labor Statistics officially publish labor share in this way).

Adjusting raw labor share indicator for the above-mentioned problems may change both the level and the path of labor share. Freeman (2011) showed for the USA that adjusting for the self-employment and taking into account the socio-economic characteristics of workers and the self-employed does not change the downward trend

of the labor share. IMF (2017) showed that netting out capital depreciation from value added does not significantly change the observed labor share trends and does not alter the factors explaining them, while Cho et al. (2017) noticed that using net value added (without depreciation) makes the downward trend in labor share no longer present. Cette and Ouvrard (2018) and Gutiérrez and Piton (2020), among others, argue that omitting the residential real estate sector and limiting the analysis to the market sector, makes the downward trend in labor share no longer visible for many developed countries.

Most of the literature concerning declining labor shares concentrates on advanced countries, notably the US economy. Kónya et al. (2020) and Dimova (2019) estimate labor shares for EU countries, including Central and Eastern European Union countries (CEEU). Kónya et al. (2020) provides an evidence for a lower labor shares in CEEU countries compared to the rest of EU member states due to the lower share of services in the former. (Kónya et al., 2020 offers a theoretical explanation of a relatively lower labor share in CEEU countries, based on Hsieh and Klenow, 2009. In a nutshell, countries enjoy higher productivity, especially in the investment products, resulting in a greater capital-labor ratio. Under capital-labor complementarity, labor share will rise accordingly.) The authors also point that the convergence process, leading to an increase in the share of services in GDP in CEEU countries will cause a rise of aggregate labor shares. Moreover, Kónya et al. (2020) did not find any evidence for a decline in labor shares in CEEU countries in period 1995-2018. Dimova (2019) identifies a downward trend of a labor share in the EU over the period 2002-2016 (it is explained by a standard group of factors, including technology, globalization and changes of some labor institutions, like a shrinking unionization and the erosion of the employment protection), but it is less visible for an average of CEEU countries. Moreover, there is a substantial variation among individual countries and over the sub-periods of 2002-2016. The paper emphasizes some structural factors that can lead to an increase in the labor share in the CEEU countries: a specialization in labor-intensive export manufacturing products and an increasing weight of services in the economies.

There is a handful of papers on labor share in Poland. Growiec (2009, 2012) based the estimation of the labor share on micro data from corporate financial statements for the period 1995-2008. The advantage of this approach is a possibility to explain labor share developments with firms characteristics like ownership or a propensity to export. The disadvantage of this method is that the labor of self-employed is not isolated in financial statements and therefore cannot be used to estimate labor share. According to the study, this leads to an underestimation of labor share by 5-10 pp. Sectoral breakdown indicates that labor share decreased in manufacturing and increased in services, reflecting relatively faster productivity growth in the former sector. Zalas and Drążkowski (2023) also exploits enterprise micro data, using a longer 1995-2019 sample taken from ORBIS database, with relatively smaller and non-representative coverage. The study points to the relative stability of a labor

share during the analyzed period, with a decrease in the labor share in industry and a compensating increase in services.

These rather scanty labor share estimates for the CEEU countries, including our results for Poland, ought to be examined bearing in mind the particularity of their economies compared to more advanced countries. The CEEU countries have undergone massive reforming processes since the beginning of 1990s aimed at re-establishing the market economy system. From the point of view of the evolution of the labor share, probably the most important element of this process was the opening of these economies to the global markets. This factor alone produced, on the one hand, the inflow of the foreign capital (together with new technologies and up-to-date organization systems) and on the other – the re-allocation of production factors to the revealed this way comparative advantages. Both mechanisms triggered rapid productivity improvements and set in motion the convergence of CEEU economies to advanced economies in terms of the level of GDP. Specifically, McKinsey (2019) documents a decisive role of Poland's joining European Union in 2004 in accelerating growth to become the fastest-growing economy of EU in the next decades. Hagemejer and Mućk (2019) shows the key contribution of exports to fast convergence facilitated to a large extent by foreign owned firms in Poland and other CEEU countries. Hagemejer and Ghodsi (2017) highlights the fact that participation of firms from Central and Eastern Europe in global value chains (GVC) create spillovers to domestic firms, fostering their productivity. The complex processes of transformation in CEEU countries affected also labor shares at both sectoral and aggregate levels, and make the evidence on labor share trends in advanced economies not fully applicable to the experience of CEEU countries.

3 Definitions, data, and measurements

The aim of the paper is the refinement of the measurement of the labor share by accounting for all labor income that is recorded and attributed to the value added (VA_{it}). The statistical definition of the value added in sector i (where i could be both a NACE sector or the total economy) in period t is as follows:

$$VA_{it} = COE_{it} + MI_{it} + GOS_{it} + TAX_{it} = w_{it}^{coe} EMP_{it} + MI_{it} + GOS_{it} + TAX_{it}, \quad (1)$$

where COE_{it} is the compensation of employees, MI_{it} is a mixed income, GOS_{it} is a gross operating surplus and TAX_{it} are taxes (net of subsidies) levied on production. Labor costs can be expressed as a product of average labor cost $w_{it}^{coe} = COE_{it}/EMP_{it}$, and a number of employees, EMP_{it}. Most data is directly observed in the national accounts (NA) and we use the Eurostat databases as sources. The number of employees (as well as self-employed) is defined consistently with NA and also taken from Eurostat database (we use the domestic concept of measurement of both measures of employment). The sectoral coverage of the data allows us to use the 1-digit NACE definitions of industries.

The basic definition of the labor share LS^*_{it} is a fraction of income (value added) that is attributed to labor costs: $LS^*_{it} = COE_{it}/VA_{it} = (w^{coe}_{it} EMP_{it})/VA_{it}$. This simple concept is disturbed by mixed income, which is a surplus (or a deficit) accruing from production by unincorporated enterprises owned by households. It implicitly contains an element of remuneration for work done by the owner, or other members of the household, that cannot be separately identified from the return to the owner as an entrepreneur. It follows that we can use the data on a number of self-employed (defined in NA as the sole or joint owners of the unincorporated enterprise), $SELF_{it}$, and some definition of wages (say, w_{it}), to extract labor income from mixed income. As a result: $MI_{it} = w_{it} SELF_{it} + GOS^{MI}_{it}$, where GOS^{MI}_{it} is a residual gross operating surplus of the self-employed, and the labor share becomes:

$$LS_{it} = \frac{w^{coe}_{it} EMP_{it} + w_{it} SELF_{it}}{VA_{it}}. \tag{2}$$

The general way to proceed with equation (2) is to set the level of wage of the self-employed person to the level that he or she would receive if he or she worked in the 'average' corporate within the identical NACE sector.
The simplest way, which is commonly found in the literature (see e.g. Gollin, 2002), is to assume that the self-employed has the same average compensation (including social contributions) as an employee. In this case $w_{it} = w^{coe}_{it} = COE_{it}/EMP_{it}$ and equation (2) becomes:

$$\begin{aligned} LS^{agg}_{it,coe} &= \frac{w^{coe}_{it}(EMP_{it} + SELF_{it})}{VA_{it}} = \frac{w^{coe}_{it} EMP_{it} \frac{EMP_{it} + SELF_{it}}{EMP_{it}}}{VA_{it}} = \\ &= LS^*_{it} \frac{EMP_{it} + SELF_{it}}{EMP_{it}}. \end{aligned} \tag{3}$$

The approach described above is data-parsimonious. Additionally to national accounts data, it only uses information on the share of employees in employment. However, the approach introduces one unwanted discrepancy with the national accounts. The correction with a share of employees in employment applies not only to wages and salaries, bur also to the employers' social contributions, effectively scaling it up. However, in the NA the employers' social contributions defined as a difference between compensation of employees and wages and salaries (NA codes: D1 and D11, respectively) almost exactly coincides with a sum of employers' actual and imputed social contributions (NA codes: D611 and D612, respectively), calculated for the total economy. It implies that if self-employed are paying any employer's social contributions they are already recorded as a part of compensation of employees and should not be double-counted in the mixed income.
The above considerations imply that in order to value the labor input of self-employed, we should use an average wage and salaries ($w^{gross}_{it} = WS_{it}/EMP_{it}$, where WS_{it} are wages and salaries), and not compensations of employees.

We can denote the difference between compensations of employees and wages and salaries as: $COE_{it} - WS_{it} = w_{it}^{coe} EMP_{it} - w_{it}^{gross} EMP_{it} = \tau_{it}^{coe} w_{it}^{gross} EMP_{it}$, where $\tau_{it}^{coe} = (COE_{it} - WS_{it})/WS_{it}$ measures the rate of social contributions paid by the employer. Thus, we may use $w_{it}^{coe} = (1+\tau_{it}^{coe}) w_{it}^{gross}$, and equation (2) becomes:

$$LS_{it}^{agg} = \frac{(1 + \tau_{it}^{coe}) w_{it}^{gross} EMP_{it} + w_{it}^{gross} SELF_{it}}{VA_{it}}. \tag{4}$$

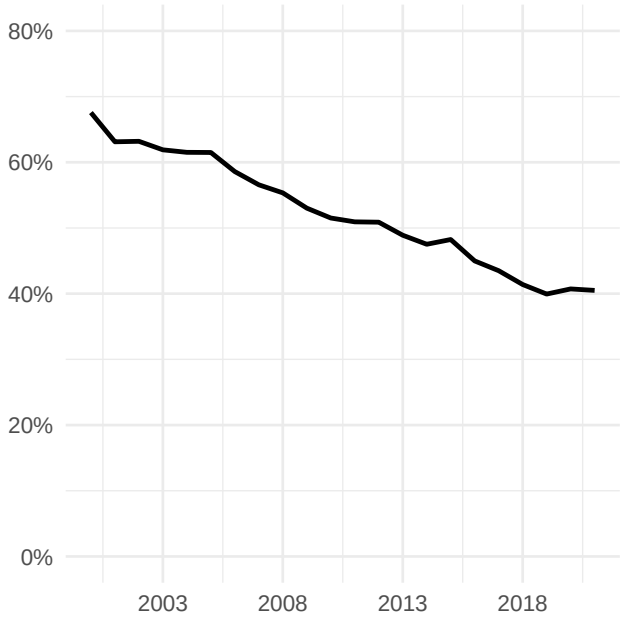
In other words, in LS_{it}^{agg} we use gross wages to remunerate the work of the self-employed and we add the whole employers' social contributions to the labor share (which should be the case, regardless the self-employed are paying these social contributions or not). In terms of for data, the correction given in equation (4) again uses the mixture of sectoral employment and national accounts data, without any additional data sources.

One additional caveat with applying equation (4) is that it does not preclude the calculated remuneration of labor of the self-employed to exceed the value of mixed income in some sectors, provided the latter is observed. It is actually the case of agriculture in Poland – about a half of self-employment is concentrated in agriculture (see Figure 1). (Agriculture is a very diversified sector with respect to the type of firms: mostly small, often subsistence farms and the minority of bigger corporates. Naturally, wages in the former are much smaller than in the latter.) Thus, the average gross wages calculated from the national accounts are relatively high (as they mainly include wages of workers in bigger corporates in agriculture) and the resulting estimate of labor share highly exceeds 100% – see Figure 1 (Kónya et al., 2020 report the same measurement problem also for Romania, Slovenia and Bulgaria where there is also prevalence of subsistence farms). The solution to this problem is either to exclude agriculture from the calculation of the labor share, or to restrict the value of the labor input of the self-employed not to exceed the mixed income. We choose the latter approach (the main results of our analysis for the total economy, excluding agriculture are presented in Figure A1 and Table A2 in the Appendix), as we want to measure the economy-wide labor share. It follows that our measurement equation becomes:

$$LS_{it,mi}^{agg} = \frac{(1 + \tau_{it}^{coe}) w_{it}^{gross} EMP_{it} + \min\left(w_{it}^{gross} SELF_{it}, MI_{it}\right)}{VA_{it}}. \tag{5}$$

In equations (3)-(5) we use sector-average wages of employees to impute wages of self-employed in a corresponding sector. The implicit assumption in this procedure is that within a sector the subpopulations of employees and self-employed do not differ with respect to factors that may affect wages. The vast literature on the estimation of the Mincer equation (see e.g. Lemieux, 2006) found a number of firm-related and worker-related factors affecting wages. The heterogeneity in sectoral composition in the context of labor share was also taken into account by Freeman (2011). The extension of equation (5) to account for heterogeneity is straightforward. When we

Figure 1: Share of agriculture in total self-employed



Source: Own calculations based on Eurostat.

denote by $j \in J$ the characteristics, into which we decompose workers in sector i, then labor share becomes:

$$LS_{it}^{disagg} = \frac{\sum_j (1+\tau_{it}^{coe}) w_{ijt}^{gross} EMP_{ijt} + \min\left(\sum_j w_{ijt}^{gross} SELF_{ijt}, MI_{it}\right)}{VA_{it}}. \quad (6)$$

In practice, the empirical application of equation (6) is constrained by the available data, as one needs to decompose both employment and wages simultaneously. We use Labor Force Survey (LFS) data, in a disaggregation provided by Eurostat to measure employment (separately employees and self-employees) and the Structure of Earning Survey (SES) micro-data (Eurostat does not publish the disaggregations of wages that allow us to perform our calculations) to measure gross wages. It allows us to define J as a crossing of gender (2 categories) and age (3 categories: 15-24, 25-50, 51+), giving a total of 6 employment classes for each NACE sector and time period. We use the LFS data to calculate the structure (according to categories in J) of employees and self-employed separately on a time-sector grid and disaggregate the respective national accounts employment categories, to ensure consistency with the definitions of labor inputs in the NA. In case of time-sectors with no information from LFS we use the economy-wide structures calculated for a specific period. A right panel of Figure 2

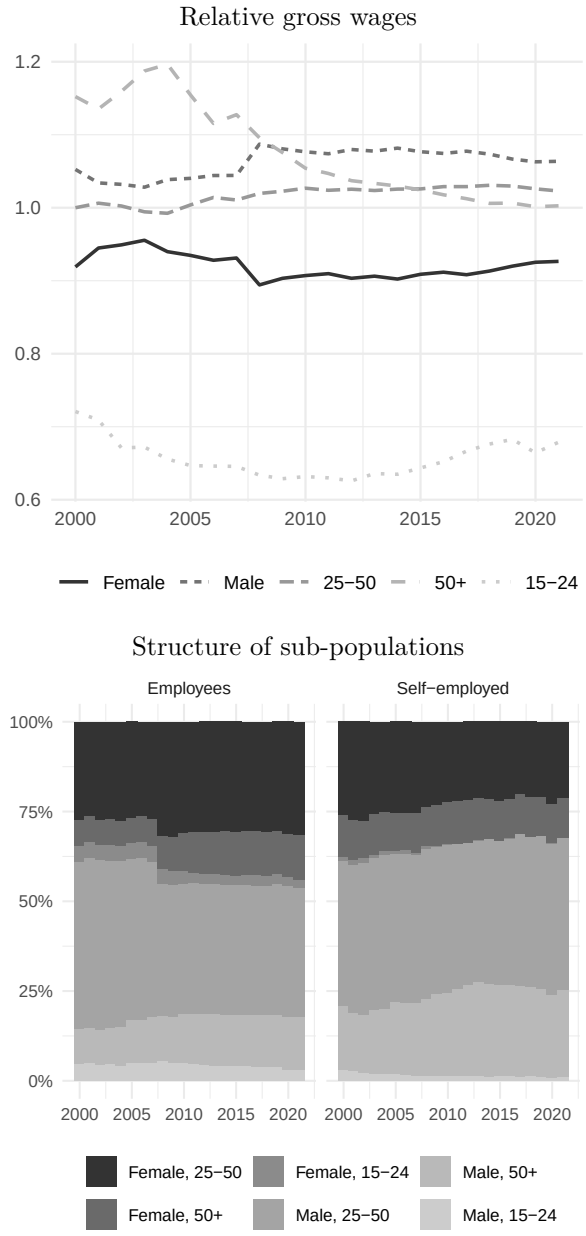
shows the differences in the structures of both sub-populations of employment. There are less females in self-employment and there is an over-representation of older males in this class, however, both sub-populations do not differ substantially.

In case of wages and SES data we define annual gross wages as twelve times the gross personal earnings for October (the month the survey is conducted). It is possible to include more ingredients of annual costs into the definition of wages, but for a shorter time horizon. SES is a two-year survey and we interpolate the missing intra-period observations using the log-average (so we assume constant growth rates in two consecutive periods). In case of sectors with missing data we use the time-gender-age averages for the total economy. Then, we additionally rescale the SES wages to assure consistency with sectoral national accounts, so in principle only the relative wages and differences in subpopulation structures matter for the disaggregation discussed here. A left panel of Figure 2 presents the aggregate wages of gender and age-related groups, relative to economy-wide wages, calculated consistently with national accounts. Apart from persistent (and expected) differences in relative wage levels, it shows a change in trend of wages of older employees – their wages were relatively high in the beginning of the 2000s and during the next 2 decades declined to the economy wide average.

The last adjustment we consider takes into account the differences in social contributions paid by the employees and self-employed. So far we have valued the labor input of the self-employed with a wage of an employee, assuming he or she would pay the same labor tax (social contribution) as an employee. In practice, the tax rates for self-employed are lower than for employees (see Figure 3), which is one of the reasons for self-employment. In fact, the self-employment category, as defined here, consist of two groups: self-employed in agriculture, who are insured mostly in the social insurance fund dedicated for farmers (KRUS in Polish), who were in principle paying mostly a reduced lump sum social contributions and no income tax. Another sub-group are the self-employed outside of agriculture and their social contributions and taxes are based in principle on the margin of 60% of average (or minimum, depending on year) salary in the economy, regardless of their actual gross income earned. Another issue refers to a changing legal basis in the analysed time span for the calculation of social contributions for self-employed outside agriculture. Due to the complex and varying rate of the labor taxation for these two sub-groups, we do not distinguish them directly in this paper. Thus, we may use the wage, net of taxes, of an employee to value the work of an self-employed and then apply the labor tax rates specific for his or her type of work. Denoting a type of employment with $k \in \{emp, self\}$ we have $w_{ijt}^{gross,k} = (1+\tau_t^k) w_{ijt}^{net}$ and equation (6) becomes:

$$\begin{aligned} LS_{it,net}^{disagg} &= \frac{\sum_j (1+\tau_{it}^{coe})(1+\tau_t^{emp}) w_{ijt}^{net} EMP_{ijt}}{VA_{it}} + \\ &+ \frac{\min\left(\sum_j (1+\tau_t^{self}) w_{ijt}^{net} SELF_{ijt}, MI_{it}\right)}{VA_{it}}. \end{aligned} \tag{7}$$

Figure 2: Gross wages of categories of employees, relative to total economy average (left panel) and structures of sub-populations of employment (right panel)



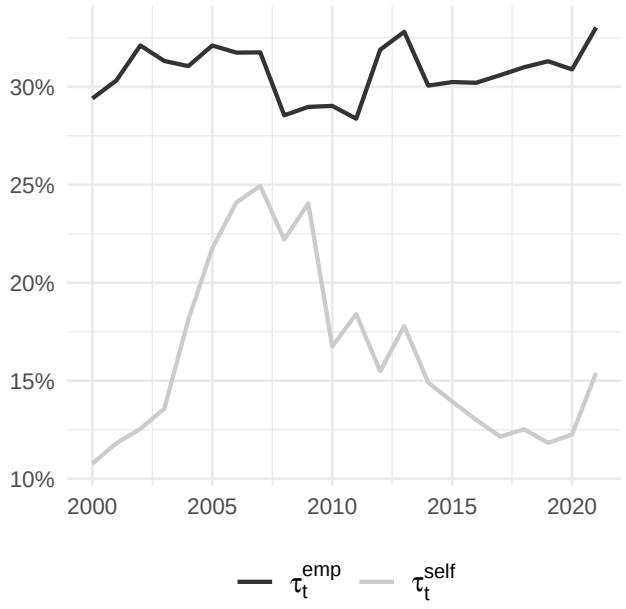
Source: Own calculations based on Eurostat and SES data.

We calculate both τ_t^k consistently with our measurement assumptions and coherently with national accounts. Net social contributions are composed of employers' social contributions and households' social contributions (plus service charges) – the former was used to construct τ_{it}^{coe}, the latter (SC_t^{hh}) – to construct τ_t^k. Households' total social contribution are composed of those paid by employees and self-employed:

$$SC_t^{hh} = SC_t^{emp} + SC_t^{self} = \tau_t^{emp} w_t^{net} \sum_i EMP_{it} + \tau_t^{self} w_t^{net} \sum_i SELF_{it}. \qquad (8)$$

SC_t^{emp} in equation (8) was taken from national accounts for institutional sectors, as households' social contributions (including service charges, related to the costs of the private pension system) paid by all subsectors of households, except for a subsector of self-employed households. It follows that $w_t^{net} = \frac{\sum_i WS_{it} - SC_t^{emp}}{\sum_i EMP_{it}}$, and $\tau_t^{emp} = \frac{SC_t^{emp}}{w_t^{net} \sum_i EMP_{it}}$, and τ_t^{self} is calculated indirectly from equation (8).

Figure 3: Households' social contributions rates



Source: Own calculations based on Eurostat and Polish Central Statistical Office data.

4 The results of the labor share calculations for Poland

In this section we present and discuss the results of applying different assumptions when calculating labor share, in accordance with their growing complexity: first the pure national accounts' concept, then the subsequent modifications described in the methodological section. The payroll measure of labor share, $LS_{payroll}$, defined directly as the share of compensation of employees in value added, equation (2), is depicted in the top left panel of Figure 4.

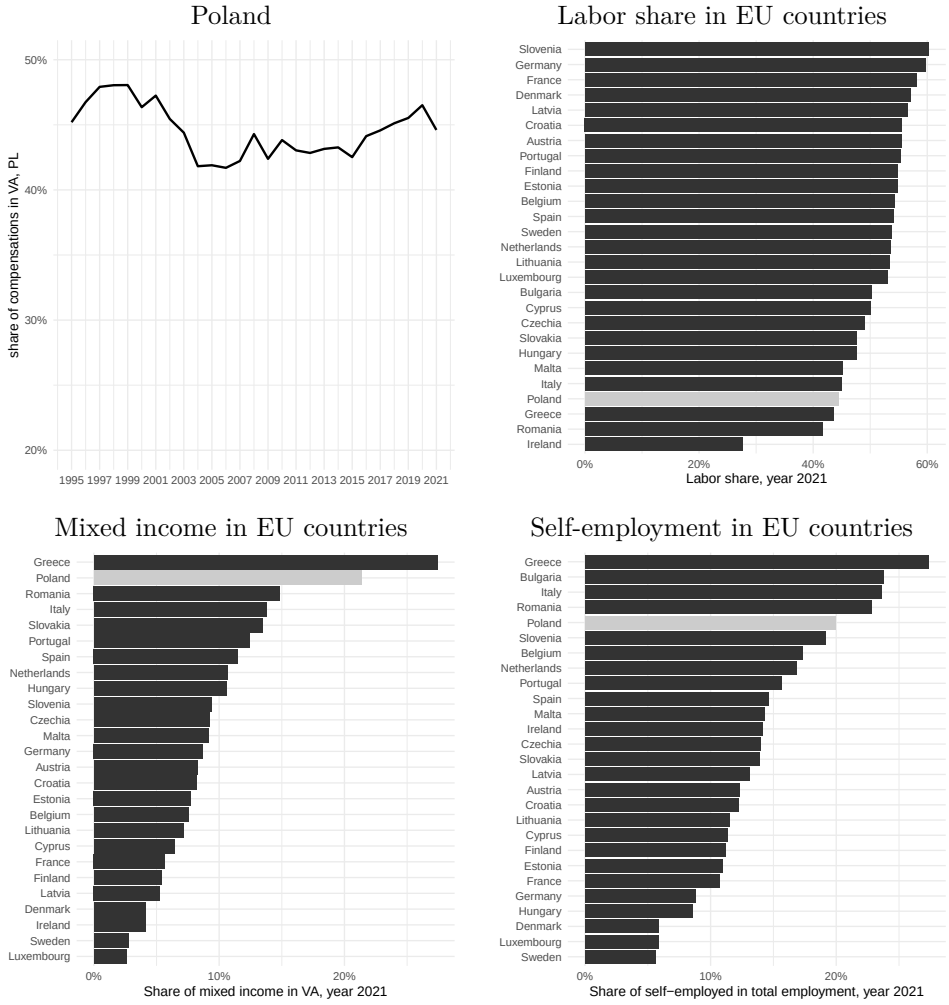
A direct measure of labor share in Poland reaches an average of 43.9% between 1995 and 2021. It is on average stable, but it is also subject to a within-period variation. It decreased in the first half of 2000's, then stayed relatively stable for a couple of years, and increased from 2015 onwards. The drop of the labor share prior to 2004 can be attributed to: 1) a substantial transformation of the Polish economy prior to entering the EU in 2004 (as an example, the employment in services rose from 42% in 1991 to 53% in 2004, according to the World Bank database) and 2) a very high unemployment rate in this period, related to a transformation of the economy and a Russian financial crisis in 1999, which triggered the reorientation of Polish exports from the east to the west and was connected with increasing quality and efficiency of production processes. An increase in labor share from 2015 onwards may be related to a sequence of considerable shifts of a minimum wage (the OECD data show that the ratio of minimum to median wage for full-time workers increased from already relatively high 51% in 2015 to 55% in 2021), which marked a period of a relatively high growth of wages in Poland.

The other panels of Figure 4 show why the correction of labor share for the labor of self-employed is particularly important for Poland. The average labor share in Poland is one of the smallest among the EU countries. Simultaneously, the share of mixed income in value added is among the highest in the EU (the mixed income exceeds 20% of value added only for Greece and Poland), as well as the share of self-employment in total employment, which is close to 20% in Poland, again one of the highest among EU countries.

4.1 Aggregate corrections of labor share for mixed income

Figure 5 shows the results of aggregate corrections of the payroll labor share ($LS_{payroll}$) with the value of labor of self-employed. LS^{coe}_{agg} values the labor input of self-employed with total compensations of employees, as defined by equation (3). In this case the labor share increases on average by almost 13 pp., from $LS_{payroll} = 43.9\%$ to $LS^{coe}_{agg} = 56.8\%$. However, as discussed in Section 3, the correction is too high and artificially increases the social contributions. Accounting for this results in LS_{agg}, defined by equation (4), is presented in Figure 5. The average correction of payroll labor share is smaller and amounts to 11.1 pp., thus the average labor share in this

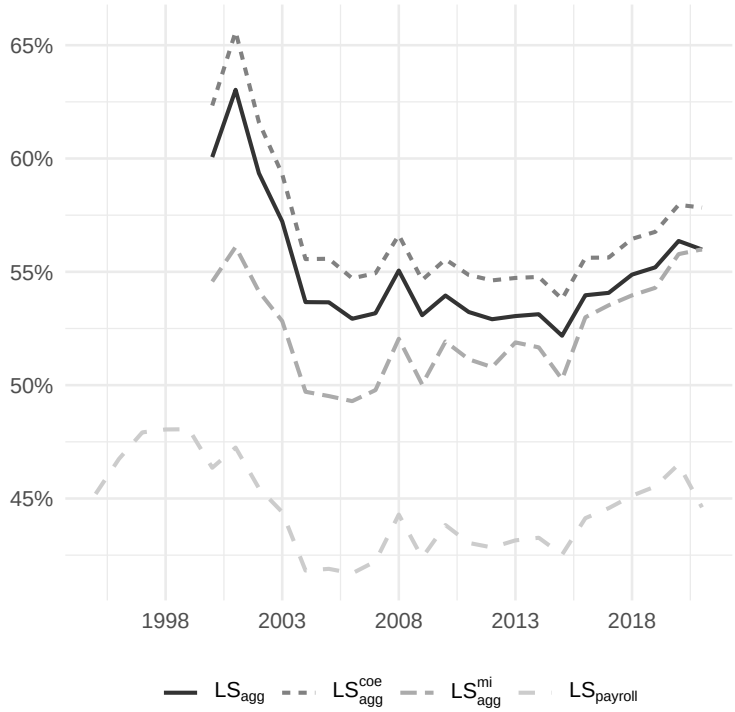
Figure 4: Labor share in Poland (top left panel) and in the EU countries (top right panel), together with prevalence of mixed income (bottom left panel) and self employment (bottom right panel) in EU countries



Source: own calculations based on Eurostat.

case is $LS_{agg} = 55.0\%$. The general shape of the corrected labor share paths have not changed after 2004, but their levels in the very beginning of 2000s are much higher and the subsequent drop in the period 2001-2004 is much more pronounced.

Figure 5: Aggregate corrected measures of the labor share in Poland



Source: Own calculation based on Eurostat (national accounts and the number of employees, employed and self-employed in the NACE sectors).

The problem with corrections discussed so far is a possibility of the value of labor of self-employed to exceed mixed income in specific sectors. This is indeed the case of agriculture in Poland (see Figure 8), with a mixture of a relatively low number of employees and a high number of self-employed. The former makes the average wage calculated from the national accounts relatively high, and combined with the latter results in a very high estimate of labor income of the self-employed. Equation (5) defines a labor share addressing this issue and LS^{mi}_{agg} in Figure 5 shows the results of the calculations. The average labor share drops down further to $LS^{mi}_{agg} = 52.4\%$ and the correction of the payroll labor share shrinks to 8.5 pp., on average. Moreover, accounting of agriculture slightly changes the shape of the labor share. The drop of

the labor share observed prior to 2004 is less pronounced and the subsequent recovery is more apparent. The overall change of labor share in period 2000-2021 for both LS^{coe}_{agg} and LS_{agg} is definitely negative, whereas the cumulative change of LS^{mi}_{agg} is close to neutral.

4.2 Accounting for heterogeneity

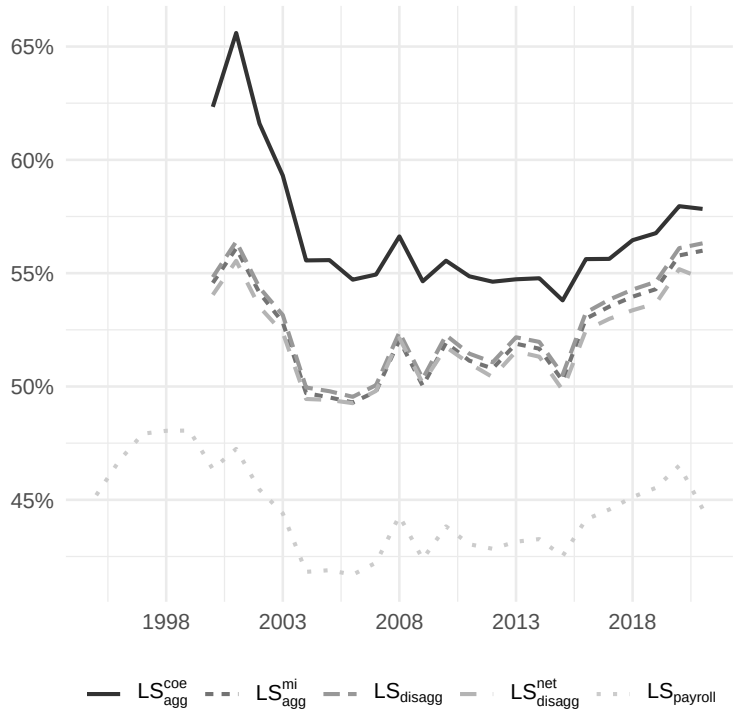
LS_{disagg} in Figure 6 shows the results of accounting for heterogeneity in the sub-populations of employees and self-employment, on top of the previously discussed corrections, as defined by equation (6). The average $LS_{disagg} = 52.7\%$, which is just 0.3 pp above the average LS^{mi}_{agg}, implying an overall correction of LS_{baisc} equal to 8.8 pp. Moreover, accounting for heterogeneity has not changed significantly the path of the measured labor share. A natural question arises why it has a so tiny impact on the results? First, given our effort to maintain consistency with national accounts, only the differences in relative wages within the analyzed heterogeneous groups and differences in the heterogeneity within employees and self-employed matter. Second, although the differences in relative wages, depicted in the left panel of Figure 2, are quite substantial, but the differences in structures of both sub-populations (see a right panel of Figure 2) are only modest, translating into small differences of labor shares. Third, a 40-60% of the self-employed (see Figure 1) work in agriculture, and an imposition of a binding upper limit in our procedure effectively limits the effects of differences in sub-populations.

4.3 Using net wages to value work of self-employed

Finally, we add (on top of the other corrections) an assumption that self-employed earn the same net wages as employees in respective population groups (the imputation of relatively high wages of employees to self-employed, especially in agriculture, may cause an excessive valuation of wage that "clears" this sectoral labor market). In practice, the difference boils down to social security contributions rate (labor tax), described in Section 3 and depicted on Figure 3. LS^{net}_{disagg} in Figure 6 shows the results, also to be followed in Table A1. The average $LS^{net}_{disagg} = 52\%$ implies a correction of 8.1 pp. over the payroll labor share. Using net wages to value the work of self-employed results in lower values of the labor share, resulting from lower tax rates they pay (see Figure 3). The difference is more visible only in recent years, as the differences in tax rates are also the highest then. The path of the labor share resembles both paths of labor share based on heterogeneity and gross wages and labor share based on aggregate data with an upper limit in agriculture. It seems that the most important modification is the imposition of an upper limit, which put the average level of labor share on levels close to 52-53% and results in a close to zero cumulative change of labor share in the period 2000-2021.

Additionally, Figure A1 and Table A2 in the Appendix present labor shares for the total economy, excluding agriculture (as this is the most problematic sector in our

Figure 6: Labor shares accounting for heterogeneity together with the lower and upper bounds of $LS_{payroll}$ and LS^{coe}_{agg}, respectively



Source: own calculations based on Eurostat and SES data.

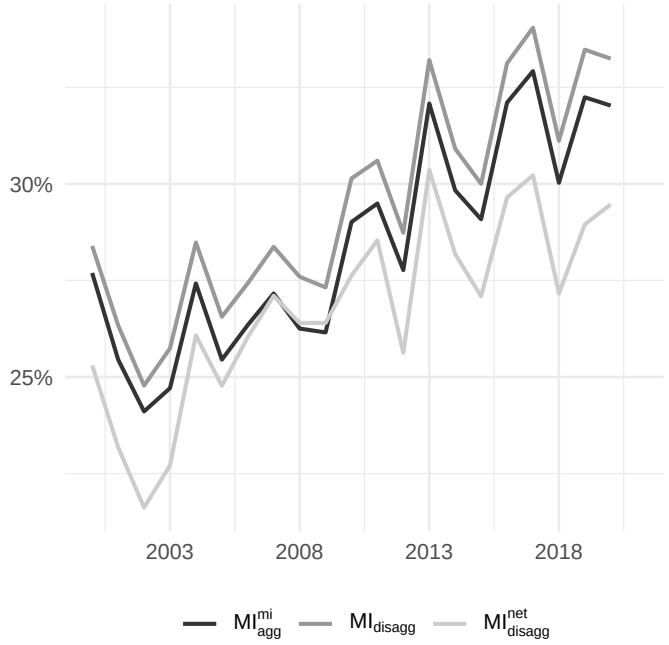
measurement). The difference in aggregate labor shares for the total economy and the total economy excluding agriculture is relatively high when the are calculated in a way not restricted by the size of the sectoral mixed income (LS_{agg} and LS^{coe}_{agg}). But once the sectoral mixed incomes are taken into account, the difference between the aggregate labor shares narrows to 2 pp.

4.4 The labor share in mixed income

As a byproduct of our identification procedure we calculated what is the share of the mixed income that can be attributed to the labor input of self-employed. The results are depicted in Figure 7 (it shows the results for all cases with an upper limit for mixed income in agriculture). The labor shares in mixed income tend to grow and increase between 2000 and 2021 from around 25% to over 35%. Accounting for heterogeneity results in a higher share of mixed income attributed to the remuneration

of labor, whereas using net wages instead of gross wages shrinks the labor share of mixed income.

Figure 7: The share of labor remuneration in mixed income



This noticeable increase in share of the remuneration of labor in the mixed income may be to a large extent explained by the change in the sector composition of the population of the self-employed during the analyzed period. While in year 2000 the vast majority of the self-employed were low-wage farmers classified within agriculture (63.1%), then by the 2020 their share substantially decreased to 40.5%. Instead, an intensive modernization of the Poland's economy resulted in an increase in the share of self-employment (and employment in general) in the following high-wage NACE sectors: "Information and Communication" (eg. computer and telecommunication specialists) from 0.6% to 3.6% and "Professional, Scientific and Technical Activities" (eg. lawyers, architects, consultants etc.) from 2.1% to 7.2%. Moroever, the enlarged importance of self-employment in "Construction" (from 4,9% to 11.4%) and "Health Services" (from 1.1% to 3.5%) supported an upward trend in the share of the remuneration of labor in mixed income in years 2000–2020.

5 Labor share and the changing structure of the economy

So far we have discussed the results of our corrections for the total economy, but in practice they were applied to industry-level data (using 1-digit NACE disaggregation). In this section we present the results for the sectors of the economy and we apply a shift-share analysis to gouge the importance of shifts in sectoral structure of the economy for the evolution of the aggregate labor share.

The paths of sectoral labor shares are presented in Figure 8. Apart from agriculture, discussed in previous sections, some observations emerge. First, in manufacturing and other industries (sectors B-E) downward tendencies in labor share dominate, whereas in services the trends are more dispersed, but increasing tendencies seems to dominate (especially since 2010), consistently with the results of e.g. Growiec (2009) and Zalas and Drążkowski (2023), discussed in Section 2. Second, our corrections have smaller effects in the other industries (although it is visible in manufacturing, sector C), where the share of self-employment is smaller. In market services (sectors: G-N) a much larger share of self-employed lift the labor share trends roughly by 10 pp. The correction is visible, but stays relatively low in construction (section F), while on the other hand it is very high in trade (sector G). In public services (sectors O-R), where the employment contracts are more frequent, the correction for the mixed income is less prevalent.

5.1 Shift-share decomposition of the labor share

Given the differences in the paths of labor share, especially in manufacturing and service sectors and the fact that services were gaining importance in the last decades, we try to assess the role of structural changes in the evolution of aggregate labor share. We use a shift share decomposition, given by:

$$\Delta LS_t = \sum_j s_{j,t-1}\Delta LS_{j,t} + \sum_j LS_{j,t-1}\Delta s_{j,t} + \sum_j \Delta LS_{j,t}\Delta s_{j,t}, \tag{9}$$

where $s_{j,t}$ is the share in value added (a weighting variable) of a sector j in period t. As we are interested in cumulative changes, we define Δ as a cumulative change from year 2000 up to period t. The first component (*within*) captures the effects of changes in average labor shares at the industry level while the second term (*between*) arises when there is a substantial shift in the sectoral structure of the economy. The remaining component (*reallocation*) measures the joint effect of simultaneous changes in labor shares and industry composition and is a measure of a reallocation effect.

Figure 9 shows the result of a shift-share decomposition, applied to different measures of labor share. Apart from the differences in the cumulative changes of various labor shares, discussed before, in all cases the overall changes in aggregate labor share are dominated by the *within* component. It means industry level changes dominate the

Figure 8: Evolution of labor shares (various definitions), in years 2000-2021 in NACE sectors

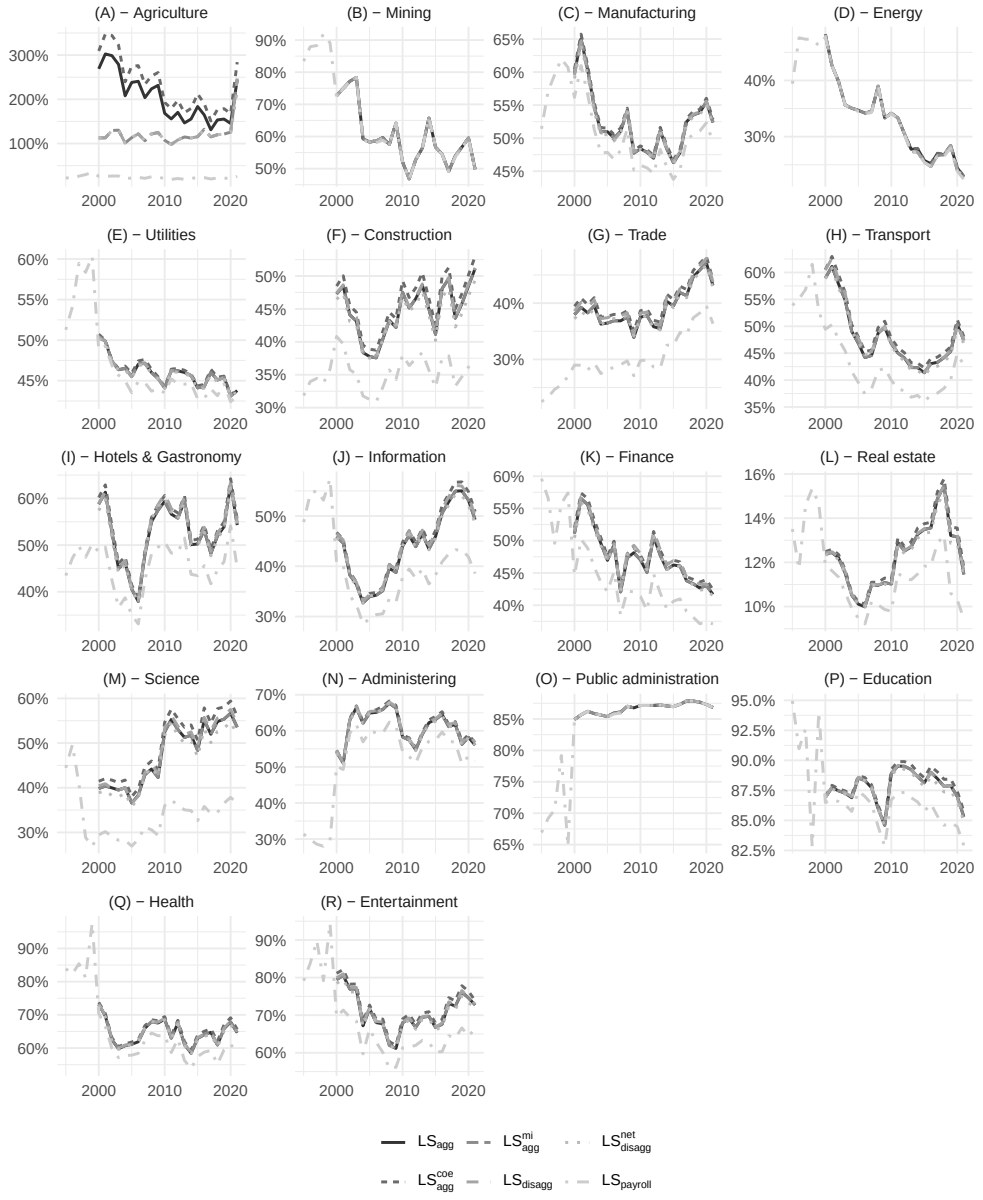
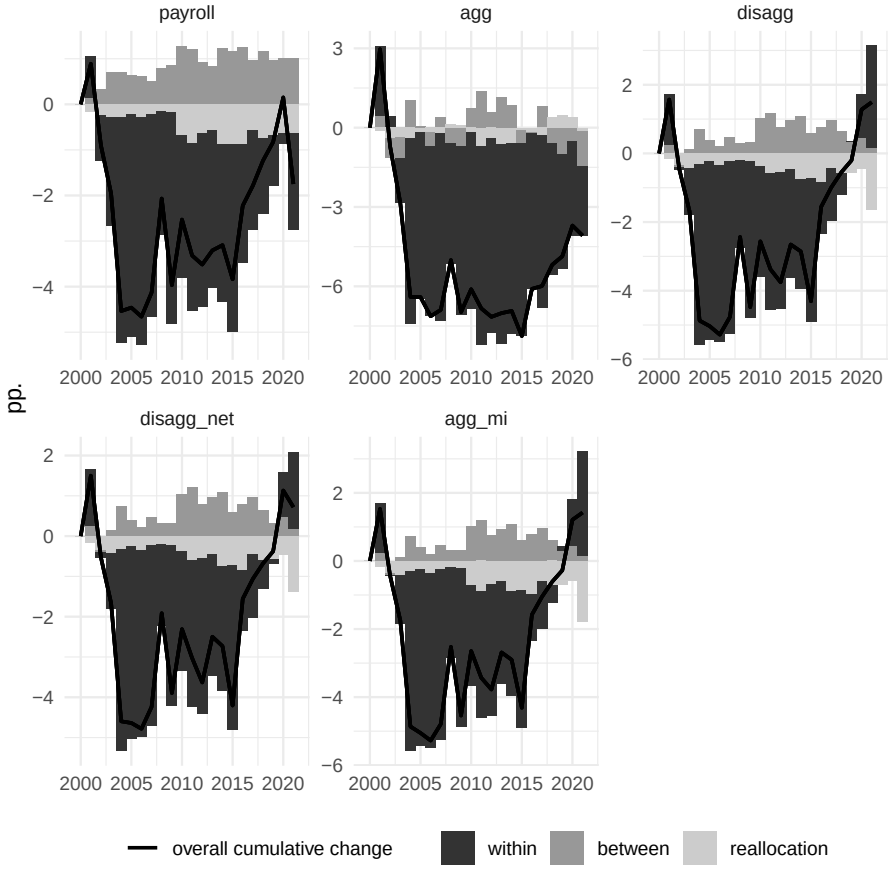


Figure 9: A shift-share decomposition of cumulative change of aggregate labor shares (percentage points)



economy-wide movements of labor share. The *between* component, positive in all cases shows that changes in the structure of the economy were conducive to the growth of labor share, reflecting the growing importance of the more labor-intensive services. Finally, the *reallocation* effect is negative, showing that in sectors gaining importance in the economy, labor shares were on average declining.

6 Conclusions

In the paper we have addressed the well-known problem of how to measure correctly the labor share, given inadequacy of the treatment of labor compensation in national accounts. Taking the case of Poland, we have applied several methods of estimating the labor share, experimenting with various assumptions regarding how to allocate the mixed income of self-employed between the compensation of labor and capital, consistently with the national accounts. Our computations show that not accounting for the mixed income in the labor compensation results in a significant undervaluation of the labor share. In the most extreme case we consider, an average corrected labor share rises by almost 13 percentage points (43.9% to 56.8%). Given an inherent flaw of this method (overvaluation of the social contributions) we applied the other methods that produced a less pronounced upward corrections of the payroll labor share. Our general approach has been to proceed with more complex correction procedures, starting from the adjustment of the social contributions of self-employed (resulting in an upward adjustment of labor share by 11.1 pp.), then adding a ceiling for the labor compensation in agriculture (resulting in the adjustment of the payroll labor share shrinking to 8.5 pp.). Next, we additionally account for the heterogeneity in socio-demographic characteristics of employees and self-employed (the adjustment goes up slightly, to 8.8 pp.) and finally – differentiating social security contributions rate between employees and self employed (a further drop of adjustment to 8.1 pp.). The latter method is an original contribution to the literature on labor share measurement. Therefore, a choice of the method of dividing of mixed income into labor and capital remunerations matters, with average corrections ranging from 8 to 13 pp.

An analysis at the aggregate level has been supplemented by the estimation of labor shares for the sectors of the economy (at a 1-digit NACE disaggregation). In manufacturing and other industries a downward tendency of labor shares dominates, but simultaneously increasing tendencies seem to dominate in services. Given this heterogeneity, the shift-share analysis has been applied to evaluate whether the evolution of the aggregate labor share was driven by intra-sectoral processes or by the shifts in the sectoral structure of the economy. The analysis showed that the within sector changes dominate the economy-wide movements of the labor share. Changes in the sectoral structure of the economy turned out to be conducive to the increases in the labor share, but their contribution to the overall labor share change was neutralized by the negative reallocation component – the labor shares in the sectors gaining importance were on average declining.

Finally, let us put forward two general conclusions. First, a long-run declining trend of labor share, often found in the advanced economies, has not been detected in Poland. A drop in the level of labor share is clearly visible only in the early years on transition (till 2004), irrespective of the measure of labor share applied. Then, labor share stabilizes and increases by approximately 2-5 percentage points (depending on the measurement method) till the end of the analyzed period. Second, various methods of corrections of the payroll labor share applied in our study produce slightly different results, rather in terms of the level than the trend. Moreover, including additional dimensions like the heterogeneity of labor with respect to socio-economic characteristics or the details of tax wedge on wages, contributes to a better understanding of the evolution of the labor share. To conclude with a direct answer to the question in the title: no, it does not seem that the labor compensation heterogeneity matters very much for the labor share, at least with the methodology we applied for the Polish data.

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A Appendix

Figure A1: Aggregate measures for labor shares – total economy excluding agriculture

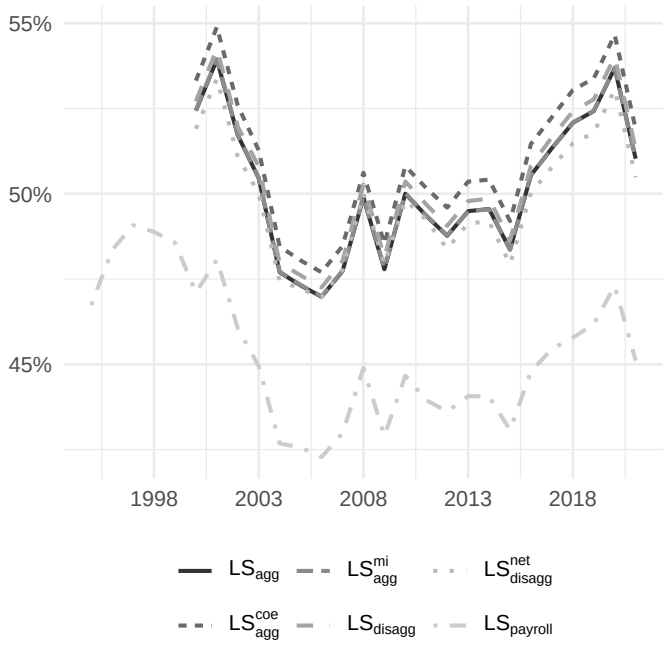

Table A1: Labor share results for Poland as percentage of value added in years 1995-2021, to be followed also on Figure 6

Year	LS_{agg}	LS_{agg}^{coe}	LS_{agg}^{mi}	$LS_{payroll}$	LS_{disagg}	LS_{disagg}^{net}
1995	-	-	-	0.45	-	-
1996	-	-	-	0.47	-	-
1997	-	-	-	0.48	-	-
1998	-	-	-	0.48	-	-
1999	-	-	-	0.48	-	-
2000	0.60	0.62	0.55	0.46	0.55	0.54
2001	0.63	0.66	0.56	0.47	0.56	0.56
2002	0.59	0.62	0.54	0.45	0.54	0.54
2003	0.57	0.59	0.53	0.44	0.53	0.52
2004	0.54	0.56	0.50	0.42	0.50	0.49
2005	0.54	0.56	0.50	0.42	0.50	0.49
2006	0.53	0.55	0.49	0.42	0.50	0.49
2007	0.53	0.55	0.50	0.42	0.50	0.50
2008	0.55	0.57	0.52	0.44	0.52	0.52
2009	0.53	0.55	0.50	0.42	0.50	0.50
2010	0.54	0.56	0.52	0.44	0.52	0.52
2011	0.53	0.55	0.51	0.43	0.51	0.51
2012	0.53	0.55	0.51	0.43	0.51	0.50
2013	0.53	0.55	0.52	0.43	0.52	0.52
2014	0.53	0.55	0.52	0.43	0.52	0.51
2015	0.52	0.54	0.50	0.43	0.51	0.50
2016	0.54	0.56	0.53	0.44	0.53	0.52
2017	0.54	0.56	0.54	0.45	0.54	0.53
2018	0.55	0.56	0.54	0.45	0.54	0.53
2019	0.55	0.57	0.54	0.46	0.55	0.54
2020	0.56	0.58	0.56	0.47	0.56	0.55
2021	0.56	0.58	0.56	0.45	0.56	0.55

Table A2: Average labor shares for the total economy with and without agriculture

Name	Total economy	Excluding 'agriculture	Difference
LS_{agg}	0.550	0.501	0.049
LS_{agg}^{coe}	0.568	0.510	0.058
LS_{agg}^{mi}	0.524	0.501	0.022
LS_{disagg}	0.527	0.504	0.022
LS_{disagg}^{net}	0.520	0.498	0.022
$LS_{payroll}$	0.446	0.453	-0.008