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I use the STAN database of the OECD and different econometric methods to investigate the effects of exports towards the EU-15 on wages in the Visegrad countries (CEEC-4; Czech Republic, Hungary, Poland, and Slovakia). The results do not allow to draw any definite statements about this effect. While the impact of exports towards the EU-15 on wages in the countries investigated is likely to be negative in the short run (1-2 years), it seems to be positive in the medium and long run, at least for Hungary and Poland.
Nevertheless, it is clear that the pattern of the CEEC-4 exports towards the EU-15 does not correspond with the predictions of the Heckscher-Ohlin model. Therefore, also the theorems of Stolper and Samuelson (1941) and concerning the equalization of factor prices, which are based on the Heckscher-Ohlin model, do not seem accurate to describe the underlying forces linking trade with factor prices. I argue that missing regional and related inter-sectoral labor mobility might be a potential factor preventing employees from taking advantage of trade liberalization. To substantiate this suspicion, however, analysis of more disaggregated data is necessary.

JEL Classification: C23, F14, F15, F16
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The present paper is a summary of his diploma thesis in economics at the University of Vienna. The author would like to thank Arda Kostem, Wendelin Moritz, Stefan Sperlich, Walter Zucchini, and especially Neil Foster for comments on various earlier versions of this paper. The usual disclaimer applies.

The Influence of Trade With the EU-15 on Wages in the Czech Republic, Hungary, Poland, and Slovakia between 1997 and 2005

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Introduction

The Stolper-Samuelson (1941) and the factor prize equalization (FPE; Samuelson, 1948 and 1949) theorem predict that after the transition from an autarky to a free trade equilibrium under certain assumptions, the income of the relatively abundant factor of the country will rise and factor prizes will be equalized among trading partners. While there is no need for a logically proven theorem to be empirically tested, this paper aims for testing the correlation between trade and wages in the actual process of four Central and Eastern European Countries' (CEECs) accession to the EU-15 rather than within the perfect Heckscher-Ohlin-Samuelson (HOS) model. It is investigated, whether the predicted mechanisms of the latter account for the actual behavior of factor prices in this process. I find serious limitations of the explanatory power of the HOS model to describe the dynamics of factor prices and provide weak evidence for differences in the trade-income relationship between Hungary and Poland on the one side and Czech Republic and Slovakia on the other hand. Finally, I pose possible explanations for these findings.

1 Institutional and theoretical background

After the breakdown of centrally planned economies in Central and Eastern European Countries (CEECs), there was widespread hope for a "return to Europe" (cf. Segert, 2002: ch. 1) which included not only an institutional but also a social perspective. The macro response to the implemented stabilization programs, however, was at least disappointing. On the micro level, workers experienced a dramatic increase of unemployment.

One might argue thus that the transition environment is a too shaky ground to investigate the trade-income relationship. When considering economic processes to happen within a perfect model, this objection might have something going for it. Realistically, some arguments mitigate this "best world" view. First of all, it is pretty seldom, that a government only liberalizes foreign trade but leaves all other policy parameters unchanged.[2] Furthermore, by 1997 - the first

[2]Having this in mind, it is surprising, how little economic theory on the role of trade liberaliza-

year of the present analysis - the CEEC-4 have mainly stabilized economically and politically: In Poland, GDP p.c. was 29,4 % above its (low) 1990 level, in Czech Republic and Hungary it amounted to 96.6 % and 99.1 % of its 1990 level, respectively. Only in Slovakia, GDP p.c. lagged more than 10 % behind its 1990 level.[3]

Finally, we have seldom observed such an extensive liberalization of foreign trade as it has been the case between the EU and some of the CEECs after 1990, and trade amounts to a significant portion of the GDP of the latter. The legal basis of this trade liberalization were the 'Europe Agreements' which replaced less extensive agreements on trade and cooperation (cf. Merli/Huster, 2009: 37) and were signed in 1991.[4] More precisely, they consisted of an asymmetric liberalization in goods trade (but not in services or personal mobility), where the EU abolished non-tariff barriers to trade immediately and tariffs within five years while the CEECs had more time to fulfill these tasks. Therefore, the 'Europe Agreements' should be seen as probably the most important agreements on free trade between the CEEC-4 and the EU-12 (by then) until the 'Accession Treaties' (signed April 16, 2003) came into force in 2004, even though goods considered "sensitive", such as textiles, coal, and steel, as well as agricultural goods obtained special treatment[5], and furthermore some of the protection clauses were operated rather pedantic sometimes, and some agreements suffered lacks of realization (cf. Brasche, 2008: 284f, Merli/Huster, 2009: 37f). Finally, anti-dumping clauses prevented EU markets from too harsh competition (see Ehrenhaft et al. 1997: esp. ch. 3 on the issue).

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tion in the context of transition and/or economic stabilization exists. An exception worth emphasizing is the contribution of McKinnon (1993), even though it deals with stabilization in general and not transition especially (and it makes in fact a difference if markets are distorted or non-existent). Winiecki (2002), another contribution worth mentioning, agrees that "surprisingly few (works) have been devoted to surveying the foreign trade issues emerging during the transition process" (p. 1) but is generally not able to fill this gap even though alluding to some interesting and central points.

[3] Own calculations based on Heston et al. (2006). Have in mind that Slovakia had to set up its own institutions after the separation from Czech Republic in 1993 which might account for this delay at least partially. If real wages are considered instead of GDP p.c., the story looks a little different: By 1997 only Czech Republic reached its 1989 level (103.2), whereas real wages were significantly below that level in Poland (83.2) and Hungary (77.9; Nesporova, 1999: 23). Unemployment rate, on the other hand, has clearly risen: The number of employees fell by 7.6, 11.7, and 27.4 % in Czechoslovakia, Poland and Hungary, respecitively (Nesporova, 1999: 8). Nevertheless, we can consider the unemployment rate as relatively stable at this high level.

[4] For Czech Republic and Slovakia, the agreement had to be formally renewed in 1993.

[5] Some authors emphasize that these were especially the sectors where CEECs had comparative advantages and economic development was therefore undermined. In fact, goods considered "sensitive" amounted to about one third in CEEC-4 exports towards the EU-15 in 1991 (cf. Wielgoss, 1997: 85). However, in all these sectors economies of scale are unlikely and even decreasing returns are possible so that these "barriers" might even have fostered a sustainable long term development (cf. Raffer, 1994, for a theoretical background).

What effects of this trade liberalization would we expect for factor prices? CEECs are usually assumed to be relatively labor abundant (as compared to the more capital abundant EU-15) which means, according to the Heckscher-Olin model, that they have a comparative advantage in producing labor-intensive goods. When in an autarky equilibrium trade with the EU-15 is liberalized, this would lead to a relative increase in the price of the labor-intensive good.[6] This creates incentive to increase the production of this good in CEECs until marginal production costs equal prices which frees up more capital (from the capital-intensive sector) than can be employed at the current capital-labor ratio in a new free-trade equilibrium. Therefore, this ratio must fall in *all* sectors of the economy which makes capital less scarce while demand for labor rises which causes the wage rate to rise and capital income to fall.[7] Since prices must be equal in all countries in a free-trade equilibrium, this also leads to an equalization of factor prices (if additionally no transportation costs and no full specialization is assumed). The essential "crux" of the whole story is "the unique correspondence between product price and factor price" (Cline, 1997: 42), i.e. that the change in factor prices operates *through a change in product prices* which will cause a shift of the sectoral distribution of production.

1.1 A short survey of previous studies

Even though the trade-income relationship has received much attention in attempts to explain the rising income inequality in the United States (see Cline, 1997, for a survey), a survey of studies investigating this relationship in CEECs is rather short despite the fact that trade plays a major role in these countries and is expected to lead to more favorable outcomes concerning the income distribution.

Onaran and Stockhammer (2006) do not find a statistically significant influence of trade with the EU on wages in the CEEC-4 plus Slovenia between 2000 and 2004. Breuss (2007) investigates the effect of total trade on the wage share in ten CEECs and finds a positive influence between 1995 and 2005. Thereby, however, the effect of trade with the EU is negative. Since working in levels of the series investigated, both studies are likely to suffer from spurious regression problems (cf. Kao, 1999: 5, theorem 1). Egger and Stehrer (2003) as well as Esposito (2003) use a methodically more sophisticated approach by implying the then fashionable GMM estimator of Arellano and Bond (1991) and find a pos-

[6] Goods prices are determined exogenously by the world market.

[7] This movement will not only be relative to the other factor but absolute in real terms (cf. Stolper/Samuelson, 1941: 69).

itive effect of trade in intermediate goods on the unskilled-to-skilled workers' wage bill in favor of the former. Newell and Socha (1998) focus on distributional aspects of privatization but do also show that trade with Western Europe, especially Germany, increased employment and wages in Poland between 1992 and 1996 through a shift in labor demand. The study of Ersado and Milanovic (2008) uses household surveys to investigate determinants of the income distribution in 26 CEECs but finds that trade is neutral in this context. However, they would use policy variables instead of economic hard facts to measure the magnitude of trade.

2 Data and descriptive statistics

For my empirical investigation I use data of the OECD database for structural analysis (STAN) for twelve manufacturing industries (see table 2 in Appendix A) over the period 1997-2005[8].

Real wages are calculated by dividing the sum of wages and salaries including supplements (such as contributions to social security, private pensions, health insurance, life insurance etc.) by the number of employees in every industry. Supplementary to real wages (using CPI indexes from the OECD website) I calculated a *EU-reference wage* for each of the CEECs individually. These reference wages are the EU-15 average wages weighted by the CEECs export shares to these countries (as percentage to the EU-15 in total) and reflect the fact that trade would not equalize CEECs' wages with the EU-15 population average but with trading partners.

The intensity of CEECs' trade with the EU-15 of a sector is measured by an *export share* which is the number of exports towards the EU-15 (taken from the STAN Bilateral Trade Database) divided by gross output.

We can see from the first row of table 1 that real wages increased at least double as fast in the CEEC-4 than in the EU-15 between 1997 and 2005. This increase is a process that consists of two components: First, the level of wages in each sector may change. Secondly, there might be labor mobility between these sectors and workers may move from low wage sectors to higher wage sectors. Therefore it is of interest which of those two effects caused the wage increase. To find out I re-calculated the 2005 real wage for all countries but

[8]In the case of the Czech Republic and Hungary the data is available from 1995 onwards, for Poland starting in 1996. However, to make the results comparable, the main focus is on the period 1997 to 2005.

used the 1997 employment structure instead of the 2005 employment structure as weight. The results can be seen in the middle row of table 1 and show that keeping the employment structure fixed at the 1997 level, the wage increases are still substantial and therefore wages must have risen mainly due to wage increases within each industry. Slovakia is the only case where wages with fixed employment structure have risen more than when compared to the actual employment structure, indicating that a slight move of laborers towards lower wage sectors has taken place. On the other hand, the difference in the development of wages with fixed employment structure compared to the actual development was quite dramatic for the EU-15 countries, indicating a redeployment of workers towards sectors with higher wages. From the data analyzed so far, we do not know, why this happened. Note, however, that the HOS framework predicts a higher labor demand in the high-skill industries of the EU after trade liberalization with a "less advanced" region/country.

	CZ	H	PL	SK	EU
avg. real wage growth p.a.	3.81 %	2.92 %	1.42 %	1.63 %	0.55 %
avg. real wage growth p.a. if employment structure fixed	3.49 %	2.39 %	1.22 %	1.77 %	0.21 %
1997 living standard index	0.409	0.450	0.566	0.374	1
2005 living standard index	0.565	0.547	0.606	0.480	1

Table 1: DEVELOPMENT OF MANUFACTURING WAGES 1997-2005

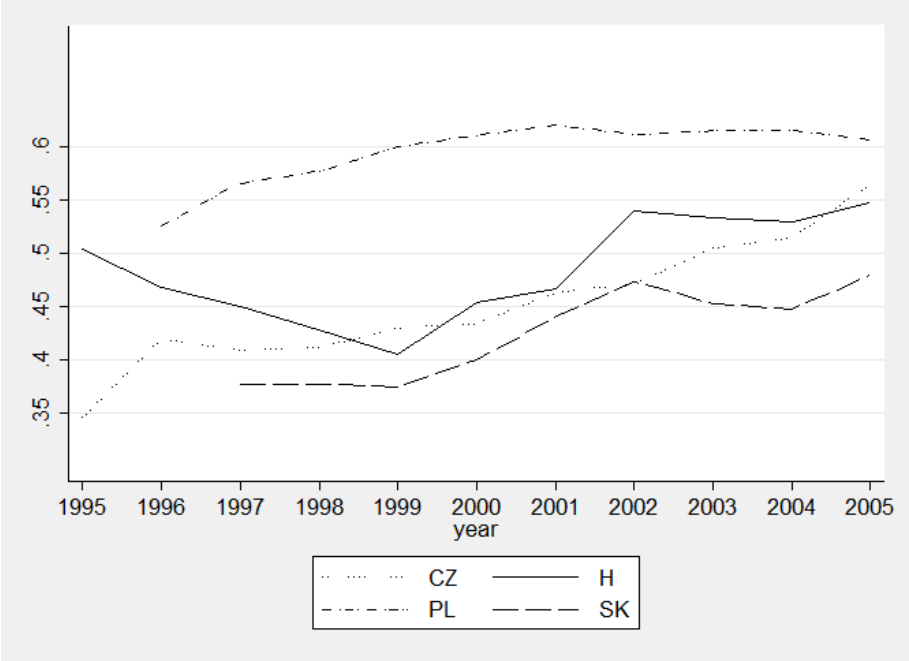
Despite this catching-up in real wages, living standards of employees widely diverged between CEEC-4 and EU-15 countries as can be seen from the third row of table 1 and from figure 1. Living standard of any CEEC-4 country is measured here in terms of the corresponding living standard in EU-15 trading partners:

$$living\ standard\ index\ _{CEEC/EU-15} = \frac{w_{CEEC}/PPP_{CEEC}}{w_{EU-15}/PPP_{EU-15}},$$

where w_{CEEC} is the nominal wage in the CEEC-country, w_{EU-15} is the nominal EU-15 reference wage and PPP measures purchasing power parities. In 2005, Polish employees reached about 60.6 % of the living standard of its EU-15 trading partners, in the case of Slovakia, this index was only 48 %.

Furthermore, from figure 2 it can also be seen, that the significance of EU-15 trade indeed drastically increased for the CEEC-4 during the period under consideration. For all countries but Poland the share of manufacturing exports towards the EU-15 (as percentage of the manufacturing gross product) adds up to about 40 %, in the larger Polish economy it amounts to slightliy below 30 %. An interesting development of CEEC-4 export pattern towards the EU-15 is revealed by a look at figure 3 which depicts the percentage change of man-

Figure 1: DEVELOPMENT OF INDEX OF LIVING STANDARDS OF MANUFACTURING EMPLOYEES



ufacturing exports to the EU-15 (as a percentage of manufacturing gross production) between 1997 and 2005 by skill intensity (according to the classification given in table 2 in Appendix A): We can see that the relevance of high-skill and medium-high-skill intensive exports has dramatically risen for all countries, especially for the Czech Republic and Slovakia, while the significance of less skill intensive exports remained fairly unchanged (or even decreased in the case of Hungary). This descriptive finding reveals inadequacies of the (neo-)classical HOS framework in explaining the driving forces in the trade-income relationship and is in accordance with the empirical findings of Dulleck et al (2005).

3 Econometric analysis

3.1 Model structure

To further investigate the trade-income relationship, I use the econometric model

$$\Delta y_{i,t} = \alpha_i + \hat{\beta}_1 \Delta x_{i,t} + X_{i,t}\hat{\beta} + \hat{\varepsilon}_{i,t}, \tag{1}$$

where y stands for real wages, x is the export share, subscripts i and t stand for sector and year, respectively, X is a matrix of other variables which are explained in table 3 in Appendix A, the $\hat{\beta}$'s are are (linear) estimators for a corre-

Figure 2: CEECs' MANUFACTURING EXPORTS TOWARDS THE EU-15 (AS PERCENTAGE OF MANUFACTURING OUTPUT)

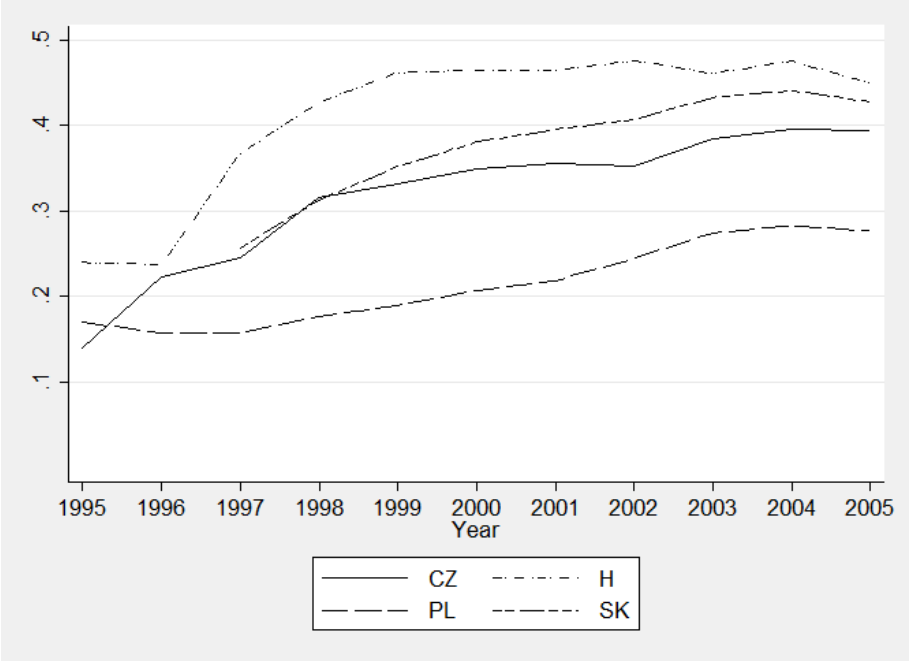
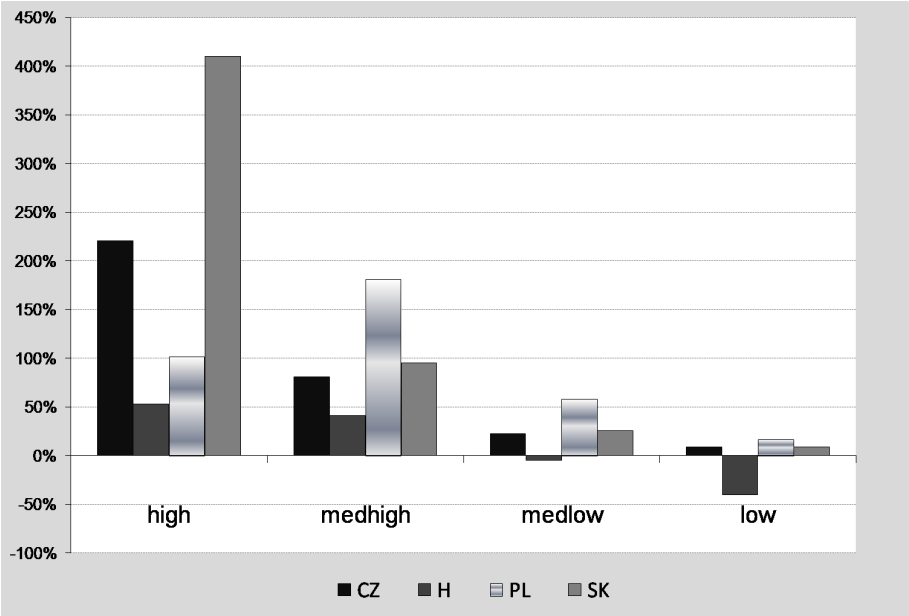


Figure 3: DEVELOPMENT OF SKILL INTENSITIES IN CEEC-4 EXPORTS TOWARDS THE EU-15, 1997-2005



lation between dependent and explanatory variables, and $\hat{\varepsilon} \sim N(0, \sigma^2)$.

The model is formulated in first differences (indicated by Δ) since neither a cross-sector augmented Dickey-Fuller test (CADF; based on Im et al., 1995/2003, and enhanced by Pesaran, 2007) nor a Fisher-Test (as proposed by Maddala/Wu, 1999) based on the Dickey-Fuller and/or the Phillips-Perron(1988) statistics allow to clearly reject the null hypothesis of a unit root in the real wages and export shares for all countries. A possible cointegration relationship was investigated using a Westerlund (2007) test for cointegration. Again, the null hypothesis of no cointegration could not been rejected.[9][10] Note, that a model in first differences with a sector-specific constant corresponds to a model in levels with sector-specific linear time trends.[11]

3.2 Main results of the full model

The results of the full model are reproduced in table 4 in Appendix B. Generally, we can see that the influence of the export share on real wages is not statistically significant (except for the first and third lag in Hungary and the first lag in all countries together). If we look at all countries together (sixth column), where standard errors are smaller than the estimated coefficients at least, we can see that the first lag of the export share has a significantly negative impact

[9] Results are not reproduced here to save space but can be found in Wacker (2009).

[10] The conventional IPS statistic requires $T > 5$ and if a trend is included $T > 6$ (cf. Im et al., 2003: 59). CADF further decreases the degrees of freedom since supplementary lagged values of the cross-section means $\bar{y}$ and differences of their actual values are used in the regression. Since the time series under consideration is relatively short (T=8), the variance will be high and therefore the results will not be very robust, so that rejection of H_0 is unlikely. The same is true for the Westerlund test for (no) cointegration. If applied for the period 1995-2005 for the Czech Republic, Hungary, and Poland (in levels), which increases the degrees of freedom, H_0 can be rejected for all three countries for Westerlund's G_τ statistic on the 1 % level and for the Czech Republic for the P_τ statistic on the 5 % level if a trend and a constant are included. It is likely therefore that there indeed exists a long-run cointegration relationship between trade and wages but we might be unable to robustly observe this in the short period under consideration. Note that Westerlund's α statistics are generally more appropriate than his τ statistics if T is substantially larger than N (Westerlund, 2007: 722) which is not the case here.

[11] The assumption of sector specific time trends is not unlikely since (especially skill-specific) wage differentials were very low in centrally planned economies and thus wages in industries with higher skill intensities are expected to rise faster than others for example. Empirically, normality of the fitted residuals is a criterion to dicriminate between a sector-specific or an overall constant. A Jarque-Bera test shows that we can easily reject the null hypothesis that the residuals of a pooled OLS model are drawn from a normal distribution on the 1 % level for all countries. On the other hand, when using a fixed-effect estimator (as suggested in equation 1) we cannot reject the null on a 10 % level for Hungary and Poland, and on a 1 % level for the Czech Republic and Slovakia. Accordingly, even though pooled OLS will be consistent and efficient under its assumptions, also both model selection criteria AIC and BIC prefer fixed effects over pooled OLS in each case.

on real wages,[12] but as lags increase, the impact turns more positive (but is statistically insignificant at conventional confidence levels). As one would expect, unemployment has a negative impact on wages and the higher the gap in real wages (compared to EU-15 trading partners), the higher is the wage increase in the CEECs (both significant at the 1 % level). While the latter is generally an indication of convergence, it does not mean that this is necessarily related to trade.

3.3 Model selection

In a next step, I applied backward model selection using the conservative[13] information criterion by Akaike (AIC).[14]

Note, that model selection has potentially considerable effect on inference (Pötscher, 1991), so reported test statistics do not have much to say in this context. The use of AIC instead of BIC is motivated by the fact that, strictly speaking, the Bayesian approach (i.e. BIC) is not applicable to model selection "if one takes the view that operating models are generally vastly more complex than any model one is likely to consider fitting to them in practice" (Zucchini, 2000: 54), while AIC (even though derived under the assumption that the operating, i.e. 'true', model belongs to the approximating familiy of models) and the associated frequentist approach accepts "that the approximating models are not necessarily the real thing" and generally goes for the best fit (ibid.) and the *closeness* to the truth instead the truth itself (Forster, 2000: 213).[15] In the present context it would be naive to assume that the simple model estimated is in fact the truth determining complex wage structures.

[12] This does not necessarily contradict the conclusions derived by Stolper and Samuelson (1941; 1948, 1949), since of course nobody "ever denied that the workers employed in the particular industry which loses a tariff could be hurt in the short-run, but according to the classical theory, in the long-run there would be an increased demand for those commodities in which the country had a comparative advantage" (Stolper/Samuelson, 1941: 59).

[13] Using a conservative selection strategy, the possibility of selecting a model that does not nest the minimal true model tends to zero asymptotically, i.e. only correct models are selected but possibly over-parameterized ones (cf. Leeb/Pötscher, 2005: 23/46, Note 6, and 35ff and Leeb/Pötscher, 2008: Section 1.2.2).

[14] I consider every model $M_r : M_0 \subseteq M_r \subseteq M_{all} \cap M_r \succeq M_{all}$, where M_0 only includes the first lag of the EU-15 export variable (and a constant) as an explanatory variable (i.e. this variable is protected) and M_{all} includes the full set of variables, as a potential candidate model. I start with the full model and eliminate one variable respectively. If a lagged variable is excluded, any higher lag of the same variable is excluded too. Out of these eleven submodels anyone that has a lower AIC is considered as a potential candidate model. Out of these, again one variable is eliminated respectively and the procedure is repeated until no further decrease in AIC is possible. From all remaining models the one with the lowest AIC is chosen.

[15] Note that Wasserman (2000: 103), however, qualifies this statement.

The results are presented in table 5 in Appendix B. We cannot make clear statements about the significance of the estimators since standard errors are underevaluated. One can note that significance levels of the export share do not increase considerably anyways. But the interesting thing is that model selection leaves all three lags of the variable in the best model (except for Czech Republic). This is some evidence that export share might indeed be a good predictor for wage levels. Again, we see the same qualitative pattern as in the full model (which is also true for the unemployment rate[16] and the wage gap).

3.4 Estimating the long-run correlation

In a final step I estimate a long-run relationship by using averages of the variables over several years. Thus, the dependent variable is the percentage increase of real wages from 1998-2005. The explanatory variables are the percentage change in the export share (towards the EU-15), in the unemployment rate,[17] and in import penetration. These changes are calculated over the period 1997-2004 to allow for a lag structure of at least one year. The real wage gap between the CEEC-4 and the EU-15 enters the equation in 1997 levels since sectors where the wage was especially low in 1997 are expected to experience higher wage increases within the following years. We can see from table 6 that this expectation is fulfilled since the parameter estimate of this variable is < 0 (and significant at the 10 % level at least for Poland, Slovakia and the combination of all countries). Also operating surpluses and R & D expenses enter the equation not in long-run differences but in averages over the period 1997-2004 since they are assumed to have a persistent influences on wages.

The results for the long-run influence of the variables on the real wage in the full model are presented in table 6 (Appendix B). As can be seen there, the long-run influence of exports towards the EU-15 is only significant in Poland (at the 5 % level and positive). Thus, in Poland sectors that got more export-oriented towards the EU-15 during the period 1997-2004 had significantly higher increases in real wages between 1998 and 2005. A positive relationship is also suggested for Hungary but is not statistically significant (at the 10 % level) there. Negative, but also insignificant, relationships are suggested for the Czech Republic and Slovakia.

[16] The unemployment rate is eliminated from most single-country models which might be due to the fact that it is not sector specific.

[17] The change in the unemployment rate is only included in the pool of all countries since it is not sector-specific. Therefore it would simply act as a constant on the country level.

Backward model selection leads to the models presented in table 7. For Slovakia, no submodel obtained a better AIC than the full model and therefore the latter is equal to the best AIC model. Again, we can see a positive relationship between exports towards the EU-15 and real wages in Hungary and Poland that is only significant in Poland (at the 5 % level). In the Czech Republic the relationship is negative but far from being significant. The same is true if all countries are pooled together. In this specification the impact of unemployment on real wages is significantly negative (at the 10 % level) and also sectors of the CEEC-4 which lagged further behind the wage level of the EU-15 had significantly higer increases in real wages.

Since it might be a strong assumption that the constant (i.e. the linear time trend of the wage variable that is not explained by the variables in the model) as well as the parameter of the influence of the export share on real wages are equal across all countries, I included dummy variables for the countries in the full pooled model (model `all(2)' in table 7) and furthermore interacted them with the share of exports towards the EU-15.[18] The obtained results are similar to the results from table 6: The share of exports towards the EU-15 has a negative impact on real wages in the Czech Republic and Slovakia, while the influence is positive in Hungary and Poland. Now, Hungary is the only country where this influence is statistically significant (at the 1 % level). Furthermore, the initial gap between the CEECs and the EU-15 in real wage and operating surpluses have a significant influence on real wages. When the best AIC submodel is selected (column `all(3)' in table 7), the impact of exports on real wages in the Slovak Republic turns positive but remains highly insignificant. All other results remain qualitatively unchanged.

4 Summary, conclusions, and perspectives

Using the OECD STAN database for twelve manufacturing industries in Czech Republic, Hungary, Poland, and Slovakia for the time period 1997-2005 I thus find no clear relationship between the share of exports towards the EU-15 and the development of real wages. Generally, real wages have stronger increased in these CEEC-4 than in the EU-15 during this period but there still exists a serious difference in living standards of employees. Furthermore, it is unlikely that the (neo-)classical arguments of trade theory explain the full story of the forces underlying this process of convergence: Contrary to the predictions of the HOS

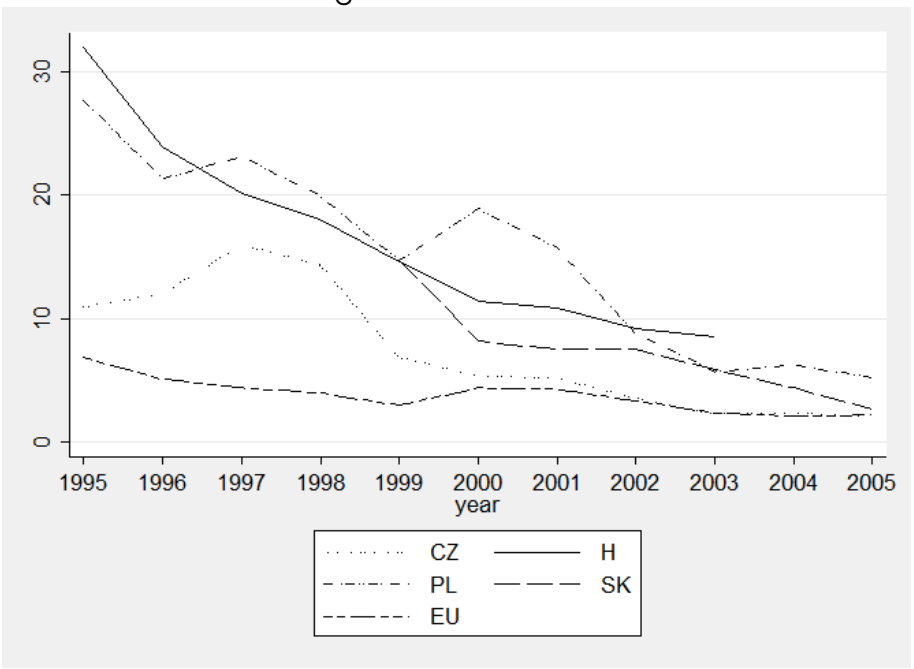
[18] It should be clear that three country dummy variables account for all four countries and then also the unemployment rate becomes obsolete as an explanatory variable. Since all four country dummies are interacted with the export share, also the overall export share is no longer needed.

framework, especially medium-high and high technology intensive goods have gained magnitude in the CEEC-4 export composition (towards the EU-15). 'The increasing returns revolution in trade' theory (Krugman, 2009) and the influence of multinational firms might well account for this trade pattern. With these extensions made, however, the irrevocableness of the Stolper-Samuelson and the factor price equalization theorem no longer exist. Even though Helpman and Krugman (1985: 59-63, 190-195) showed that factor price equalization also may hold when increasing returns and differentiated products exist, further restrictions have to be assumed and the FPE set may become very small and thus factor endowments have to be very similar in both countries and/or produced commodities have to use production factors in very different proportions (cf. Samuelson, 1948: 175, 178-180; and Krugman, 1995: 359f).

Another central point of the Stolper-Samuelson as well as the FPE theorem is the perfect mobility of factors across sectors which reflects the general equilibrium structure of trade theory. To assume such a perfect mobility for labor markets within even several years might be a too strong requirement to empirically observe FPE. On the other hand, factor incomes of capital - which is not only mobile across sectors in the medium-run but was also mobile across countries in the case of CEEC-4 - have virtually equalized during the period under investigation (see the behavior of the short-term interest rate in figure 4). Trade theorists might thus argue: In the long run, also factor income of labor may equalize. However, if that takes two generations, the employees concerned may rightly argue that "in the long run we are all dead" (Keynes, 1923: 80). Also, from a policy perspective, a trade theory that affirms that a trade liberalization two generations before has been advantageous to actual employees is of limited practical value to actual policy makers. What might be done to overcome this potential problem?

Empirically, it might be promising to devote more attention to differences in the trade-income relationship by labor mobility differences. The findings presented here for example, suggest that this relationship may seriously vary between Hungary and Poland (positive relation in the medium run) on the one hand and the Czech Republic and Slovakia on the other. While the textbook distinction between "big bang" and gradual transition strategy fails to account for these differences (Poland as well as the Czech Republic adopted a big bang strategy while Hungary is a textbook example of a gradualist strategy; cf. Roland, 2000: 11ff), different geographic aspects of labor mobility may to some extent explain the differences: manufacturing production in Poland is highly concentrated in the Silesian Voivodeship; in Hungary, it is also highly concentrated in Central and Western Transdanubia. This geographical concentration

Figure 4: SHORT-TERM INTEREST RATES



of manufacturing production might increase mobility of workers across sectors (since workers do not have to move in order to change job) while the regional dispersion of manufacturing production all over the country in Slovakia and the Czech Republic - countries that have not had the same history of market-oriented reforms prior to 1990 - might disable workers in stagnating and declining sectors to find work in industries that are expanding due to increasing foreign demand. Therefore, investigating the effects of trade capacities on a more disaggregated level in future studies might shed more light on the trade-income relationship. But also actually developing panel cointegration techniques might lead to more meaningful results as the time dimension in CEECs' data observations grows larger.

If the suspicion of missing labor market mobility gets substantiated, then from a policy perspective it seems reliable to undertake efforts to increase labor mobility so that employees can take advantage of the gains from trade. Unfortunately, this matter has been largely ignored due to theoretical reasons and public budget constraints. Not only infrastructural and housing policy[19] are among the potential spheres of action, but also education and social security that allows for labor market transitions without major short-term losses in living standards.

On the theoretical front, evidence of locally mobile but nationally rigid labor

[19]Mobility of employees in CEECs was also handicapped by overpriced housing in developing areas (cf. Nesporova, 1999: 51)

markets might well be a shot in the arm of attempts to bring forward the incorporation of economic geography into trade theory. It is questionable, however, if such models with increased complexity lead to such clear, definite, and extensive statements about the effects of trade liberalization on factor prices as the Stolper-Samuelson and the FPE theorem. If it increases the adequacy of trade theory, it is a price one should probably be willing to pay since the indisputability of these theorems suffers the same problem as all mathematical theorems do: "as far as ... (they) apply to reality, they are not certain; and if they are certain they don't apply to reality" (Einstein, (1921), 2005: 157).

Appendix A

Industry	**ISIC Rev. 3**	**Code**	**skill**
Food Products, Beverages & Tobacco	15-16	3	L
Textiles, Textile products, leather & footwear	17-19	4	L
Wood and products of wood & cork	20	5	L
Pulp, paper, paper products, printing & publishing	21-22	6	L
Chemicals & chemical products	24	8	MH
Rubber & plastics products	25	9	ML
Other non-metallic mineral products	26	10	ML
Basic metals & fabricated metal products	27-28	11	ML
Machinery & equipment, n.e.c.	29	12	MH
Electrical & optical equipment	30-33	13	H
Transport equipment	34-35	14	H
Manufacturing n.e.c.; recycling	36-37	15	L

Note: The classification of the skill intensity in the very right column follows OECD (2007: 220): L = low technology; ML = medium-low technology; MH = medium-high technology; H = high technology. Industries 13 and 14 have been assigned to high technology industry according to the subsections included in them.

Table 2: LIST AND CLASSIFICATION OF INDUSTRIES

Abbreviation	Full Name	Explanation	Source
Exp Share	Export Share	share of exports towards the EU-15 relative to gross output of the industry	OECD BTD
MPEN	Import Penetration	$\frac{imports}{grossoutput+imports-exports}$	OECD STAN
OPS	Operating Surplus	gross operating surplus for Hungary (= net OPS + depreciation of fixed capital), net operating surplus for other countries. National currencies.	OECD STAN
R & D	Research and Development	R & D expenses by main activity (by industry served for PL)	OECD website
real wage	real wage	wage p.c. at 1997 price level	OECD STAN CPIs from OECD website
real wage gap		gap in real wages between CEEC and EU-15 trading partners; < 0 indicates a wage deficit of CEECs	own calculation based on other sources mentioned
unempl	unemployment rate		OECD website

In country specific analysis all variables were used in national currencies. In pooled analysis variables were converted to Euros.

Table 3: LIST OF VARIABLES

Appendix B

	dependent variable: **d.(real wage)**				
	CZ	H	PL	SK	all
d.exp share	7,829	-1,148,858**	3,489	-26,448	-1,650**
(1 lag)	(39,128)	(487,104)	(18,645)	(61,961)	(719.8)
d.exp share	7,499	23,969	-13,220	-46,625	-712.2
(2 lags)	(40,368)	(337,318)	(16,518)	(79,421)	(599.3)
d.exp share	-9,322	568,228*	14,877	19,421	588.8
(3 lags)	(16,305)	(326,264)	(13,776)	(26,129)	(573.8)
d.unempl	-127,561	-545,245	54,461	132,753	-9,949***
(1 lag)	(89,781)	(4,495,944)	(37,016)	(142,947)	(3,370)
real wage gap	0.5132	-63.1***	-0.8384**	-3.34	-0.2593***
(1 lag)	(0.9510)	(23.0)	(0.3783)	(2.67)	(0.0371)
d.mpen	1,305	36,728*	-1,187.887	35,957	23.06
(1 lag)	(40,032)	(18,676)	(17,502)	(50,121)	(33.22)
d.mpen	-13,759	7,637	12,241	42,352	5.24
(2 lags)	(41,752)	(11,598.28)	(13,906)	(57,844)	(29.73)
d.ops	3.34e-07	-0.000259	3.67e-08	-1.16e-07	7.12e-08
(1 lag)	(8.98e-06)	(0.000269)	(1.78e-06)	(0.0000306)	(2.20e-06)
ops	-0.0000149	0.0000575	2.68e-07	0.0000183	2.54e-06
(1 lag)	(0.0000102)	(0.0001673)	(1.56e-06)	(0.0000307)	(1.86e-06)
d.R&D	-2.20	-27.9	-0.1904943	-6.97	2.50
(1 lag)	(4.32)	(17.6)	(7.497906)	(21.82)	(6.16)
d.R&D	3.26	-24.76	-16.1	19.6	-3.99
(2 lags)	(3.30)	(20.41)	(11.12)	(20.83)	(6.98)
d.R&D	-8.31**	-4.84	-17.04	-3.93	-10.47*
(3 lags)	(3.60)	(19.32)	(10.26)	(16.20)	(6.06)
constant	32,144	-1,818,200***	-26,065**	-105,111	-7,613***
	(29,986.65)	(661,762.8)	(11,422)	(83,775)	(1,120)
Prob F-stat	0.1225	0.0064	0.0655	0.7936	0.0
within R^2	0.2400	0.3468	0.5057	0.1759	0.3582
AIC	1,703	2,247	819	1,280	3,990
Obs	84	84	48	60	264

1997-2005 (98 for SK), Sector 7 excluded. Standard Errors in parentheses

Significance: * = 0.1 level, ** = 0.05 level, *** = 0.01 level

Table 4: FD FE ESTIMATION RESULTS (FULL MODEL)

	dependent variable: **d.(real wage)**				
	CZ	H	PL	SK	all
d.exp share	7,492	-1,122,453**	8,485	16,330	-1,355***
(1 lag)	(17,588)	(454,739)	(6,905)	(21,129)	(492.7)
d.exp share	X	190,731	4,305	6,745	-737.0
(2 lags)	X	(212,489)	(8,155)	(25,167)	(486.1)
d.exp share	X	597,576**	31,651***	25,586	573.2
(3 lags)	X	(242,615)	(10,410)	(22,135)	(549.3)
d.unempl	-145,691**	X	X	X	-11,007***
(1 lag)	(72,563)	X	X	X	(3,310)
real wage gap	X	-67.67***	-0.3793*	-3.97*	-0.2649***
(1 lag)	X	(19.82)	(0.1910)	(2.12)	(0.0363)
d.mpen	X	35,481**	X	X	X
(1 lag)	X	(17,326)	X	X	X
d.ops	X	X	6.25e-07	X	-2.59e-07
(1 lag)	X	X	(1.00e-06)	X	(2.12e-06)
ops	-0.000013**	X	X	X	3.38e-06*
(1 lag)	(5.64e-06)	X	X	X	(1.78e-06)
d.R&D	-1.71	-17.78	X	X	X
(1 lag)	(3.92)	(13.72)	X	X	X
d.R&D	3.49	X	X	X	X
(2 lags)	(3.01)	X	X	X	X
d.R&D	-7.96**	X	X	X	X
(3 lags)	(3.29)	X	X	X	X
constant	15,793***	-1,959,282***	-12,207**	-121,745*	-7,811***
	(2,806)	(587,919)	(5,546)	(66,310)	(1,094)
Prob F-stat	0.0075	0.0003	0.0092	0.3637	0.0
within R^2	0.2275	0.3148	0.3761	0.0917	0.3426
AIC	1,692	2,239	816.3	1,269	3,987
JB	0.0215	0.7430	0.7228	0.0304	0.0208
Obs	84	84	48	60	264

1997-2005 (1998-2005 for SK), Sector 7 excluded. Standard Errors in parentheses

Significance: * = 0.1 level, ** = 0.05 level, *** = 0.01 level

Jarque-Bera reports p-values for normality test of residuals.

Table 5: FD FE ESTIMATION RESULTS (BEST AIC MODELS)

dependent variable: Δ_{98-05}**real wage**					
	CZ	H	PL	SK	all
Δ_{97-04} exp share	-0.0137203	0.3047	0.0559114**	-0.0265299	-0.0430825
	(0.0487254)	(0.2509)	(0.013508)	(0.0671819)	(0.0535559)
Δ_{97-04} unempl	X	X	X	X	-0.0619558
	X	X	X	X	(0.0600708)
real wage gap	-2.28e-06	-0.0000154	-9.62e-06*	-0.0000142**	-7.80e-06*
	(2.80e-06)	(0.0000118)	(4.01e-06)	(4.83e-06)	(4.57e-06)
Δ_{97-04} MPEN	-0.0129384	0.4924	-0.1095	0.2733	0.1345
	(0.1157)	(0.5100)	(0.0494)	(0.1916)	(0.1611)
$\overline{OPS}^{97-04}$	-0.0178824	-4.40*	-0.7938*	-0.8868	-0.9514
(% of gross prod.)	(0.4178781)	(2.01)	(0.2810)	(0.7545)	(0.7007)
$\overline{R\&D}^{97-04}$	2.47	13.22	-2.51	-118,238	10.28*
(% of gross prod.)	(3.35)	(12.30)	(14.13)	(83,228)	(5.65)
constant	0.2584**	0.1456	-0.1377	-0.2384	0.0703555
	(0.0797)	(0.3836)	(0.0996)	(0.1745)	(0.1617761)
observations	12	12	9	12	45
R^2	0.4973	0.7005	0.9657	0.6325	0.2872
prob F-stat	0.4137	0.1206	0.0209	0.2015	0.0356
AIC	-41.5152	-4.412561	-39.19999	-21.67237	-31.12484
JB	0.0	0.0139	0.0461	0.0	0.0

OLS estimation, excluding sector 7

Significance: * = 0.1 level, ** = 0.05 level, *** = 0.01 level

Table 6: LONG-RUN CORRELATION (FULL MODELS)

dependent variable: Δ_{98-05}**real wage**						
	CZ	H	PL	all	all(2)	all(3)
Δ_{97-04} exp share	-0.0124933	0.3890	0.0520576**	-0.008981	X	X
	(0.025732)	(0.2302)	(0.0173286)	(0.0463253)	X	X
Δ_{97-04} unempl	X	X	X	-0.1069*	X	X
	X	X	X	(0.0573317)	X	X
real wage gap	X	-0.0000206*	-9.07e-06***	-0.0000115***	-8.32e-06**	-8.51e-06***
	X	(9.44e-06)	(2.28e-06)	(3.92e-06)	(3.29e-06)	(2.65e-06)
Δ_{97-04} MPEN	X	X	-0.1328*	X	0.0757959	X
	X	X	(0.0689)	X	(0.1149141)	X
$\overline{OPS}^{97-04}$	X	-2.82*	-0.6197	X	-0.9742*	-0.8250*
(% of gross prod.)	X	(1.50)	(0.4075)	X	(0.4985)	(0.4564)
$\overline{R\&D}^{97-04}$	4.34**	X	X	X	1.34	
(% of gross prod.)	(1.66)	X	X	X	(4.31)	
constant	0.3115***	-0.0262775	-0.1368	-0.0979964	-0.0438819	-0.0574905
	(0.0159)	(0.2510)	(0.0930239)	(0.1130082)	(0.1313139)	(0.1068122)
CZ	X	X	X	X	0.2627*	0.2660***
(dummy)	X	X	X	X	(0.0704994)	(0.0654068)
H	X	X	X	X	0.0905609	0.1028*
(dummy)	X	X	X	X	(0.065151)	(0.059471)
PL	X	X	X	X	-0.0806327	-0.0581152
(dummy)	X	X	X	X	(0.0769566)	(0.0658328)
expshare	X	X	X	X	-0.0942253	-0.0672449
(CZ)	X	X	X	X	(0.0981182)	(0.0883706)
exp share	X	X	X	X	0.4731218***	0.4880513***
(H)	X	X	X	X	(0.1445702)	(0.1366209)
exp share	X	X	X	X	0.0349513	0.0315527
(PL)	X	X	X	X	(0.0508951)	(0.0446638)
exp share	X	X	X	X	-0.0145322	0.0005896
(SK)	X	X	X	X	(0.0659978)	(0.0597317)
observations	12	12	12	48	45	48
R^2	0.4369	0.6191	0.8284	0.2075	0.7030	0.7044
prob F-stat	0.0754	0.0431	0.0082	0.0158	0.0	0.0
AIC	-46.15499	-5.528724	-41.26866	-35.4272	-60.5143	-70.77059
JB	0.0	0.0988	0.0199	0.1592	0.0	0.0

OLS estimation, excluding sector 7
Significance: * = 0.1 level, ** = 0.05 level, *** = 0.01 level

Table 7: LONG-RUN CORRELATION (BEST AIC MODELS)

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