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Trade's Impact on the Labor Share: Evidence from German and Italian Regions

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Trade's Impact on the Labor Share:
Evidence from German and Italian Regions

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Abstract

Has the labor share declined? And what is the impact of international trade? These questions are not only relevant in an international context they also matter for understanding the regional distribution of incomes in a given country. In this paper, we study two regions with trade exposures that differ from the rest of the country, and which display distinct changes in the labor share. East German and Southern Italian regions have a degree of international openness which is below the countries' averages. At the same time, there has been a more pronounced decline in the labor share in East Germany than in West Germany. In Southern Italy, the labor share has increased in recent years. We show that increased trade openness is not the main culprit behind changing labor shares.

JEL codes: E25, F10, R10

Keywords: labor share, trade, regions

1 Motivation

Many empirical studies show that greater openness for trade has positive implications for economic growth.[1] The public often perceives trade openness to be less beneficial. Across EU countries, 19-51% of respondents consider themselves being winners of globalization (Opaschowski and Reinhart 2007). The perceptions of who looses from globalization are equally dispersed with shares of 13-48% of the population. Attitudes towards free trade also differ by skill group. Scheve and Slaughter (2001), for instance, find that high-skilled individuals in the US are relatively more in favor of free trade than low-skilled workers.

Notwithstanding that the survey evidence is somewhat amorphous, public perceptions of the benefits of free trade are to a large extent shaped by distributional concerns. For this reason, it is important to understand the determinants of the labor share and its relation to trade openness. While most studies to date are based on cross-country data, we study the implications of trade openness for the within-country income distribution.

We use regional data for two large European countries, Germany and Italy. Our data come from regional national accounts and cover the 1991-2005 period; for the West German states, we also have a sample which starts in 1970. Methodologically, we study the long-run determinants of the labor share using panel cointegration methods. These methods have the additional advantage of accounting for the endogeneity of trade. For shorter panels starting in the 1990s, we use the method proposed by Frankel and Romer (1999) to generate instruments for trade that are based on gravity regressions.

Why do we focus on Italy and Germany? We have three main reasons for this choice.

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[1]   See Baldwin (2003), Helpman (2007), or Rodriguez (2006) for recent surveys of the literature.

First, these countries show distinct regional disparities in terms of growth performance and international openness. In 2006, GDP per capita has been about 50% higher in West than in East Germany (29,839 versus 20,070 €).[2] In Italy, the gap between nominal incomes in the North and South has been about 40% (23,500 versus 16,500 €).[3] Differences in trade openness are one reason for these differences in GDP per capita (Buch and Toubal 2008, Buch and Monti 2008). West Germany and Northern Italy are more integrated into international trade and into cross-border factor movements than East Germany and Southern Italy, respectively (Graph 1). In this paper, we ask whether trade openness affects not only the level but also the distribution of income.

Second, labor shares have shown different trends over time. For the West German states, the mean labor share has remained fairly unchanged over the past 15 years (about 65% relative to GDP) (Graph 2 and Table 3b). In East Germany, the labor share has declined from 86 to 74% between 1991 and 2005. In Italy, the labor share has been lower throughout (average of 50%). It has shown a weak downward trend over time, which has been driven mainly by the Centre-North regions. In recent years, the decline in the labor share has reversed, in particular in the Southern regions (Graph 2 and Table 4).

Third, East Germany's communist past could explain both, a low degree of trade integration and high labor shares. Before the fall of the Berlin Wall, East Germany had close trade links with Eastern European countries. Following Germany re-unification, total trade of the East German states fell, and a re-orientation of trade towards Western countries has started. Moreover, to the extent that high labor shares in the early 1990s reflected political preferences concerning the distribution of incomes, the trend decline in the labor share in East Germany could be related to a convergence of these preferences. A priori, increasing trade integration

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[2]   See http://www.vgrdl.de/Arbeitskreis_VGR/.

[3]   Data are for 2005 according to the Italian Statistical Office *Istat*

could thus be a less important factor behind declining labor shares in East Germany than in the other regions studied here.

In the following, we analyze the link between openness and the labor share at the regional level more systematically, thus complementing literature using country-level data (Table 1). According to a recent IMF study (IMF 2007), higher export prices, lower import prices, more offshoring, and more immigration lower the labor share. Guscina (2006) also finds that more trade lowers the labor share. Harrison (2002) uses a large cross-country panel dataset and documents changing labor shares for the 1960-1997 period. Her results suggest that rising trade shares and exchange rate crises lower the labor share. Tighter capital controls increase the labor share. Hence, these studies contradict the conventional wisdom that labor shares are constant over time,[4] and that changes in international openness might be a driving force.

We develop our results in the following steps. In Part Two, we derive our testing equation, we describe the data, and we present descriptive statistics. Part Three explains the estimation method and presents the regression results. Part Four discusses welfare implications of increased trade openness, and Part Five concludes. We find that greater openness for trade has not generally been associated with a decline in the labor share. For East Germany, there has been a trend decline in the labor share in the early 1990s, which is unrelated to trade openness.

2 Testing Equation and Data

2.1 *Testing Equation*

The main intuition of why increasing levels of foreign trade could lead to a redistribution of income between factors of production comes from the Heckscher-Ohlin (HO) model.

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[4] See Krueger (1999) or Gollin (2002) for reviews of the literature.

According to this model, the relatively abundant factor in each country gains from trade while the relatively scarce factor loses. For developed countries such as Germany and Italy, which are richly endowed with capital, the model would predict a declining labor share as trade intensity increases.

There has been an intensive discussion on the validity and empirical support of the HO-model. (See, e.g., Feenstra (2004) for an overview.) Ultimately, the link between trade and factor shares must thus be determined empirically. One popular empirical approach is based on Kohli (2003), who shows how factor shares can be derived from a translog GDP function:[5]

$$
\begin{aligned}
\ln Y = \alpha_0 + \sum_{i=1}^{N} \alpha_i p_i + \sum_{k=1}^{M} \beta_k \ln V_k + \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \gamma_{ij} \ln p_i \ln p_j \\
+ \frac{1}{2} \sum_{k=1}^{M} \sum_{l=1}^{M} \delta_{kl} \ln V_k \ln V_l + \sum_{i=1}^{N} \sum_{k=1}^{M} \phi_{ik} \ln p_i \ln V_k
\end{aligned}
\tag{1}
$$

where p = product prices, and V = factor endowments. The derivative of the translog GDP function with respect to factor endowment k is given by: $\frac{\partial \ln G}{\partial \ln V_k} = \frac{\partial G}{\partial V_k} \cdot \frac{V_k}{G}$. Since $\frac{\partial G}{\partial V_k}$ is the payment to endowment k, $\frac{\partial G}{\partial V_k} \cdot \frac{V_k}{G}$ gives the share of GDP paid to factor k – i.e. the labor or the capital share $s_k = \frac{w_k V_k}{G}$. Factor shares can thus be written as a function of factor endowments and product prices:

$$
s_k = \beta_k + \sum_{l=1}^{M} \delta_{kl} \ln V_l + \sum_{i=1}^{N} \phi_{ik} \ln p_i
\tag{2}
$$

Empirically, factor shares also depend on parameters related to trade openness. We thus estimate the following augmented labor share equation:

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[5]   The translog representation of the national income function as the minimum of the total cost function is derived under the assumption of constant returns to scale, convexity, perfect competition, and fixed technologies. The following presentation follows Feenstra (2004).

$$s_{it} = \alpha_0 + \alpha_1 \ln K_{it} + \alpha_2 \ln L_{it} + \alpha_3 \ln Y_{it} + \alpha_4 \mathbf{T}_{it} + \alpha_5 \mathbf{X}_{it} + \alpha_5 \mathbf{p}_{it} + \varepsilon_{it} \tag{3}$$

where s_{it} is the labor share in state i in year t, K = capital, L = labor, Y = output, $\mathbf{T}$ = a vector of variables capturing international openness, $\mathbf{X}$ = a vector of control variables, $\mathbf{p}$ = a vector of input and output prices.

Our explanatory variables are closely related to earlier literature in the field (Table 1). We include the regional per capita capital stock (K) and regional employment (L) used as inputs in the production of regional output (Y). The expected signs of these variables depend on the shape of the production function and on the degree of substitutability between capital and labor. In the case of a Cobb-Douglas production function, the labor share is a monotonic function of the capital-labor ratio: if labor and capital are substitutes, a higher capital intensity of production will lower the labor share; if they are complements, a higher capital intensity it will increase the labor share (Bentolila and Saint-Paul 2003).

We also add different proxies for the integration into the international division of labor.[6] In our main specifications, we use the level of imports and exports relative to GDP. If trade increasingly takes place with labor-abundant low income countries, we expect trade integration to put pressure on wages relative to the return to capital in the developed countries studied here. Hence, we expect a negative sign. Note that changes in international openness could also affect the labor share by changing the bargaining power of workers. Harrison (2002) has a model in which workers and firms bargain over the allocation of profits in a Nash bargaining game. One reason for changes in the bargaining power of firms and workers in a globalized world is that firms can threaten more credibly to leave the country if workers demand higher wages.

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[6] In a cross-country setting, one could also account for differences in labor market institutions and union power. However, we have no information on differences in these variables across the German or Italian regions.

2.2   *Data and Descriptive Statistics*[7]

For Germany, data on regional labor shares come from the regional national account published by the German Statistical Office. We have two samples. For the eleven West German states, we have data for 36 years (1970-2005). These long-run time series do not contain information on depreciation and on national income, which would be the ideal measures to scale employee compensation (Feldstein 2007). We therefore compute the ratio of compensation of employees relative to gross domestic product (GDP). Since (in our case) GDP exceeds national income, the corresponding labor share is lower than the one computed using national income (Table 3a). For all German states, including the five East German states, our data span the period 1991-2005. For this period, we also have information on national income.

Table 3a shows that, since the 1970s, the average labor share for the West German states has declined from 0.56 to 0.53. Scaling employees' compensation by national income and using data for all German states in the 1990s and 2000s shows a small decline of the labor share as well. At the same time, labor shares differ quite considerably across states (Table 3b). On average, the East German states had higher labor shares than the West German states, and the decline in the labor shares has been more pronounced in the East. Among the West German states, heterogeneity is substantial as well with the highest values being observed in city states such as Hamburg and Bremen, and the lowest in Rheinland-Pfalz and Schleswig Holstein.

In parallel, trade integration has increased (Table 3a). In the past 15 years, the ratio of imports over GDP in Germany has increased from 0.23 to 0.29; the export ratio has increased from 0.22 to 0.28. The most internationally integrated states are city states hosting harbors (Bremen, Hamburg), small states located close to the French border (Saarland) as well as the

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[7]   Details are given in Table 2.

Southern German state of Baden-Württemberg. The main dividing line is between East and West German states though. Over the full sample period (1991-2005), mean export and import shares were less than 0.10 of GDP in the East and about 0.24 in the West.

In sum, the data show a higher labor share in East than in West Germany and a lower degree of trade openness in the East than in the West. Also, the labor share has decreased while trade openness has increased over time. Hence, the unconditional correlation between the labor share and trade openness has been negative for Germany.

Turning to Italy, evidence shows that the labor share has been lower than in Germany, but it has shown similar trends (Table 4a). The largest decline occurred during the 1980s. More recently, the negative trend has reversed somewhat. The labor share computed as a ratio between employees' compensation and net national income, net of indirect taxes (available from 1980) is about 10 percentage points higher. Apart from this level effect, the time trends are very similar.

There are some distinct differences in the time patterns across regions as well. Not only has the labor share of the Southern regions been constantly higher than that of the Northern regions. Starting from the late 1990s, the trend reversal (from decline to increase) has also been more pronounced in the South.

Similar to Germany, trade integration has increased for all regions, but the degree of trade openness has on average been higher in regions that record lower labor shares. Prima facie, this would confirm a negative cross-sectional relationship between the labor share and trade openness. However, with regard to the evolution of the labor share over time, the Italian data paint a more nuanced picture. Since the early 2000s, the labor share has increased in parallel to increased trade integration.

3 Estimation Method and Regression Results

The previous section has provided descriptive evidence suggesting a negative link between the labor share and trade openness. In the following, we analyze this relationship more systematically by estimating equation (3). This poses two main challenges.

First, we are interested in the long-run determinants of the regional labor share. Hence, we have to take its potential non-stationarity into account. Unit root tests presented in Table 5 show that, for the full sample period, the hypothesis that the labor share is non-stationary is rejected for Germany. All explanatory variables are non-stationary though. However, visual inspection shows a downward trend in the labor share, which started around the mid-1970s. Excluding the 1970s and re-running the panel unit root tests for the West German states in fact gives evidence in favor of the hypothesis that the labor share contains a unit root. For Italy, the hypothesis that the labor share has been non-stationary cannot be rejected.

Second, the potential endogeneity of trade has to be taken into account. If international trade flows are triggered by differences in factor endowments across countries, there will be a feedback effect between factor shares and trade flows.

We deal with these problems using panel cointegration methods and instrumental variables techniques, which are described next.

3.1   Panel Cointegration

In a first step, we explicitly account for the non-stationarity of the data and test whether there is a long-run cointegration relationship between the labor share and trade openness. We present estimates for the long-run cointegration coefficients using the Two-Step panel estimator proposed in Breitung (2005), which has the additional advantage of accounting for the endogeneity of trade. This Two-Step estimator is based on the following general representation of a cointegrated VAR(p):

$$\Delta y_{i,t} = \psi_i d_t + \alpha_i \beta' y_{i,t-1} + \sum_{m=1}^{p-1} \Gamma_{i,m} \Delta y_{i,t-m} + \varepsilon_{i,t} \tag{4}$$

where $\varepsilon_{i,t}$ is an error term with $E(\varepsilon_{i,t}) = 0$, $\Sigma_i = E(\varepsilon_{i,t}\varepsilon'_{i,t})$, d_t is a vector of deterministic variables, ψ_i is a coefficient matrix, and $y_{i,t}$ is the vector of variables including the labor share, trade, and other control variables. The interpretation of this equation is that changes in y in each state i and each year t are driven by the long-run error correction term $\beta' y_{i,t-1}$, the loading coefficient α_i, and the short-run dynamics $\sum_{m=1}^{p-1} \Gamma_{i,m} \Delta y_{i,t-m}$. Since the cointegration estimator requires a balanced panel, we drop incomplete time series. This leaves us with a sample of $T = 36$ and $N = 11$ for German states and $T = 15$ and $N = 20$ for Italy.

We are interested in the estimation of the long-run cointegration vector β. This vector is assumed to be homogenous across states. Within a given country, this assumption is reasonable, since it essentially implies the use of the same production technology. However, the speed of adjustment to the steady state α_i, which depends on the institutional setting, is allowed to differ across states. Again, this assumption is reasonable considering that the impact of institutions or even the institutions as such could differ across regions. $\Gamma_{i,m}$ is a vector of coefficient estimates describing the short-run adjustment, and it is assumed to be heterogeneous.

The Two-Step estimator performs a correction for endogeneity at the second stage (Breitung and Pesaran 2005), and it creates a smaller estimation bias in small samples such as ours compared to alternative cointegration estimators such as the Dynamic OLS (DOLS)- and the

Fully Modified OLS (FMOLS)-estimator.[8] In unreported regressions, we use these alternative estimators and find very similar results.

Table 6 provides the results of cointegration tests and of estimates of the long-run cointegration coefficients. These results support the presence of cointegration relationships among the variables of interest. Exceptions are specifications applying tests for panel cointegration which do not allow for cross-sectional heterogeneity. This is an unrealistic assumption, in particular considering the different time trends across states shown in Graph 2.

Results presented in Table 6 show one result that is robust across the sub-samples. Higher GDP is associated with a lower labor share. The estimated elasticity is –0.14 for West Germany and –0.08 for Italy. For employment, we find a negative impact for Germany and a positive impact for Italy. The capital stock enters with a positive and significant sign for Germany, thus pointing to a complementary relationship between labor and capital. For Italy, it is insignificant.

We find mixed effects of the impact of openness on the labor share. For Germany, the impact of import openness is positive, and the impact of export openness is negative. Adding up the coefficients for imports and exports gives a negative net effect of a proportional increase in trade. For Italy, export and import openness are insignificant.

3.2   Instrumental Variable Estimates

Results of the panel cointegration tests presented so far provide evidence on the long-run determinants of the labor share. They do not help answering the question whether the impact of trade on the labor share differs across regions or across time. In particular for East

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[8]   Both, the FMOLS and the DOLS estimator address serial correlation and endogeneity of the regressors. The FMOLS estimator corrects the OLS estimator non-parametrically, while the DOLS estimator uses information from past and future leads and lags of all variables.

Germany, the period under study is too short to estimate long-run cointegration vectors.[9]

Hence, we have additionally used instrumental variable techniques to account for the endogeneity of trade in a standard panel fixed effects model. This model gives us more flexibility with regard to splitting the samples across sub-periods and across regions. To account for time trends in the data, we include a linear trend term in all regressions.

The instrumental variables method we use is borrowed from Frankel and Romer (1999). Frankel and Romer (1999) propose using the geographic component in bilateral trade obtained from gravity regressions as a proxy for total trade. The method requires a two-step estimation procedure. In a first step, a bilateral openness equation is specified. Predicted bilateral openness measures from this equation are then aggregated to obtain an instrument for trade openness at the state level. The original approach uses time-invariant geographic determinants of trade only; we additionally include foreign and domestic GDP as well as domestic population. Hence, our underlying assumption is that these variables are not endogenous to the labor share. Moreover, we include an *East* dummy variable that captures the exogenous shift in policies that happened in the early 1990s. We allow the impact of this variable to vary over time by specifying a multiplicative term between the *East* dummy for Germany and the year fixed effects. We specify similar interaction terms for Southern Italy. In a second step, predicted aggregated openness is used as an instrument in a regression explaining the impact of openness on the labor share.

We assess the quality of our IV strategy in two ways. First, we take a look at *F*-statistics of the joint significance of the excluded instruments at the first stage (Bound et al. 1995) Second, we assess the orthogonality of the instrument variables using the Hansen *J*-test of overidentification.

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[9] Data on the capital stock by East German state are not available before the mid-1990s. Hence, the time series dimension of a balanced panel including East German states would be less than 10 years.

Results for the instrumental variables regressions for Germany are presented in Table 7a.[10]

For West Germany, we confirm the negative impact of GDP, the positive impact of the capital stock, and the positive impact of imports on the labor share.[11] The elasticity with regard to imports is similar as in Table 6, but the elasticity with regard to the capital stock and output increases. However, exports now become weakly significant and positive in one specification, and employment has a positive impact. Results for the full sample (East and West Germany) are largely in line with those for the Western states, except for the capital stock, which is insignificant for the full sample.

For East Germany, we confirm the negative impact of output and the positive impact of employment. The capital stock and trade are insignificant. Since data for the capital stock are available since the mid-1990s only for East Germany, we re-run the regression excluding the capital stock (column (7)). Import openness is now negative and significant while export openness is positive. In absolute terms, the positive impact of export openness is larger. In addition, this final specification is the only one in which the trend term is negative and significant. This could be taken as an indication that the adjustment in the early 1990s has been driven by some political factors outside the scope of our empirical model.

For Italy, the IV regressions confirm the cointegration results regarding the impact of GDP and employment on the labor share (Table 7b). These are negative and positive, respectively. In one specification, however, import openness now has a negative and export openness has a positive impact on the labor share. However, this result is not robust with regard to different instrumentation strategies (compare columns (1) and (2)), and it does not survive the sample

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[10] Lacking bilateral trade data for the period before 1990, we run these regressions only for the period 1991-2005 also for West Germany.

[11] These results are somewhat sensitive to the instrumentation strategy chosen. Note, however, that some of the additional instruments such as government spending over GDP and import and export prices are not available for the full period. Hence, the sample size changes as well moving, for instance, from column (1) to (2) or from column (3) to (4) in Table 7a.

splits into the Southern and Northern regions. The capital stock now has a positive and significant sign in some specifications, thus supporting earlier evidence for German for a complementary relationship between capital and labor. For Italy, the trend term is positive and highly significant throughout, and the point estimate is higher for the Southern than for the Northern regions. Hence, it seems to pick up the trend reversal in the labor share in the 2000s. Note that the IV results for Italy should be interpreted with caution since some specifications tests suggest that our instruments are weak. This result is interesting as it supports our prior that interaction terms between the dummy for East Germany and time fixed effects indeed pick up exogenous policy changes. For Italy, interaction terms between a South dummy and time fixed effects cannot be interpreted in a similar way.

3.3   Robustness

We have checked the robustness of our results by including additional variables and testing for the effects of outliers.[12] As regards additional variables, we have added the share of imported inputs and the log of export and import prices.

For Germany, the share of imported inputs as a measure for offshoring has a positive sign and is highly significant. However, the import share itself now switches signs from positive to weakly negative. One interpretation is that the positive sign on the import share reported earlier reflects a positive impact of imported inputs whereas imports of final goods lower the labor share. Export and import prices have an insignificant impact. One exception is the specification for East Germany where higher export prices lower the labor share.

Since Hamburg and Bremen are city states with exceptionally high trade ratios and high labor shares, we have checked whether results are driven by these states. The positive impact of the import share is robust. A higher export share is now associated with a lower labor share both

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[12]   Results are not reported but are available upon request.

for the full sample and for the West German sample, thus supporting the earlier finding for the panel cointegration tests.

For Italy, we get results that are very similar to those for Germany. In particular, Italy's regressions for the full sample also return a significant positive sign for imported inputs. Import openness remains insignificant. Both, import and export prices, have an insignificant impact.

3.4   What are the Trade Offs?

For West Germany, there has been a negative long-run effect of export openness. This negative effect is driven mainly by the 1970s and 1980s though. For East Germany, greater import openness has lowered the labor share in the early 1990s. In and of itself, this could have a negative impact on the well-being of workers. However, there are three mechanisms through which workers might be compensated.

First, empirical studies often find that more trade has a positive effect on income per capita and on economic growth. If workers care about their absolute incomes,[13] welfare might thus increase even if the labor share declines. One key issue in the literature linking openness to growth is to account for the endogeneity of trade (Rodriguez and Rodrik 2000). Buch and Toubal (2008) and Buch and Monti (2007) thus apply the Frankel-Romer-methodology described above to regional data for Germany and Italy and find a positive impact of openness on GDP per capita. Felbermayr (2005) argues that the model by Frankel and Romer might be mis-specified because of its implicit assumption that countries are in their respective steady state. He confirms the positive link between trade and growth using dynamic panel data models though. Hence, irrespective of the methodology used to account for the endogeneity of trade, studies find a positive link to GDP per capita. (See also Dollar and Kraay (2003) or

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[13]   Stevenson and Wolfers (2008) show that, contrary to a number of earlier empirical studies, subjective well-being indeed seems to be related to absolute rather than relative incomes.

Lee et al. (2004).) Even if more trade leads to a decline in the compensation of workers relative to capital, workers may thus still gain in absolute terms.

A second reason why changes in the labor share might not fully account for the well-being of workers is that total incomes of workers are not only determined by their labor incomes. If workers hold equity in domestic firms, they also benefit from an increase in the compensation of capital. For Germany, this effect is probably small though. Between 1991 and 2005, the share of household income derived from returns to capital has increased only slightly from 1.94% to 2.52% (Sachverständigenrat 2007), and it still accounts for only a small fraction of total incomes.

The third and perhaps most important channel which affects not only absolute but also relative incomes is the public redistribution mechanism. Through taxation and the social safety net, governments might redistribute income also from the winners to the losers of globalization. Redistribution is particularly important for households in the lowest income deciles, which receive a large share of their incomes in the form of government transfers or payments from the social security system. One piece of evidence supporting the leveling effect of redistribution comes from Fuchs-Schündeln et al. (2008) who use micro-data for Germany. These authors document an increasing degree of inequality of market incomes in East and West Germany, in particular since German re-unification. This increase in income dispersion has been most pronounced in East Germany. At the same time, the allocation of income and consumption *after* re-distribution through taxes and the welfare state has been much less pronounced.

There are indeed indications that the drop in the labor share has been compensated by net transfers. First, disposable income relative to GDP exceeds the labor share by a considerable margin, both in Germany and in Italy (Graph 2). Second, the correlation between net transfers and the labor share has been negative, in particular for the East German states. For Italy, the

relationship between net transfers and the labor share is not strong. In particular, while in some Northern regions the labor share has been compensated by net transfers, in the South, an increase in the labor share has gone hand in hand with stable net transfers per capita

Table 98 provides a more systematic analysis of the determinants of disposable income relative to GDP. For Germany, lower GDP is associated with higher disposable income, and there has been a trend increase in disposable incomes both in the West and in the East. However, some determinants of disposable income also differ between the East and the West. A higher capital stock increases and higher employment decreases disposable income in the East but not in the West German states. While transfers do not affect the impact of imports (positive for the West / negative for the East), the effect of exports changes. Higher exports lead to a higher labor share in the West as well as in the East (Table 7a), but the impact of exports on the ratio of disposable income over GDP become negative for the West German states and insignificant for the East German states (Table 8a). Adding up the coefficients on import and export shares gives a negative impact of a proportional increase in trade on disposable incomes.

For Italy, exports and the capital stock have no significant impact on disposable incomes. Higher GDP is associated with higher disposable income in the South. The impact of imports is now negative and significant, with a higher point estimate for the Northern than for the Southern regions. In this sense, greater integration into international trade has had a negative impact on Italian workers' disposable incomes.

4 Summary and Conclusions

There has been a widespread concern within the population and among policymakers that increased trade might lower the labor share. Stylized facts for German and Italian regions

indeed provide tentative evidence for a negative link between a (declining) labor share and an (increasing) degree of trade openness.

Analyzing the link between trade and the labor share empirically requires taking the endogeneity of trade into account. We address this issue using panel cointegration as well as instrumental variables methods. Our regression results provide a nuanced picture of the link between trade openness and the labor share. Results of long-run cointegration tests for West Germany over a period of 35 years show a positive impact of import openness and a (stronger) negative impact of export openness. For Italy, there is no evidence for a significant impact of trade openness on the labor share for the past 15 years.

The picture changes when studying developments over shorter time periods or for different regions. For West Germany in the past 15 years, higher imports and exports tended to have a positive impact on the labor share. For East Germany, the impact of increased openness has mainly been confined to the early 1990s. In this period, higher exports increased and higher imports decreased the labor share. The positive effect of exports has been stronger in absolute terms. At the same time, there has also been a trend decline in the labor share which is unrelated to trade openness. This would be consistent with the hypothesis that the decline of the labor share in East Germany also reflects a transition phenomenon and changes in preferences concerning the distribution of incomes.

In sum, our results support the notion that relative incomes of workers have declined during the recent globalization period. However, we cannot trace this decline to increased trade openness in a consistent way. Instead, effects of imports and exports differ, regional differences need to be taken into consideration, and time trends need to be accounted for. When assessing the impact of trade on the economic well-being of workers, two further aspects must be borne in mind. First, increased trade openness has had a positive impact on GDP per capita. Second, workers' disposable incomes are higher than their market incomes,

and public redistribution mechanisms have partly compensated declining labor shares. At the same time, we find a mixed impact of trade openness on disposable incomes.

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Table 1: Trade and the Labor Share – Previous Empirical Evidence

Authors	Sample and Methodology	Explanatory variables
IMF (2007)	18 countries 1982-2002 Factor share equation derived from a translog revenue function as in Feenstra (2004) IV estimates (2SLS, 3SLS) using own lags of potentially endogenous variables as instruments Additional instruments: government consumption / GDP, consumption tax rate, log population, weighted GDP of trading partners	Log relative export price (-) Log relative import price (+) Log capital labor ratio (0) Offshoring (share of imported intermediated inputs) (-) Immigration (-) ICT capital (-) ICT capital squared (+) Tax wedge (-) Unemployment benefits (-)
Dreher & Gaston (2007)	100 countries 1970-2000 Different specifications (OLS, GMM) yield different results, impact of globalization index not robust to changes in specification	Globalization index Democracy index GDP per capita (-) GDP per capita squared (+)
Harrison (2002)	Large cross-country dataset obtained from UN national account data (UN) 1950-1997 Factor shares derived from a translog function IV, OLS, long differences	Capital-labor ratio (-) Capital controls (0) Relative GDP per capita (0) Log nominal exchange rate (0) Relative price (world endowments labor / capital) (+) Crisis (-) Inward FDI (-) Outward FDI (0) Government spending / GDP (+) Exports + imports / GDP (-)
Guscina (2006)	18 industrial countries 1960-2000 Data averaged over 5-year periods to eliminate cyclical effects. Different results for pre-/ post-globalization period.	Dependent variables: Compensation share Employment share Gini coefficient Explanatory variables: Exports + imports / GDP (-) Lagged productivity (+/-) Employment protection (+)

Table 2: Data Definitions and Sources

Unless indicates otherwise, German data are taken from *Statistisches Bundesamt*, *Volkswirtschaftliche Gesamtrechnung der Länder* (German Statistical Office, Regional National Accounts). Italian data are taken from ISTAT data (*Coeweb: statistiche del commercio estero*)

Variable	Germany
Capital stock	Capital stock in 1000 Euro per employee.
Disposable income	Primary incomes of private households plus net transfers from the government.
Employment	Employed persons (*Erwerbstätige*), in 1,000
Export and import prices	Weighted price indices for eight product categories (living animals, meat food products, non-meat food products, luxury food, raw materials, semi-finished products, finished products – inputs, finished products – output). Weights are computed from the shares of these products in total imports and exports by state. Source: German Federal Statistical Office, *Fachserie* 7, *Reihe* 1
GDP	Gross domestic product in million Euro
Government spending / GDP	Source: Statistisches Bundesamt
Labor share	We use two measures of the labor share. The first is available for all German states for the years 1992-2005, and it is defined as the ratio between labor income (*Arbeitnehmerentgelt*) and to gross national product (*Volkseinkommen*). Since gross national product if not available for the years 1970-1990 for the West German states at the regional level, we use gross domestic product instead.
Regions	<u>West Germany</u>: Schleswig-Holstein, Hamburg, Niedersachsen, Bremen, Nordrhein-Westfalen, Hessen, Rheinland-Pfalz, Baden-Wuerttemberg, Bayern, Saarland <u>East Germany</u>: Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt
Trade	State-level exports and imports relative to state GDP. The data are taken from the German Federal Statistic Office (*Statistisches Bundesamt*)

Variable	Italy
Capital stock	Capital stock per employee. The regional capital stock is computed from the total capital stock for Italy (at 2000 prices) using the annual regional share in national real investment as a proxy to allocate regionally the national capital stock. Source: ISTAT (*Conti economici - Conti nazionali e Conti territoriali*).
Disposable income share	The disposable income share is defined as households' disposable income / gross domestic product (net of indirect taxes). Source: own calculations from EUROSTAT and ISTAT data (respectively for disposable income and GDP).
Employment	Total employment in standard labor units.
Export and import price index	Weighted price indices derived from the national export and import unit values of 44 product categories of ATECO 3 digits. Weights are computed from the shares of these products in total imports and exports by region.
Exports + imports / GDP	Source: ISTAT (*Coeweb: statistiche del commercio estero and Conti nazionali*)
GDP per capita	Source: ISTAT (*Conti economici - Conti territoriali*).
Government spending and revenue	Expenditures and revenues of the Public Administration (million euros). Source: Ministero dello Sviluppo Economico (*Conti pubblici territoriali*)
Labor share	The labor share is defined as employee compensation (*Reddito da lavoro dipendente*) / gross domestic product (net of indirect taxes). For Italy, excluding net indirect taxes is relevant because, since the 1990s, the tax wedge has been increasing over time. Source: ISTAT (*Conti economici - Conti territoriali*).
Offshoring	Share of imported intermediate inputs (million euro). Source: ISTAT (*Coeweb: statistiche del commercio estero*).
Regions	<u>North</u>: Emilia Romagna, Friuli Venezia Giulia, Lazio, Liguria, Lombardia, Marche, Piemonte, Toscana, Trentino Alto Adige, Umbria, Valle d'Aosta, Veneto. <u>South</u>: Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna, Sicilia.

Table 3: Descriptive Statistics for Germany

For West Germany, the labor share is defined as the ratio of the compensation of employees relative to GDP. For Germany as a whole, it is defined as the ratio of the compensation of employees to national income.

a) Labor share and trade ratios over time

	Labor share (West Germany)	Labor share (East and West Germany)	Imports / GDP	Exports / GDP
1970s	0.56	…	0.23	0.22
1980s	0.56	…	0.28	0.26
1990s	0.54	0.75	0.24	0.21
2000s	0.53	0.73	0.29	0.28

b) Labor shares by state

	1991	2003
Baden-Wuerttemberg	0.70	0.71
Bayern	0.68	0.70
Berlin	0.76	0.84
Bremen	0.82	0.88
Hamburg	0.82	0.79
Hessen	0.73	0.73
Niedersachsen	0.66	0.67
Nordrhein-Westfalen	0.68	0.69
Rheinland-Pfalz	0.65	0.65
Saarland	0.80	0.78
Schleswig-Holstein	0.61	0.63
Mean West Germany (excl. Berlin)	*0.65*	*0.66*
Brandenburg	0.81	0.67
Mecklenburg-Vorpommern	0.88	0.75
Sachsen	0.89	0.79
Sachsen-Anhalt	0.88	0.76
Thueringen	0.86	0.74
Mean East Germany	*0.86*	*0.74*

c) Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
West Germany (1970-2005)					
Imports / GDP	396	0.256	0.132	0.055	0.691
Exports / GDP	396	0.238	0.086	0.079	0.502
Ln capital stock	396	12.917	0.990	10.848	14.619
Ln GDP	396	11.042	1.075	8.513	13.100
Ln employment	396	7.488	0.953	5.886	9.049
Labor share	396	0.550	0.033	0.437	0.630
Germany (1991-2005)					
Imports / GDP	224	0.199	0.133	0.036	0.643
Exports / GDP	224	0.188	0.103	0.040	0.492
Ln capital stock	204	12.948	0.948	11.332	14.608
Ln GDP	224	11.219	0.951	9.546	13.084
Ln employment	224	7.410	0.854	5.939	9.049
Labor share	224	0.748	0.072	0.608	0.893

Source: Statistisches Bundesamt

Table 4: Descriptive Statistics for Italy

Labor shares, both GDP and national income (net of depreciation) are net of indirect taxes.

a) Labor share and trade ratios over time

	Labor share (compensation of employees / GDP)	Labor share (compensation of employees/national income)	Imports of Goods & Services/GDP	Imports of Goods/ GDP	Exports of Goods & Services/GDP	Exports of Goods/ GDP
1970s	0.53	...	0.19	0.16	0.19	0.16
1980s	0.50	0.59	0.21	0.18	0.21	0.17
1990s	0.48	0.58	0.20	0.16	0.22	0.18
2000s	0.46	0.57	0.26	0.21	0.27	0.22

b) Labor shares by region

	1990	2005
Emilia-Romagna	0.48	0.46
Friuli-Venezia Giulia	0.53	0.49
Lazio	0.52	0.43
Liguria	0.52	0.43
Lombardia	0.51	0.46
Marche	0.50	0.46
Piemonte	0.50	0.45
Toscana	0.50	0.46
Trentino-Alto Adige	0.47	0.46
Umbria	0.51	0.46
Valle d'Aosta	0.49	0.46
Veneto	0.48	0.44
Mean Northern Italy	*0.50*	*0.46*
Abruzzo	0.46	0.50
Basilicata	0.55	0.51
Calabria	0.57	0.49
Campania	0.53	0.51
Molise	0.49	0.48
Puglia	0.52	0.51
Sardegna	0.53	0.50
Sicilia	0.48	0.50
Mean Southern Italy	*0.52*	*0.50*

c) Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Imports/GDP	300	0.132	0.074	0.014	0.405
Exports/GDP	300	0.156	0.095	0.008	0.358
Ln capital stock	300	11.654	1.003	9.217	13.513
Ln GDP	300	10.391	1.093	7.694	12.525
Ln employment	280	6.544	1.038	3.951	8.341
Ln employment	300	6.626	1.057	4.043	8.417
Labor share	300	0.473	0.027	0.420	0.550

Source: Own calculations, based on *ISTAT*.

Table 5: Panel Unit Root Tests

This table reports the results of panel unit root tests based on Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003). The Null-Hypothesis is that the series contains a unit root. The maximum lag length is automatically chosen based on the SIC criterion. Newey-West bandwidth selection uses a Bartlett kernel. Trend and constant term included in all specifications. All variables are in logs. *, **, *** = significant at the 10%, 5%, 1%-level.

a) West Germany (1970-2005)

Variable	Levin, Lin, Chu (2002)	Im, Pesaran, Shin (2003)
Levels		
Imports / GDP	0.72	1.58
Exports / GDP	1.78	1.28
Ln capital stock	-2.30**	0.47
Ln GDP	-1.95**	2.57
Ln employment	-2.96***	-3.18***
Labor share	-3.63***	-3.88***
First differences		
Imports / GDP	-13.00***	-12.10***
Exports / GDP	-13.51***	-13.14***
Ln capital stock	0.49	-2.84***
Ln GDP	-8.79***	-7.37***
Ln employment	-9.86***	-6.74***
Labor share	-9.06***	-8.75***

b) Italy (1991-2005)

Variable	Levin, Lin, Chu (2002)	Im, Pesaran, Shin (2003)
Levels		
Imports / GDP	-7.69***	-2.79***
Exports / GDP	-3.81***	0.13
Ln capital stock	-7.40***	-3.12***
Ln GDP	0.58	4.75
Ln employment	1.67	-4.09***
Labor share	-0.71	3.73
First differences		
Imports / GDP	-12.15***	-7.87***
Exports / GDP	-10.19***	-7.21***
Ln capital stock	-11.03***	-8.11***
Ln GDP	-14.73***	-8.46***
Ln employment	-1.81**	-1.04
Labor share	-11.95***	-8.86***

Table 6: Long-Run Cointegration Tests

This table presents estimates of the cointegration vector based on Breitung (2005). The dependent variable is the uncorrected labor share. Results of the panel cointegration tests are based on Kao (1997) and Pedroni (1995). Kao's (1997) tests DF_ρ and DF_t are based on the assumption of strong exogeneity of the regressors and errors; DF^*_ρ and DF^*_t are based on the assumption of endogeneity of regressors and errors. The H_0 hypothesis is 'no cointegration'. Pedroni's tests allow for heterogeneity in the cointegration relationships and are based on the H_0 of no cointegration. Data for West Germany are for the years 1970-2005, data for Italy are for the years 1991-2005. t-values in brackets. *, **, *** = significant at the 10%, 5%, 1%-level.

	West Germany	West Germany	West Germany	Italy	Italy	Italy
Import share	0.12***	0.04		-0.04	-0.04	
	(4.82)	(1.54)		(-0.78)	(-0.75)	
Export share	-0.23***		-0.19***	-0.03		-0.04
	(7.64)		(6.98)	(-0.69)		(-1.04)
Ln capital stock	0.23***	0.27***	0.27***	0.002	0.001	0.01
	(9.33)	(8.88)	(9.47)	(0.24)	(0.09)	(0.74)
Ln GDP	-0.12***	-0.15***	-0.13***	-0.08***	-0.08***	-0.08***
	(10.02)	(11.26)	(9.40)	(-11.74)	(-12.68)	(-10.97)
Ln employment	-0.14***	-0.05*	-0.19***	0.19***	0.21***	0.18***
	(5.61)	(1.73)	(7.15)	(5.66)	(6.29)	(4.89)
Observations ($N * T$)	396	396	396	300	300	300
Regions (N)	11	11	11	20	20	20
Cointegration tests						
DF_ρ	-4.69***	-1.73**	-3.88***	-1.62*	-1.68**	-1.57*
DF_t	-3.35***	-1.04	-2.73***	-0.98	-1.03	-0.94
DF^*_ρ	-11.14***	-6.49***	-9.81***	-5.83***	-5.92***	-5.74***
DF^*_t	-3.71***	-2.09**	-3.28***	-2.38***	-2.42***	-2.35***
$t_{\hat\rho NT}$	-252.09***	-187.54***	-232.75***	-130.14***	-130.32***	-129.75***
$t_{N1\rho}$	-22.49***	-18.18***	-20.69***	-14.58***	-14.73***	-14.48***
$t_{N2\rho}$	-22.18***	-17.92***	-20.40***	-14.08***	-14.23***	-13.99***

Table 7: Instrumental Variables Regressions

Results are based on instrumental variables regressions using robust standard errors. Standard errors in brackets. Exports and imports are instrumented using the method proposed by Frankel and Romer (1999) using predicted values from a gravity equation for bilateral trade as the dependent variable and log of distance, common state border, log of area, dummy variable for landlocked regions, foreign GDP, and dummies for regions (East Germany and Southern Italy, respectively) as regressor. Columns (1), (3), (5), and (7) use predicted trade shares as well as time fixed effects as instruments, in columns (2), (4), (6) government revenues and expenditures, export and import prices, and the share of imported inputs have been added as additional instruments. Constant term not reported. *, **, *** = significant at the 10%, 5%, 1%-level.

(a) Germany

	(1) Full	(2) Full	(3) West	(4) West	(5) East	(6) East	(7) East
Import share	0.093***	0.175	0.102***	0.038	0.080	-0.062	-0.179***
	(5.12)	(1.69)	(6.21)	(0.40)	(1.00)	(-0.96)	(-4.48)
Export share	0.016	0.046	0.050	0.171*	-0.069	-0.003	0.2737**
	(0.23)	(0.54)	(0.81)	(2.07)	(-0.68)	(-0.04)	(3.44)
Ln GDP	-0.195**	-0.398**	-0.238***	-0.499***	-0.233***	-0.252***	-0.049***
	(-3.24)	(-3.15)	(-4.38)	(-4.69)	(-3.61)	(-4.92)	(-7.62)
Ln capital stock	0.184	-0.006	0.402**	0.591***	-0.065	-0.051	
	(1.33)	(-0.04)	(2.86)	(3.56)	(-1.59)	(-1.55)	
Ln employment	0.023	0.398***	0.002	0.543***	0.329**	0.342***	0.036
	(0.30)	(3.42)	(0.02)	(4.48)	(3.59)	(4.96)	(1.27)
Trend	0.0002	0.004	-0.003	-0.005	0.005	0.005	-0.007***
	(0.07)	(1.04)	(-1.14)	(-1.22)	(1.28)	(1.72)	(-8.93)
Observations	188	144	143	99	45	45	65
R-squared	0.448	0.456	0.217	0.118	0.902	0.903	0.961
Hansen J-statistic	16.456	11.558	16.314	9.520	5.779	6.436	7.791
p-value	0.125	0.239	0.129	0.391	0.566	0.696	0.732
1st stage F-statistic:							
Import	7.19	3.23	7.59	4.11	9.59	25.29	5.86
Export	4.36	3.43	7.38	10.65	8.94	6.45	3.38

(b) Italy

	(1) Full	(2) Full	(3) North	(4) North	(5) South	(6) South
Import share	-0.142**	0.028	-0.115	0.117	-0.028	-0.042
	(1.98)	(0.22)	(1.58)	(0.54)	(0.20)	(0.40)
Export share	0.148***	-0.039	0.027	-0.285	0.05	-0.159
	(2.65)	(0.27)	(0.47)	(1.03)	(0.41)	(1.25)
Ln GDP	-0.400***	-0.756***	-0.325***	-0.525***	-0.371***	-0.937***
	(12.22)	(5.87)	(9.97)	(3.25)	(5.56)	(6.01)
Ln capital stock	0.036***	-0.039	0.050***	0.102	0.022**	0.01
	(4.27)	(0.60)	(3.62)	(0.89)	(2.39)	(0.29)
Ln employment	0.233***	0.726***	0.169***	0.853***	0.239***	0.676***
	(7.19)	(3.17)	(5.52)	(3.21)	(6.20)	(3.95)
Trend	0.012***	0.020***	0.009***	0.007	0.014***	0.034***
	(7.62)	(5.03)	(5.46)	(1.09)	(4.61)	(5.38)
Observations	260	160	156	96	104	64
R-squared	0.84	0.33	0.85	0.12	0.67	0.37
Hansen J-statistic	16.99	12.95	15.24	10.02	13.85	12.44
p-value	*0.11*	*0.07*	*0.17*	*0.19*	*0.24*	*0.09*
1st stage F-statistic:						
Import	11.40	11.32	10.83	9.23	11.32	15.81
Export	16.22	5.52	17.99	7.44	5.52	2.99

Table 8: Determinants of Disposable Income

Results are based on instrumental variables regressions using robust standard errors and panel fixed effects. Export and imports are instrumented using the method proposed by Frankel and Romer (1999). Results for Italy are for the years 1995-2004. T-statistics in brackets. *, **, *** = significant at the 10%, 5%, 1%-level.

(a) Germany

	(1) Full Sample	(2) West	(3) East	(4) East
Import share	0.056***	0.052***	0.097	-0.288***
	(5.29)	(5.10)	(0.78)	(-4.03)
Export share	-0.112*	-0.116**	0.041	0.153
	(-2.47)	(-2.70)	(0.44)	(1.50)
Ln GDP	-0.208***	-0.193***	-0.252***	-0.185***
	(-7.56)	(-6.63)	(-4.91)	(-12.71)
Ln capital stock	-0.027	-0.034	0.238***	
	(-0.48)	(-0.57)	(7.41)	
Ln employment	0.031	0.066	-0.267***	-0.362***
	(0.73)	(1.55)	(-4.19)	(-7.73)
Trend	0.008***	0.008***	-0.001	0.011***
	(6.32)	(5.97)	(-0.32)	(9.07)
Observations	188	143	45	65
R-squared	0.791	0.632	0.931	0.8
Hansen *J*-statistic	17.815	16.639	6.299	8.514
p-value	0.086	0.119	0.505	0.667
1st stage *F*-statistics:				
Import	7.19	7.59	9.59	5.86
Export	4.46	7.38	8.94	3.38

(b) Italy

	(1) Full	(2) North	(3) South
Import share	-1.930***	-2.316***	-0.752*
	(3.89)	(3.52)	(1.68)
Export share	0.574	1.281	-0.167
	(0.99)	(1.53)	(0.45)
Ln GDP	0.065	0.213	0.449**
	(0.35)	(1.14)	(2.43)
Ln capital stock	0.028	0.032	0.001
	(0.54)	(0.55)	(0.02)
Ln employment	-0.567**	-1.113***	-0.933***
	(1.99)	(3.01)	(4.85)
Trend	0.003	0.004	-0.015**
	(0.31)	(0.39)	(2.25)
Observations	175	103	72
R-squared	0.37	0.36	0.35
Hansen *J*-statistic	14.72	8.42	10.02
p-value	*0.04*	*0.3*	*0.19*
1st stage *F*-statistic:			
Import	6.99	7.04	1.01
Export	10.19	10.13	3.36

Graph 1: International Openness by Region

Trade share is defined as the share of exports plus imports relative to GDP.

(a) Germany

1992   2004

(b) Italy

1992   2005
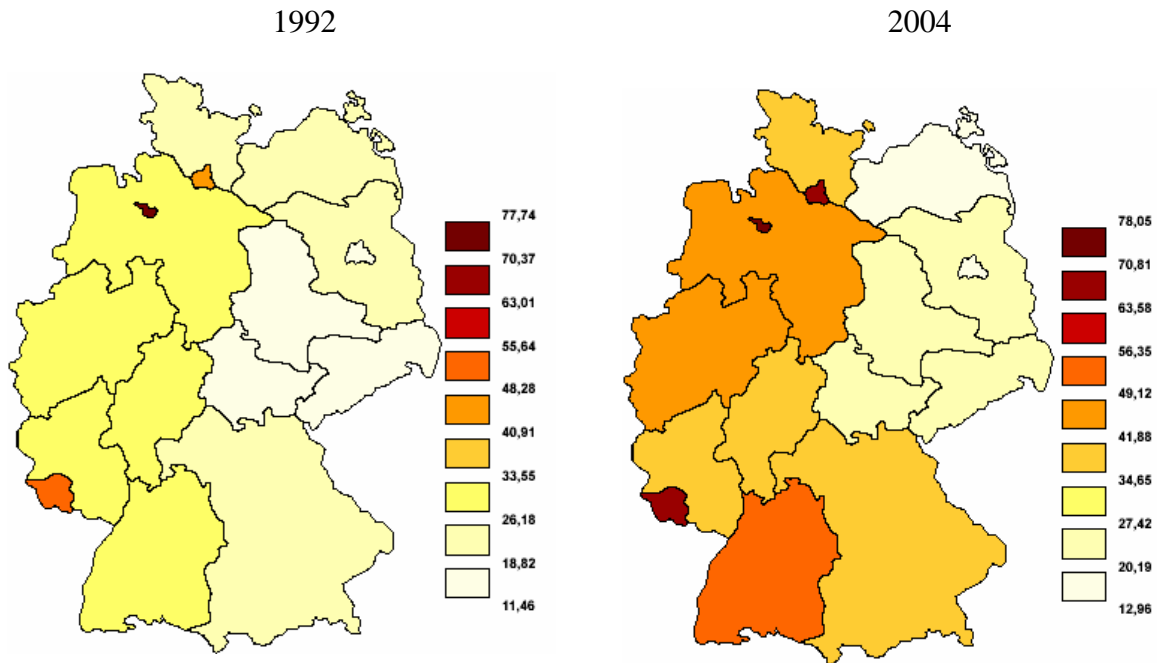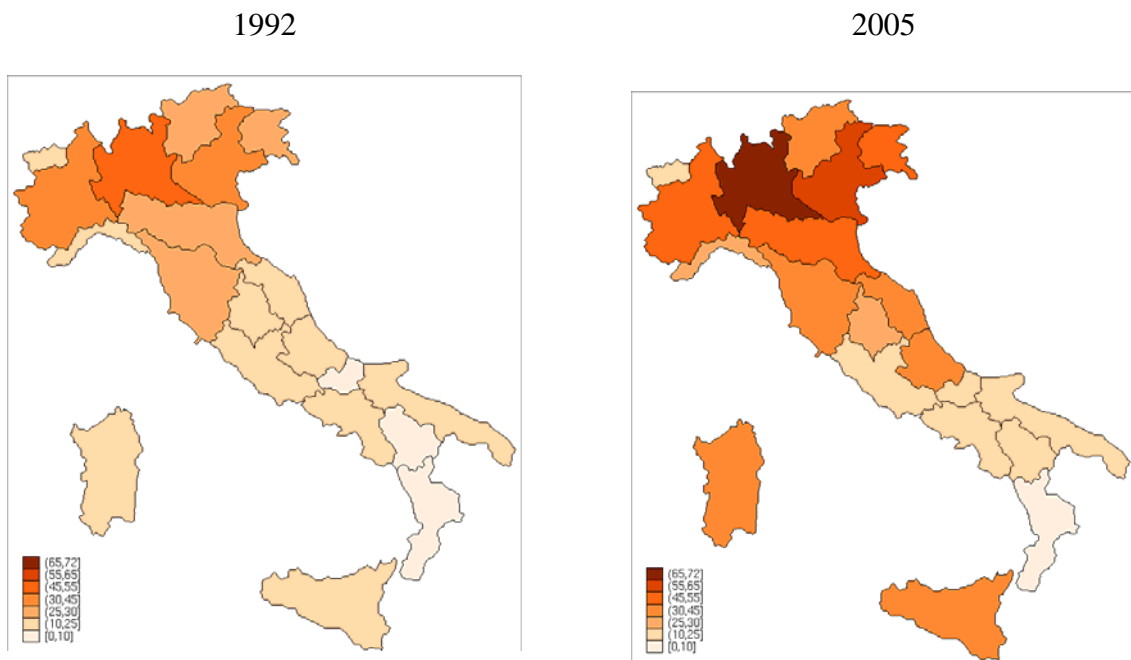
Source: Own calculations based on *ISTAT* and *Statistisches Bundesamt*.

Graph 2: Labor Share and Disposable Income

Labor share is the corrected labor share.

<u>(a) Germany</u>

Graphs by state

<u>(b) Italy</u>

Graphs by state
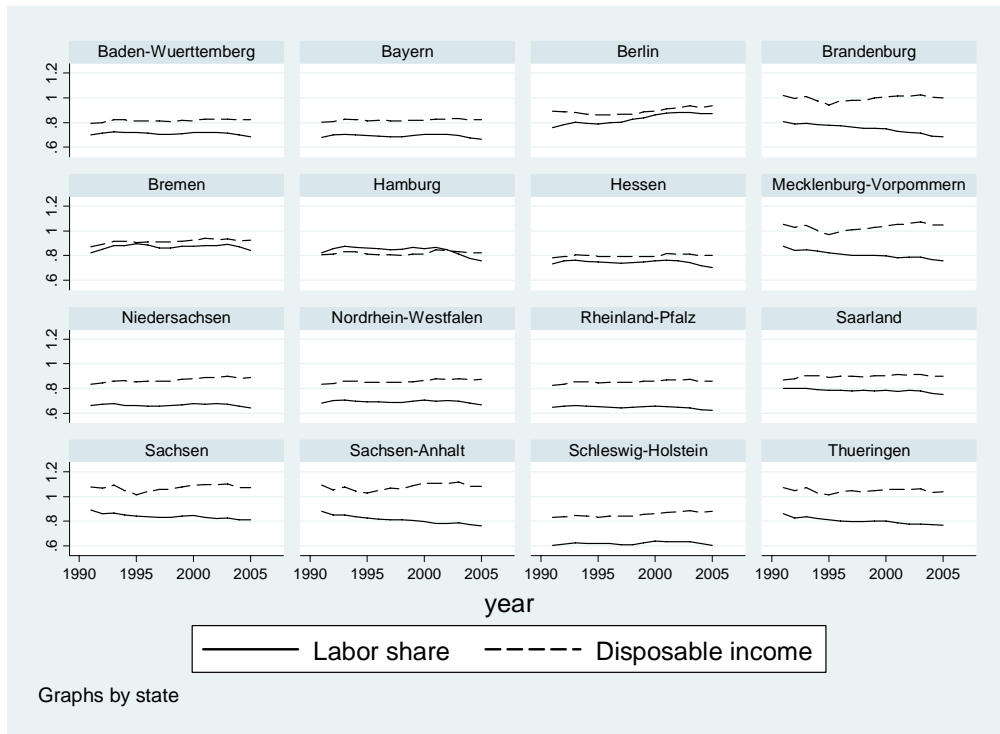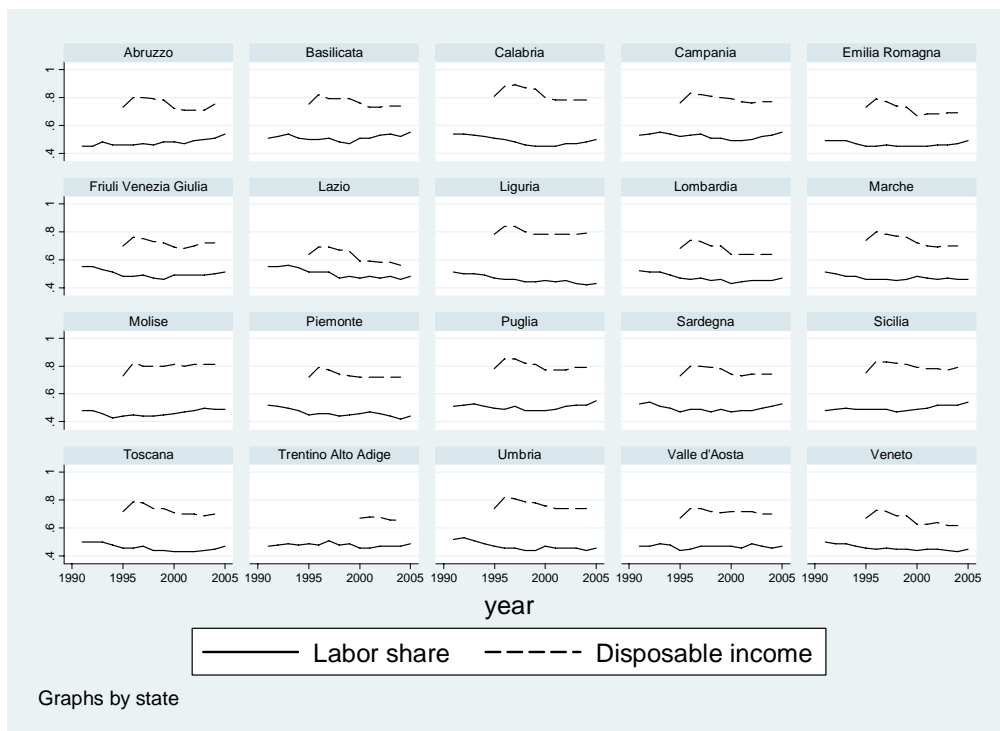
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