Globalization, creative destruction, and labor share change: Evidence on the determinants and mechanisms from longitudinal plant-level data* / Petri Böckerman** & Mika Maliranta***

Abstract

We examine the sources and micro-level mechanisms of the changes in the labor share of value added. We link the micro-level dynamics of the labor share change with that of productivity and wage growth. Using a useful variant of the decomposition method we make a distinction between the change in the average plant and the micro-level restructuring. With Finnish plant-level data covering three decades we show that micro-level restructuring is the link between the declining labor share and increasing productivity in 12 manufacturing industries of four regions, and that increased international trade is a factor underlying those shifts.

JEL Classification: F16; J31

Key words: Globalization; International trade; Foreign ownership; Micro-level restructuring; Labor share

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1. Introduction

The labor share of value added was regarded as ña magic constantò (Solow 1958). The constancy of the labor share was also treated as one of the stylized facts of economic growth (e.g. Gollin 2002). In contrast to this, there are several industrialized countries in which the labor share has declined substantially over the past few decades (e.g. Blanchard 1997, 2006). Secular decline in the labor share since the early 1980s has been much more pronounced in Europe and Japan (roughly 10 percentage points) than in Anglo-Saxon countries, including the United States (about 3-4 percentage points) (IMF 2007). Within Europe, the strongest decline in the labor share has been experienced in Austria, Finland, Ireland, and the Netherlands. It is important to know how these changes emerge: Are the labor shares declining because of increasing productivity or falling wages, and in particular, what are the micro-level mechanisms underlying those changes?

Modern growth theories emphasize the role of intra-industry micro-level restructuring as one of the key mechanisms for explaining industry productivity growth (e.g. Aghion and Howitt 2006). Research in the field of international trade has also indicated that globalization is an important stimulant of productivity-enhancing micro-restructuring (ñcreative destructionò) within industries (e.g. Bernard et al. 2007; Lileeva 2008). In particular, Bernard and Jensen (2004) show that exporting does not increase plant productivity growth but has positive aggregate productivity effects because it is associated with the reallocation of resources from less efficient to more efficient plants.

We contribute to the literature by distinguishing between two intrinsically different micro-level mechanisms underlying the industry labor share changes: 1) the labor share change of the average plant and 2) the micro-structural change. Furthermore, we both formally and empirically link the micro-level dynamics of the labor share change, productivity growth and wage growth. These links emerge due to the fact that industry productivity and wage growth together determine the change in the labor share. In this paper, we apply this novel approach to analyze the potential contribution of globalization on the decline in the labor share.[1] In particular, we examine whether increased competition owing to the exposure to international trade and foreign ownership forces the plants with the highest share of labor income to decrease their market shares and eventually forces them out of business. This central hypothesis of the paper is closely related to the modern theoretical insights. Melitz (2003) argues that an increase in an industryǵs exposure to international trade will lead to inter-firm reallocations towards more productive firms by increasing competitive pressures.

Our approach allows a coherent tracking of the roles of the micro-level dynamics of productivity and wage growth. We take advantage of longitudinal plant-level data from the Finnish manufacturing sector over a period of 30 years. To preview, the results show that globalization stimulates productivity-enhancing and the labor share curbing micro-level restructuring within industries. Wage increases in the industries correspond closely to those of the plants, which implies that micro-level restructuring does not contribute much to the industriesô wage increases.

The link between the labor share and globalization is not well understood. Existing evidence about the effects of globalization on the labor share is based on cross-country studies (e.g. European Commission 2007, 2008; Guscina 2006; Harrison 2002; Jaumotte and Tytell 2007; Jayadev 2007). The main problem with the cross-country studies is that there are a large number of contributing factors across countries that are identified with a relatively small number of observations, i.e. the curse of dimensionality plagues the cross-country approach. Cross-country regressions are therefore likely to suffer from omitted variable and parameter heterogeneity biases. The differences in the data characteristics make it hard to conduct a reliable comparison of the plant-level dynamics of the labor share across countries.[2] This makes it particularly useful to provide a detailed analysis of one country. To examine the effects of globalization, we construct a panel of industries and regions from the micro-level components of the labor share. While using the same plant-level data in the analysis of industries and regions within the same country, data comparability problems can be bypassed.

The role of labor market regulations and other institutional aspects has gained considerable attention in the cross-country comparisons of the labor share dynamics (e.g. Azmat et al. 2007; Bentolila and Saint-Paul 2003; IMF 2007). In contrast to this research, we build on the fact that there are large differences in the micro-level dynamics of the labor share across regions within the same country that share exactly the same institutions and regulations. Hence, the focus on one country allows us to isolate the effects of globalization on the labor share more clearly, because we are able to avoid, by construction, the problems that emerge from the complex interactions between a variety of labor market institutions and openness that Agell (1999) and Rodrik (2008) have pointed out.

The Finnish case provides an excellent opportunity to analyze the effects of globalization, because the openness of the economy has greatly increased during the past few decades. At the same time, there has been a considerable decline in the labor share. Figure 1 exhibits the trends in the manufacturing sector in four Finnish regions. Plenty of variation in the trends provides us with an interesting opportunity to identify the mechanisms underlying these changes.

=== FIGURE 1 HERE ===

The structure of the paper is as follows. Section 2 introduces the decomposition method. Section 3 describes the longitudinal plant-level data. Section 4 relates the micro-level components to the changes in international trade and foreign ownership. The last section concludes.

2. Decomposition of the labor share into its micro-level components

The starting point of our analysis is the fact that the industry (or aggregate) labor share declines when industry labor productivity growth exceeds industry wage growth (measured in product prices). The existing studies in the literature assume that these industry or more aggregate level changes represent changes in a representative firm, and, as a consequence, the role of the micro-level restructuring is ignored. Our contribution is that we formally and empirically distinguish between the two intrinsically different mechanisms of the industry change in the labor share: 1) the change in the average plant and 2) the change due to plant-level restructuring.

The literature provides several different methods to decompose aggregate productivity growth (e.g. Bartelsmans and Doms 2000; Foster et al. 2001; Kruger 2008). In this paper we adopt a formula that has several useful properties that make the interpretation of the components easy in this context. Our method has some important resemblances to those proposed by Maliranta (1997), Vainiomäki (1999) and, more recently, by Diewert and Fox (2009).[3] The within component is defined as the weighted average of the changes in the labor shares of the continuing plants. The between component is negative when there is a systematic structural change among continuing plants in terms of value added towards those plants that have a lower labor share. It is also possible to separate the entry and exit components. The total effect of entries and exits is the difference between the total aggregate change in the labor share and the aggregate change in the labor share among the continuing units.

We denote the labor share of a production plant *i* in period *t* with $f_{it} = w_{it} / v_{it}$, where w_{it} is the wage sum (including social security payments) and v_{it} is value added. Both of them are measured in product prices (i.e. deflated by a price index of the industry).[4] We decompose the change rate of the aggregate labor share from period *t*-1 to period *t*. Plants appearing in periods *t*-1 and *t* are classified into three groups: those appearing in both *t*-1 and *t*, i.e. continuing plants, are indicated by *C*, those appearing in *t* but not in *t*-1, i.e. entrants, are indicated by E, and those appearing in *t-1* but not in *t*, i.e. disappearing plants, are indicated by *D*.

The aggregate labor share change rate consists of two distinct main components. These are the change rate within units and the effect of micro-structural change that is the structural component (denoted by STR_t^F):[5]

$$\frac{F_t - F_{t-1}}{\overline{F}} = \sum_{i \in C} \overline{s}_i \frac{f_{it} - f_{i,t-1}}{\overline{f}_i} + STR_t^F \tag{1}$$

where $F_t = \sum_i w_{it} / \sum_i v_{it}$ is the aggregate labor share in period *t*; $\bar{F} = 0.5(F_{t-1} + F_t)$ is the average aggregate labor share in periods *t*-1 and *t*; $\bar{f}_i = 0.5(f_{i,t-1} + f_{it})$ is the average labor share of plant *i* in periods *t*-1 and *t*, and $s_{it} = v_{it} / \sum_{j \in C} v_{jt}$ is the weight of unit *i* as measured by its share of aggregate value added *among continuing units*.

It should be noted that

$$\frac{F_t - F_{t-1}}{\bar{F}} \cong \log \frac{F_t}{F_{t-1}} \text{ and}$$

$$\frac{f_{it} - f_{i,t-1}}{\bar{f}_i} \cong \log \frac{f_{it}}{f_{i,t-1}} \quad .$$

Consequently, here the within component is similar to a Divisia index of the growth rate of the total factor productivity but now applied to the continuing plants (where the change rate is relevant) and used for the estimation of the growth rate of the labor share. It describes the change rate of the labor share in a ñrepresentativeò plant.

The structural component consists of four sub-components

$$STR_t^F = S_t^E \frac{\left(F_t^E - F_t^C\right)}{\bar{F}} - S_{t-1}^D \frac{\left(F_{t-1}^D - F_{t-1}^C\right)}{\bar{F}} + \sum_{i \in C} \frac{\bar{f}_i}{\bar{F}}\left(s_{it} - s_{i,t-1}\right) + \sum_{i \in C} \bar{s}_i \frac{f_{it} - f_{i,t-1}}{\bar{f}_i}\left(\frac{\bar{f}_i - \bar{F}}{\bar{F}}\right) \qquad (2)$$

where $F^X = \sum_{i \in X} w_i / \sum_{i \in X} v_i$ is the aggregate labor share among the group $X \in \{E, C, D\}$, and $S^X = \sum_{i \in X} v_i / \sum_i v_i$ is the value added share of the group $X \in \{E, C, D\}$, and $\bar{s}_i$ is the average of s_{t-1} and s_t.

The direct contribution of the entering plants to the aggregate growth rate of the labor share is gauged by the first component of the Equation (2). It is positive when the average labor share of the new plants (weighted by the value added share) in the period t is higher than that of those who appeared also in the period t-1. The magnitude of the contribution is dependent on the value added share of the new plants in the period t.

The second component, the exit component, is analogous to the entry component. Therefore, one of the great advantages of this decomposition method is that entries and exits are treated symmetrically. The exit component is negative when the average labor share of the disappearing plants (weighted by the value added share) is higher than that of those plants that appear also in the next period t. The magnitude of the contribution is dependent on the value added share of the disappearing plants before they leave, i.e. in the period t-1 (see also Maliranta 1997, 2003; Diewert and Fox 2009).

The third component is the between component, which captures the effect of the value added share changes among the continuing plants on the aggregate labor share change rate. This component is negative when the low labor share plants (i.e. high profitability plants) increase their market shares at the cost of the high labor share plants (i.e. low profitability plants). The between component, like the within component, is defined among the continuing plants only. As a result, entering or disappearing plants do not have any direct effect on those components. The fourth component on the right-hand side of the Equation (2) can be called the cross-component.

The Equations (1) and (2) can be applied to industry productivity and wage growth. When industry labor productivity and industry wage growth are measured in nominal terms or when both are deflated by the same price index (as in our paper), the following relationship holds at the industry (or aggregate) level:

$$\begin{aligned} &\frac{F_t - F_{t-1}}{\overline{F}} \approx \frac{W_t - W_{t-1}}{\overline{W}} - \frac{P_t - P_{t-1}}{\overline{P}} \\ &\Leftrightarrow \frac{f_t - f_{t-1}}{\overline{f}} + STR_t^F \approx \frac{w_t - w_{t-1}}{\overline{w}} + STR_t^W - \frac{p_t - p_{t-1}}{\overline{p}} - STR_t^P \end{aligned} \tag{3}$$

where W is the wages and social security payments per labor input, P is the value added per labor input (i.e. labor productivity), and STR_t^W and STR_t^P are the structural components of industry wage and industry productivity growth, respectively.

Naturally, an analogous relationship holds at the plant level, i.e.

$$\frac{f_t - f_{t-1}}{\overline{f}} \approx \frac{w_t - w_{t-1}}{\overline{w}} - \frac{p_t - p_{t-1}}{\overline{p}} \tag{4}$$

where *f*, *w* and *p* denote labor share, wages and social security payment per labor input and value added per labor input in a plant, respectively.

By inserting (4) into (3) we obtain

$$STR_t^F \approx STR_t^W - STR_t^P \tag{5}$$

which shows how the structural components of the labor share change, wage growth and productivity growth are related to each other.

Panel A of Table 1 illustrates our approach to track the changes in the labor share. The earlier literature has focused only on some specific aspects of these changes. There are various popular ways to decompose the industry-level aggregate productivity growth (see Foster et al. 2001). However, the existing studies have not provided decompositions of wage growth (ód*W*ô) that is the other important aggregate determinant of the observed changes in the labor share. In this paper, we provide a complete and coherent picture of the micro-level mechanisms (ó*a*ô, é , ó*d*ô) that are behind the aggregate movements in the labor share.

=== TABLE 1 HERE ===

Analysis of the micro-level components of the labor share is particularly useful in the Finnish context, because the wage bargaining system adopted in Finland has distinct implications on the evolution of the micro-level components. The coverage of collective agreements is roughly 95% of all employees in Finland, one of the highest rates among the OECD countries (Layard and Nickell 1999). Minimum increases in nominal wages are determined by collective bargaining. The Finnish ówage increase formulaô defines the scope for nominal wage cost increases as the sum of the core inflation target (e.g. 2% *per annum*) and the average increase in productivity across the whole economy. Nominal wages are therefore not encouraged to adjust to the changes in labor productivity that are considered to be isolated to certain sectors or regions. Specifically, wage increases have not been tied to plant-level (real or nominal) productivity advances.

Because of the attributes of the Finnish wage bargaining system, our expectation is that wage growth takes place mainly through the within plant component and therefore intra-industry restructuring is not a significant source of industry wage growth. If industry productivity growth equals industry wage growth (i.e. the aggregate labor share is stable) and industry productivity growth exceeds plant productivity growth, the within component of the labor share change has a positive contribution and the restructuring component has the opposite (negative) contribution. This paper looks at how globalization drives wedges between these balances.

Panel B of Table 1 provides an empirical description of the micro-level channels of the industry labor share change in Finnish manufacturing in the period 1976-2007, based on the longitudinal plant-level data. It shows the break-down of the industry labor share change into the contributions of productivity and wage growth, and what are the micro-level components of productivity and wage growth. The industry labor share has declined 0.5 percent *per annum* because the labor productivity growth rate (4.2 percent) has exceeded that of wages (3.7 percent, measured in product prices) by a margin of 0.5 percentage points. At the ñaverage plantò the development has been, however, quite different as can be seen from the table; wage growth has exceeded productivity growth by a margin of 0.5 percentage points. The last column of Panel B reveals the ultimate source of the labor share decline; the micro-level restructuring has been an essential ingredient of labor productivity but not wage growth.

3. Data

The micro-structural components of the labor share are calculated by the use of longitudinal plant-level panel data that has been constructed especially for economic research purposes by the Research Laboratory of Statistics Finland. Our data are based on the Annual Industrial Statistics Surveys that basically cover all manufacturing plants employing at least five persons up to 1994. Since 1995 it has included all the plants owned by firms that have no fewer than 20 persons. Maliranta (2003) has examined in detail how sensitive the patterns of productivity components are to the change in the cut-off limit from 5 to 20 in the period 1975-1994. The result was that the cut-off limit made little difference. This is because larger plants account for a substantial share of the total input usage. Still, to make our decompositions as comparable as possible over all the years we have harmonized the coverage of our data. We have included all the plants that have at least 5 persons and are owned by a firm that has no fewer than 20 persons.

Our data are exceptionally good when it comes to the coverage, the content and the length of time series. However, as always with these kinds of data, our data are not perfect, either. Data include outliers that might be influential in an economic analysis. A transparent procedure is therefore needed to clean the data. We have adopted an approach similar to that of Mairesse and Kremp (1993). Those observations are deemed as outliers whose log of the labor share differs by more than 4.4 standard deviations from the input-weighted industry average in that year. We have performed the decomposition computations for each pair of the consecutive years. If a plant is classified as an outlier in either an initial (i.e. in year t-1) or an end year (i.e. in year t) it is not included in this computation (but is possibly included in earlier and later periods).

This way we have avoided causing artificial entries or exits by removing outliers. In the course of our analysis we noted that a single plant might sometimes have an impact on one of the components of our interest that is simply unbelievable. A more detailed inspection of these cases revealed that the changes in value added or labor input are sometimes erroneous beyond reasonable doubt. Since, on certain occasions, these errors are very influential in our decomposition calculations, further cleaning may be worthwhile. For this reason, the decompositions are made in two rounds. If the absolute value of the contribution of a single plant to one of the components is greater than four percentage points, the plant is classified as an outlier in the first round. This is a conservative criterion since, as we will see below, usually the size of these components is less than four percentage points at the level of industry and region. These outliers, accounting for 9.6 percent of the total hours in the whole period, are removed in the second round, which generates our final decomposition results.

To examine the effects of globalization, we have computed the micro-level components of the labor share change rate, productivity growth rate and wage growth rate for 12 industries and four regions over the period 1976-2007. Our industry classification is close to the two-digit standard industry classification, but we have combined some industries. Our industries are the following: ñFoodò (NACE 15-16), ñTextileò (17-19), ñWoodò (20), ñPaperò (21), ñPrintingò (22), ñChemicalsò (23-25), ñMineralsò (26), ñMetal productsò (27-28), ñMachineryò (29 and 34-35), ñElectrical equipmentò (30-31), ñCommunications equipmentò (32-33), and ñOtherò (36-37). This classification is dictated by our need for a reliable measurement of the decompositions of the labor shares by industries and regions.[6]

Finland is divided into five provinces (the so-called NUTS2 level in the European Union). However, we exclude the province of Åland, because the small number of plants in this island community means that the measures of the micro-level components of the labor shares would not be reliable. The use of these classifications gives us a panel data that has 4×12=48 observations per year. Since the components can be calculated for 31 pairs of years (1975-1976, 1976-1977,é , 2006-2007), in principal we have 1488 observations. Since we use lagged explanatory variables, the number of observations is slightly smaller in our econometric analysis, however.

Productivity and wage growth rates are computed by using the industry-specific deflators that are implicit price indexes of output obtained from the Finnish National Accounts. We have used a ñchain-indexò procedure. For each pair of the consecutive years, value added (and wages plus social security payments) of the end year (i.e. t) is converted into the price level of the initial year (i.e. t-1). The use of price indexes is not necessary in our analysis. (We obtained similar results with nominal measures.) The main point here is that we use the same deflators for both productivity and wage growth (or no deflators at all) to obtain consistent results for productivity, wage and labor share change (see Feldstein 2008).

Globalization is measured by two variables, which capture the exposure to international trade and foreign ownership.[7] The exposure to international trade is measured by dividing exports by the gross output. This is the measure that has been most frequently used in the literature to describe the effects of globalization on the labor share. For example, it has been used by Harrison (2002) and Guscina (2006), among others. The share of foreign-owned plants in an industry and a region is defined on the basis of output share. A 50% threshold is used in classifying a particular plant as foreign owned.

4. Results

Descriptive evidence shows out there have been considerable differences in the micro-level dynamics of the labor share across regions within the same country that have shared exactly the same institutions and regulations. (These patterns are documented in our working paper version.) The variation has been neglected in the literature. It can be exploited when we estimate the effect of globalization on the labor share change.

We use Prais-Winsten regressions with panel-corrected standard errors as our baseline reduced-form specifications for the period 1978-2007.[8] The estimator is based on the principle of estimating the amount of autocorrelation and then re-weighting the standards errors to correct them. Therefore, it is a weighted least squares estimator. The estimator is preferable in terms of efficiency to OLS in our context, because we have a considerable number of repeated observations on fixed units (industry × regions) with a potential first-order serial correlation. We assume that the structure of the AR (1) process is similar in each panel of the data, as recommended by Beck and Katz (1995). A further advantage of Prais-Winsten regressions is that we are able to incorporate cross-sectional correlation to the model when the number of time-series observations is less than the number of cross-sectional observations, whereas standard feasible generalized least squares cannot (Chen et al. 2005). The sample consists of 1440 observations (4 regions, 12 industries and 30 years).

If the focus were the within plant changes, we would use those approximately 150 000 plant-level observations that are available in our original panel data. However, in this paper our main interest is to look at the role of plant-level restructuring. The industry-region panel constructed by the decomposition computations is a useful way to capture it. The aim is to identify an additional role of the exposure to globalization, i.e. to study whether there is evidence of a structural change in terms of valued added towards those plants that have a lower labor share because of globalization. With the data and the methods applied here we can consistently analyze the role of plant-level changes (i.e. within plant changes) and micro-structural components in industry development.

The dependent variables of the models are the industry growth rates of the labor share, labor productivity and wage, and their micro-level components by regions. The explanatory variables are the measures of globalization along with the control variables. The control variables include a full set of the unreported fixed industry-region effects. Prais-Winsten regressions do not contain separate year effects. However, it is assumed that disturbances are heteroscedastic and contemporaneously correlated across panels (i.e. industry × regions).

The variables that capture the changes in the exposure to international trade and foreign ownership are included in the models as lagged up to two years. There are two reasons for this. First, and most importantly, it should take some time before the effects on the labor share change appear. In particular, Maliranta (2005) shows that it is worthwhile taking into account the lagged effects when examining the influences of international trade on restructuring. Second, the contemporary correlation between the exposure to international trade and the labor share change could be the reverse, because a decline in the labor share improves the competitiveness of domestic production that tends to increase export volume in a small open economy.

The lagged effect is arguably closer to the causal effect. That being said, we cannot directly address the possibility that the measures of globalization may be endogenous, because our data do not contain appropriate economic instruments for globalization that could be claimed to be truly independent of the micro-level components of the labor share change. Thus, we document essentially correlations between globalization and different micro-level components of the labor share change. The problems regarding the causal interpretation of the estimates are even more apparent in the existing cross-county studies (e.g. European Commission 2007, 2008; Guscina 2006; Harrison 2002; Jaumotte and Tytell 2007; Jayadev 2007). One advantage of our approach is that the labor market regulations and other institutional aspects are similar for all units of observation (industry × region) in the estimations, because we focus on one country. This reduces the omitted variable bias. We are also able to test the strict exogeneity of the regressors by including the lead values of the measures of globalization among the explanatory variables. Furthermore, to examine the robustness of the baseline estimates we have estimated GMM specifications that allow us to instrument potentially endogenous variables with their lagged levels in the dynamic setting. This modeling framework offers the second-best solution dealing with endogeneity problems, since our data do not contain appropriate economic instruments.

All models are estimated by taking advantage of unfiltered data. The use of filtered data to estimate models is not an appropriate strategy for two reasons. First, the Hodrick-Prescott filter smoothes the data and leads to a complicated pattern of autocorrelation with future and past components in the dependent variables. This most likely would lead to spurious regression results (Meyer and Winker 2005). Second, the pre-filtering of the dependent variables would mean that they are measured with an error. This generates a systematic pattern of heteroskedasticity (Saxonhouse 1977). It would be very difficult to construct an econometric model to tackle both of these problems.

Our baseline estimates that consist of nine models are reported in Table 2. The first column shows that increasing exports lowers the industry labor share. The negative effect of the industry labor share comes from both the within component (-0.096) and the structural component (-0.125), as shown in Columns 2-3, respectively. Note that the Equation (1) holds: -0.223 å -0.096 ï 0.125. Therefore, a substantial part of the negative effect of increasing exports on the labor share change can be attributed to the micro-structural component.

=== TABLE 2 HERE ===

The negative industry effect of exports on the labor share (-0. 223) reported in Column 1 is a consequence of the fact that exports increase industry labor productivity (0.170), as shown in Column 4. The relationship between industry labor share change, industry wage growth (Column 7) and industry productivity growth given in the Equation (3) holds; for example, for d_EXPORT(t-1) we find that -0.223 å -0.043 ï 0.170.

Column 6 reveals that greater international trade involves intra-industry productivity-enhancing restructuring towards high productivity plants. This pattern is in accordance with the findings in the literature (e.g. Bernard and Jensen 2004; Bernard et al. 2007; Maliranta

2005). The industry productivity effect is a sum of the within component and micro-level restructuring, i.e. 0.170 = 0.010 + 0.160.

Column 7 of Table 2 shows that exports have no effect on industry wage growth. This explains why the productivity effect has such a large dominance in the determination of the labor share change. Exporting has only a weakly significant positive effect on the micro-structural component of industry wage growth (Column 9).

Overall, the estimates reveal that micro-level restructuring is an important channel through which exporting reduces the industry labor share. The effect comes essentially from the restructuring component of labor productivity growth. The restructuring component of industry wage growth has a very minor role to play, which can be seen from the empirical counterpart of the Equation (5) for the subcomponents of the restructuring component of labor share change: -0.125 å 0.013 ï 0.160.

The results also point out that the exposure to international trade is clearly a more important determinant of the micro-level components of the labor share change than foreign ownership. Foreign ownership does not have a statistically significant effect on labor productivity or wage growth.

So far we have found that the micro-structural components have had an important role in the determination of the labor share and productivity. We next take a closer look at the sub-components of the structural component, as described earlier in the Equation (2). This decomposition allows us to pinpoint the exact sources of the effects.

Table 3 reports the estimates for the labor share change. Column 1 in Table 3 is the same as Column 3 in Table 2. It is approximately the sum of the estimates of Columns 2-5 in Table 3 so that one can read the contribution of each sub-component to the structural component. We discover that the negative effect of the structural component on the labor share change emerges largely through the exits of plants, i.e. those plants with a particularly high share of labor income are eventually forced out of business as exports increase (Column 3). In addition, the between component has a negative contribution to the structural component.

=== TABLE 4 HERE ===

Table 4 reports the corresponding results for labor productivity growth. These estimates show that the productivity-enhancing restructuring effect of exports derives essentially from the exit component (Column 3).

=== TABLE 5 HERE ===

To assess the direction of causality between the variables of interest, we have tested the strict exogeneity of the regressors by including the lead values of the explanatory variables (export share and foreign ownership) in the model (Wooldridge 2002). The results reveal that the lead values of export share and foreign ownership are not statistically significant in none of the nine models that are estimated (Table 5). This supports the conclusion that the causal loop runs from the measures of globalization on the micro-level components of labor share change and not the other way around. This interpretation of our findings is also consistent with the theoretical and empirical literature that underlines the importance of exposure to international trade as a stimulus of restructuring.

=== TABLE 6 HERE ===

To examine the robustness of the results, we have performed several checks. First, we have estimated models that also include a variable that measures skill upgrading (i.e. the change in the highly educated) among the explanatory variables to account for the changes in labor supply. Because this variable is not available for the earlier years, these estimations cover the period 1990-2007. In spite of the different period and the slightly different set of explanatory variables the main findings are relatively similar to those made in Table 2 (not reported). We also have estimated OLS models. (The control variables include a full set of the unreported industry-region and year effects.) The central findings for the role of micro-level restructuring remain (Appendix: Table A1). However, the estimated standard errors are much larger than the panel-corrected standard errors from the Prais-Winsten regressions, because the structure of autocorrelation is not taken into account in the OLS estimation (see Beck and Katz 1995). We also have estimated specifications by using system GMM panel estimation methods to tackle the potential endogeneity of the measures of globalization (see Blundell and Bond 1998). The parameter estimates from system GMM panel estimations are relatively close to those reported in Table 2, but they are not statistically significant at the conventional levels (not reported). This is not surprising, because the method is not very efficient in our context. Finally, we have estimated the models of Table 2 separately for each of 12 manufacturing industries. These results reveal an interesting pattern. It turns out that the contribution of international trade to the decline in the labor share has been particularly pronounced within the telecommunication equipment industry that consists of ñcommunications equipmentò (NACE 32-33) (Appendix: Table A2). Therefore, our results point out that the high-tech industries can constitute an important vehicle through which the effects of globalization on the labor share decline manifest themselves in a small open economy.[9]

To summarize the picture that emerges, the estimates show that globalization squeezes the labor share because of increasing labor productivity. Labor productivity growth, in turn, derives to an important degree from intra-industry restructuring. The export share has increased more than 20 percentage points over the last three decades, though it varies to some extent between regions and a great deal between industries. According to our estimates this would lead to a decline in the labor share by 10 percent (or 5-6 percentage points), of which 40 percent takes place through intra-industry restructuring.

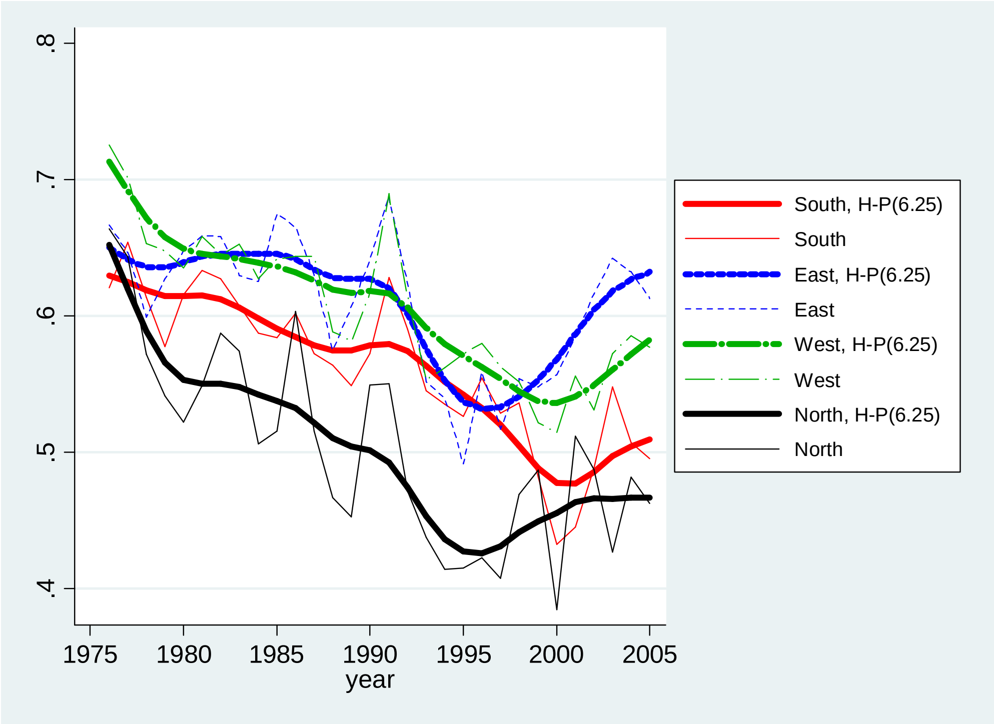
5. Conclusions

The labor share is an important aggregate variable, subject to possible mistaken policy interventions but mistaken interpretations as well. The labor share of the national income has declined substantially in several industrialized countries during the past few decades. Globalization is likely to have some role to play in directing the changes in the labor shares. Despite the fact that the role of labor market regulations and other institutional aspects affecting the determination of the labor share has gained a considerable amount of attention in the cross-country comparisons (e.g. Azmat et al. 2007; Bentolila and Saint-Paul 2003; IMF 2007), knowledge of the exact micro-level sources and mechanisms of industry wage growth is absent. Therefore, the determinants of systematic movements in the labor shares are not well understood.

This paper contributes to the literature by distinguishing between two intrinsically different mechanisms underlying the industry labor share changes: 1) the labor share change of the average plant and 2) the micro-structural change. Specifically, we take advantage of a useful variant of the decomposition of the labor share, labor productivity and wage growth in 12 manufacturing industries and four regions to distinguish between the within and micro-restructuring components, through the use of Finnish longitudinal plant-level data over the period 1975-2007. Regression analysis of the micro-level components allows us to examine not only the effects of international trade and other factors on the labor share changes but also to look at the distinct micro-level mechanisms.

Our analysis points out the importance of looking at the micro-level mechanisms underlying industry-level changes. The most important empirical finding is that we identify an additional role of the exposure to international trade: there is evidence of a systematic micro-structural change in terms of value added towards those plants that have a lower labor share. Globalization squeezes the labor share because of increasing labor productivity. The labor productivity growth effect of globalization, in turn, predominantly comes through intra-industry restructuring. Furthermore, the negative effect of exporting on industry labor share change emerges largely through the exits of plants, i.e. those plants with a particularly high share of labor income are forced out of business as exports increase. In contrast, wage formation has been largely insulated from the influences of increasing international trade over a period of three decades. These micro-economic mechanisms are also relevant in the economic context of other advanced economies and the effects should generalize beyond the Finnish case. Our results carry an important policy lesson. Taken that globalization boosts labor productivity while wages do not fall, it will eventually also benefit employees in the long run. However, this requires flexibility of labor markets so that employees from the exiting plants move to more productive and profitable jobs. Greater wage flexibility between plants would be one way to mitigate this pressure (see Moene and Wallerstein 1997).

FIGURE 1 The labor share by region



NOTE: The labor shares are smoothed by using the Hodrick-Prescott filter with a parameter value of 6.25, as proposed by Ravn and Uhlig (2002).

TABLE 1 Conceptual framework and empirical decomposition of the changes in the labor share, annual weighted averages for the period 1975-2007

Panel A: Conceptual framework		**Micro-level mechanisms**	
Industry-level aggregates		*Change in the average plant*	*Plant-level restructuring*
Wage change (= $a+b$)	dW	a	b
Labor productivity change (= $c+d$)	dP	c	d
The labor share change (= (dW - dP) = ($a+b$) - ($c+d$) = ($a-c$) + ($b-d$))	dF		
Panel B: Empirical decomposition		**Micro-level mechanisms**	
Industry-level aggregates		*Change in the average plant*	*Plant-level restructuring*
Wage change = dW	*3.7%*	*3.7%*	*0.0%*
Labor productivity change = dP	4.2%	*3.3%*	*1.0%*
The labor share change = dF = (dW - dP)	-0.5%		

NOTES: Averages are computed by using the valued-added share weights. Figures may not add up due to rounding.

TABLE 2 Estimation results for the micro-level components of the labor share change, labor productivity growth and wage growth for the years 1978-2007

	Labor share change			**Labor productivity growth rate**			**Wage growth rate**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	total	within	structural	total	within	structural	total	within	structural
d_EXPORT(t-1)	-0.223**	-0.096	-0.125**	0.170*	0.010	0.160**	-0.043	-0.054	0.013
	(0.076)	(0.066)	(0.046)	(0.078)	(0.069)	(0.052)	(0.055)	(0.054)	(0.009)
d_EXPORT(t-2)	-0.226**	-0.180**	-0.050	0.165*	0.138*	0.028	-0.059	-0.057	-0.003
	(0.078)	(0.068)	(0.047)	(0.079)	(0.069)	(0.053)	(0.057)	(0.056)	(0.009)
d_FOROWN(t-1)	-0.011	0.009	-0.021	0.019	0.005	0.016	0.010	0.010	-0.001
	(0.045)	(0.040)	(0.018)	(0.050)	(0.047)	(0.023)	(0.039)	(0.038)	(0.007)
d_FOROWN(t-2)	0.005	0.020	-0.017	0.032	0.043	-0.009	0.044	0.053	-0.008
	(0.046)	(0.041)	(0.020)	(0.052)	(0.048)	(0.025)	(0.040)	(0.039)	(0.007)
Observations	1440	1440	1440	1440	1440	1440	1440	1440	1440
R-squared	0.057	0.026	0.087	0.019	0.036	0.081	0.097	0.103	0.033

NOTES: Coefficients are from Prais-Winsten regressions. Panel-corrected standard errors are reported in parentheses. Observations are weighted by the value added shares. Lagged values are used for the changes in export and foreign ownership shares. All models include the fixed industry-region effects. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

TABLE 3 Estimation results for the structural component of the labor share change for the years 1978-2007

	(1) structural	(2) entry	(3) exit	(4) between	(5) cross-component
d_EXPORT(t-1)	-0.125**	0.017	-0.115*	-0.074*	0.046
	(0.046)	(0.025)	(0.053)	(0.034)	(0.032)
d_EXPORT(t-2)	-0.050	0.027	-0.060	0.044	-0.069*
	(0.047)	(0.023)	(0.052)	(0.034)	(0.032)
d_FOROWN(t-1)	-0.021	0.004	-0.012	-0.003	-0.008
	(0.018)	(0.010)	(0.015)	(0.024)	(0.024)
d_FOROWN(t-2)	-0.017	-0.023*	0.010	0.000	-0.005
	(0.020)	(0.011)	(0.017)	(0.025)	(0.025)
Observations	1440	1440	1440	1440	1440
R-squared	0.087	0.061	0.092	0.047	0.033

NOTES: Coefficients are from Prais-Winsten regressions. Panel-corrected standard errors are reported in parentheses. Observations are weighted by the value added shares. Lagged values are used for the changes in export and foreign ownership shares. All models include the fixed industry-region effects. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

TABLE 4 Estimation results for the structural component of labor productivity growth for the years 1978-2007

	(1) structural	(2) entry	(3) exit	(4) between	(5) cross-component
d_EXPORT(t-1)	0.160**	0.007	0.110*	0.004	0.037
	(0.052)	(0.021)	(0.049)	(0.016)	(0.025)
d_EXPORT(t-2)	0.028	-0.008	0.052	0.014	-0.016
	(0.053)	(0.021)	(0.049)	(0.016)	(0.025)
d_FOROWN(t-1)	0.016	-0.006	0.013	0.017+	-0.006
	(0.023)	(0.011)	(0.014)	(0.010)	(0.016)
d_FOROWN(t-2)	-0.009	0.016	-0.006	0.003	-0.020
	(0.025)	(0.012)	(0.016)	(0.010)	(0.016)
Observations	1440	1440	1440	1440	1440
R-squared	0.081	0.033	0.084	0.108	0.014

NOTES: Coefficients are from Prais-Winsten regressions. Panel-corrected standard errors are reported in parentheses. Observations are weighted by the value added shares. Lagged values are used for the changes in export and foreign ownership shares. All models include the fixed industry-region effects. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

TABLE 5 Estimation results for the micro-level components of the labor share change, labor productivity growth and wage growth for the years 1978-2007

	Labor share change			**Labor productivity growth rate**			**Wage growth rate**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	total	within	structural	total	within	structural	total	within	structural
d_EXPORT(t+1)	0.049	-0.013	0.068	-0.018	0.000	-0.019	0.039	0.037	0.003
	(0.077)	(0.069)	(0.044)	(0.080)	(0.071)	(0.050)	(0.053)	(0.052)	(0.008)
d_EXPORT(t-1)	-0.229**	-0.099	-0.128**	0.192*	0.034	0.157**	-0.029	-0.037	0.009
	(0.078)	(0.068)	(0.047)	(0.080)	(0.072)	(0.052)	(0.058)	(0.057)	(0.008)
d_EXPORT(t-2)	-0.229**	-0.180*	-0.054	0.150+	0.118+	0.033	-0.072	-0.068	-0.004
	(0.082)	(0.070)	(0.049)	(0.082)	(0.072)	(0.054)	(0.058)	(0.056)	(0.008)
d_FOROWN(t+1)	0.017	0.000	0.015	0.006	0.021	-0.015	0.016	0.023	-0.008
	(0.042)	(0.040)	(0.013)	(0.046)	(0.044)	(0.017)	(0.044)	(0.042)	(0.006)
d_FOROWN(t-1)	-0.013	0.007	-0.021	0.023	0.009	0.016	0.011	0.010	0.001
	(0.046)	(0.040)	(0.019)	(0.050)	(0.048)	(0.023)	(0.039)	(0.038)	(0.007)
d_FOROWN(t-2)	-0.001	0.024	-0.025	0.033	0.037	-0.001	0.041	0.049	-0.007
	(0.047)	(0.041)	(0.021)	(0.051)	(0.049)	(0.025)	(0.040)	(0.039)	(0.007)
Observations	1392	1392	1392	1392	1392	1392	1392	1392	1392
R-squared	0.063	0.027	0.114	0.024	0.033	0.106	0.082	0.090	0.042

NOTES: Coefficients are from Prais-Winsten regressions. Panel-corrected standard errors are reported in parentheses. Observations are weighted by the value added shares. Lagged values are used for the changes in export and foreign ownership shares. All models include the fixed industry-region effects. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

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APPENDIX

DERIVATION OF THE EQUATIONS (1) AND (2)

The aggregate labor share is

(A.1) $$F_t = \frac{\sum_i w_{it}}{\sum_i v_{it}} = \sum_i \frac{v_{it}}{v_t}\frac{w_{it}}{v_{it}}$$

In period t plants can be divided into two groups: plants that appeared also in period t-1, (continuing plants, denoted by C) and plants that made an entry after t-1 (entering plants, denoted by E). Then the aggregate labor share can be written as follows:

(A.2)
$$\begin{aligned}
& F_t = \sum_{i\in C}\frac{v_{it}}{v_t}\frac{w_{it}}{v_{it}} + \sum_{j\in E}\frac{v_{jt}}{v_t}\frac{w_{jt}}{v_{jt}} \\
& \Leftrightarrow F_t = \frac{\sum_{i\in C} v_{it}}{v_t}\frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} + \frac{\sum_{j\in E} v_{jt}}{v_t}\frac{\sum_{j\in E} w_{jt}}{\sum_{j\in E} v_{jt}} \\
& \Leftrightarrow F_t = \left(1 - \frac{\sum_{j\in E} v_{jt}}{v_t}\right)\frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} + \frac{\sum_{j\in E} v_{jt}}{v_t}\frac{\sum_{j\in E} w_{jt}}{\sum_{j\in E} v_{jt}} \\
& \Leftrightarrow F_t = \frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} - \frac{\sum_{j\in E} v_{jt}}{v_t}\frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} + \frac{\sum_{j\in E} v_{jt}}{v_t}\frac{\sum_{j\in E} w_{jt}}{\sum_{j\in E} v_{jt}} \\
& \Leftrightarrow F_t = \frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} + \frac{\sum_{j\in E} v_{jt}}{v_t}\left(\frac{\sum_{j\in E} w_{jt}}{\sum_{j\in E} v_{jt}} - \frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}}\right)
\end{aligned}$$

In a similar manner we can define the aggregate labor share in period t-1:

(A.3) $$F_{t-1} = \frac{\sum_i w_{i,t-1}}{\sum_i v_{i,t-1}} = \sum_i \frac{v_{i,t-1}}{v_{t-1}}\frac{w_{i,t-1}}{v_{i,t-1}}$$

In period t-1 plants can be divided into two groups: plants that survive until period t (continuing plants, denoted by C) and plants that disappear after period t-1.

$$F_{t-1}=\sum_{i\in C}\frac{v_{i,t-1}}{v_{t-1}}\frac{w_{i,t-1}}{v_{i,t-1}}+\sum_{k\in D}\frac{v_{k,t-1}}{v_{t-1}}\frac{w_{j,t-1}}{v_{k,t-1}}$$

$$\Leftrightarrow F_{t-1}=\frac{\sum_{i\in C}v_{i,t-1}}{v_{t-1}}\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}+\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}$$

(A.4) $$\Leftrightarrow F_{t-1}=\left(1-\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\right)\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}+\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}$$

$$\Leftrightarrow F_{t-1}=\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}-\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}+\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}$$

$$\Leftrightarrow F_{t-1}=\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}+\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\left(\frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}-\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}\right)$$

By using (A.3) and (A.4) we obtain

(A.5) $$F_t-F_{t-1}=\frac{\sum_{i\in C}w_{it}}{\sum_{i\in C}v_{it}}+\frac{\sum_{j\in E}v_{jt}}{v_t}\left(\frac{\sum_{j\in E}w_{jt}}{\sum_{j\in E}v_{jt}}-\frac{\sum_{i\in C}w_{it}}{\sum_{i\in C}v_{it}}\right)-\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}-\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}\left(\frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}-\frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}\right)$$

Let us denote

$$\frac{\sum_{j\in E}v_{jt}}{v_t}=S_t^E;\ \frac{\sum_{j\in E}w_{jt}}{\sum_{j\in E}v_{jt}}=F_t^E;\ \frac{\sum_{i\in C}w_{it}}{\sum_{i\in C}v_{it}}=F_t^C;$$
$$\frac{\sum_{k\in D}v_{k,t-1}}{v_{t-1}}=S_{t-1}^D;\ \frac{\sum_{k\in D}w_{k,t-1}}{\sum_{k\in D}v_{k,t-1}}=F_{t-1}^D;\ \frac{\sum_{i\in C}w_{i,t-1}}{\sum_{i\in C}v_{i,t-1}}=F_{t-1}^C$$

We then get

(A.6) $$F_t-F_{t-1}=F_t^C-F_{t-1}^C+S_t^E\left(F_t^E-F_t^C\right)-S_{t-1}^D\left(F_{t-1}^D-F_{t-1}^C\right)$$

This shows that the aggregate labor share change, i.e. $F_t - F_{t-1}$, is the change in the aggregate labor share change among the continuing plants, i.e. $F_t^C - F_{t-1}^C$, plus the entry effect, i.e. $S_t^E\left(F_t^E - F_t^C\right)$, plus the exit effect, i.e. $-S_{t-1}^D\left(F_{t-1}^D - F_{t-1}^C\right)$.

The change in the aggregate labor share among the continuing plants can be further decomposed as follows:

$$
\text{(A.7)} \qquad
\begin{aligned}
& F_t^C - F_{t-1}^C = \frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} - \frac{\sum_{i\in C} w_{i,t-1}}{\sum_{i\in C} v_{i,t-1}} \\
& \Leftrightarrow F_t^C - F_{t-1}^C = 0.5\left(\frac{v_{it}}{\sum_{i\in C} v_{it}} + \frac{v_{i,t-1}}{\sum_{i\in C} v_{i,t-1}}\right)\left(\frac{w_{it}}{v_{it}} - \frac{w_{i,t-1}}{v_{i,t-1}}\right) \\
& +0.5\left(\frac{w_{it}}{v_{it}} + \frac{w_{i,t-1}}{v_{i,t-1}}\right)\left(\frac{v_{it}}{\sum_{i\in C} v_{it}} - \frac{v_{i,t-1}}{\sum_{i\in C} v_{i,t-1}}\right)
\end{aligned}
$$

Let us use the following expressions

$$
\begin{aligned}
& \frac{\sum_{i\in C} w_{it}}{\sum_{i\in C} v_{it}} = f_{it}; \frac{\sum_{i\in C} w_{i,t-1}}{\sum_{i\in C} v_{i,t-1}} = f_{i,t-1}; 0.5\left(f_{it} + f_{i,t-1}\right) = \overline{f}_i; \\
& \frac{v_{it}}{\sum_{i\in C} v_{it}} = s_{it}; \frac{v_{i,t-1}}{\sum_{i\in C} v_{i,t-1}} = s_{i,t-1}; 0.5
\end{aligned}
$$

Then, inserting (A.7) into (A.6) we obtain

$$
\text{(A.8)} \qquad F_t - F_{t-1} = \sum_{i\in C} \overline{s}_i\left(f_{it} - f_{i,t-1}\right) + \sum_{i\in C}\left(s_{it} - s_{i,t-1}\right)\overline{f}_i + S_t^E\left(F_t^E - F_t^C\right) - S_{t-1}^D\left(F_{t-1}^D - F_{t-1}^C\right)
$$

This formula has been used in Kyyrä and Maliranta (2008). In this paper, we turn this decomposition into a rate form. We can do this by dividing all the terms of (A.8) by the average aggregate labor share, i.e. $\overline{F} = 0.5\left(F_t + F_{t-1}\right)$. Then we have

(A.9) $$\frac{F_t - F_{t-1}}{\bar{F}} = \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{F}} + \frac{\sum_{i\in C}\left(s_{it} - s_{i,t-1}\right)\bar{f}_i}{\bar{F}} + \frac{S_t^E\left(F_t^E - F_t^C\right)}{\bar{F}} - \frac{S_{t-1}^D\left(F_{t-1}^D - F_{t-1}^C\right)}{\bar{F}}$$

One of our main goals in this paper is to look at the growth rate of the labor share within the plants. Therefore we would like to develop the first component of the right-hand side of (A.9).

(A.10) $$\frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{F}} = \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{F}} + \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i} - \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i}$$
$$\Leftrightarrow \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{F}} = \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i} + \frac{\sum_{i\in C}\bar{s}_i\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i}\left[\frac{\bar{f}_i}{\bar{F}} - 1\right]$$

Inserting (A.10) into (A.9) we get

(A.11) $$\frac{F_t - F_{t-1}}{\bar{F}} = \sum_{i\in C}\bar{s}_i\frac{\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i} + \sum_{i\in C}\bar{s}_i\frac{\left(f_{it} - f_{i,t-1}\right)}{\bar{f}_i}\left[\frac{\bar{f}_i}{\bar{F}} - 1\right] + \sum_{i\in C}\frac{\bar{f}_i}{\bar{F}}\left(s_{it} - s_{i,t-1}\right) +$$
$$\frac{S_t^E\left(F_t^E - F_t^C\right)}{\bar{F}} - \frac{S_{t-1}^D\left(F_{t-1}^D - F_{t-1}^C\right)}{\bar{F}}$$

TABLE A1 OLS estimation results for the micro-level components of the labor share change, labor productivity growth and wage growth for the years 1978-2007

	Labor share change			**Labor productivity growth rate**			**Wage growth rate**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	total	within	structural	total	within	structural	total	within	structural
d_EXPORT(t-1)	-0.061	0.014	-0.074+	0.052	-0.073	0.125*	-0.009	-0.027	0.017*
	(0.077)	(0.072)	(0.042)	(0.100)	(0.092)	(0.052)	(0.045)	(0.043)	(0.008)
d_EXPORT(t-2)	-0.089	-0.066	-0.023	0.097	0.074	0.023	0.008	0.011	-0.003
	(0.065)	(0.066)	(0.029)	(0.079)	(0.080)	(0.038)	(0.044)	(0.043)	(0.007)
d_FOROWN(t-1)	-0.006	0.006	-0.012	0.054	0.048	0.006	0.048	0.051	-0.003
	(0.041)	(0.037)	(0.018)	(0.052)	(0.049)	(0.020)	(0.036)	(0.036)	(0.005)
d_FOROWN(t-2)	-0.058	-0.017	-0.042	0.094	0.069	0.025	0.036	0.041	-0.005
	(0.056)	(0.040)	(0.035)	(0.062)	(0.043)	(0.040)	(0.029)	(0.026)	(0.008)
Observations	1440	1440	1440	1440	1440	1440	1440	1440	1440
R-squared	0.184	0.196	0.074	0.137	0.179	0.079	0.313	0.317	0.076
Adj. R-squared	0.157	0.169	0.043	0.108	0.151	0.048	0.290	0.294	0.045

NOTES: The estimation method is ordinary least squares. Lagged values used for the changes in export and foreign ownership shares. All models include a full set of the industry-region and year effects. Robust standard errors are reported in parentheses. Weighted by the value added shares. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

TABLE A2 Estimation results for the micro-level components of the labor share change, labor productivity growth and wage growth in the telecommunication equipment industry (NACE 32-33) for the years 1978-2007

	Labor share change			**Labor productivity growth rate**			**Wage growth rate**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	total	within	structural	total	within	structural	total	within	structural
d_EXPORT(t-1)	-0.683***	-0.148	-0.510**	0.625**	-0.040	0.603***	-0.035	-0.092	0.056*
	(0.173)	(0.121)	(0.157)	(0.199)	(0.147)	(0.163)	(0.075)	(0.069)	(0.023)
d_EXPORT(t-2)	-0.560**	-0.382**	-0.176	0.455*	0.422**	0.043	-0.096	-0.109	0.023
	(0.199)	(0.126)	(0.187)	(0.226)	(0.154)	(0.195)	(0.082)	(0.074)	(0.027)
d_FOROWN(t-1)	-0.390	0.009	-0.425	0.163	-0.519	0.645	-0.188	-0.301+	0.111
	(0.432)	(0.319)	(0.374)	(0.500)	(0.379)	(0.398)	(0.194)	(0.180)	(0.067)
d_FOROWN(t-2)	0.840*	0.544*	0.299	-0.866+	-0.267	-0.529	-0.008	-0.007	0.015
	(0.412)	(0.256)	(0.356)	(0.473)	(0.303)	(0.402)	(0.155)	(0.143)	(0.058)
Observations	120	120	120	120	120	120	120	120	120
R-squared	0.262	0.187	0.186	0.179	-0.102	0.193	0.182	0.158	0.081

NOTES: Coefficients are from Prais-Winsten regressions. Panel-corrected standard errors are reported in parentheses. Observations are weighted by the value added shares. Lagged values are used for the changes in export and foreign ownership shares. All models include the fixed industry-region effects. Statistical significance: + p<0.1, * p<0.05, ** p<0.01, *** p<0.001.

[1] Ripatti and Vilmunen (2001), Sauramo (2004), and Kyyrä and Maliranta (2008) provide earlier evidence on the development of the labor share in Finland.

[2] Bartelsmans et al. (2009) note the same fact in the context of cross-country comparisons of productivity dynamics.

[3] Maliranta (2003) provides an illustration of the features of various methods applied in the literature.

[4] To be more precise, we use a chain-index procedure. Value added and wages in year *t* are expressed in year *t*-1 prices.

[5] Derivation of the Equations 1-2 is presented in the Appendix.

[6] The assignment of plants to industries is not particularly problematic for two reasons. First, a plant is defined in the Annual Industrial Statistics Survey as a local kind-of-activity unit. It is a specific physical location, which is specialized in the production of certain types of products or services. Second, in this paper we use a relatively aggregated industry classification.

[7] Helpman et al. (2004) stress that multinational firms have the highest productivity. Therefore, they could be especially important in productivity dynamics as well. It is unfortunate that we do not have this information for our analysis for a period long enough. Because we take advantage of a panel of industries and regions, we are not able to incorporate import penetration into the models by using OECDǒs STAN database. One problem with the inclusion of imports would be the possible positive correlation between the changes in imports and exports.

[8] Prais and Winsten (1954) present the idea of the estimation method.

[9] Since the mid-1990s this sector has been dominated by the manufacture of mobile phones (and Nokia).