



OESTERREICHISCHE NATIONALBANK

EURO SYSTEM

FOCUS ON EUROPEAN ECONOMIC INTEGRATION

Q 1 / 09

The Focus on European Economic Integration (FEEI) is a channel for communicating the OeNB's ongoing research on Central, Eastern and Southeastern European (CESEE) countries, thus reflecting a strategic regional research priority of the OeNB. Contributions primarily deal with macrofinancial and monetary integration and also include economic country analyses. One of the purposes of publishing theoretical and empirical studies in the FEEI, which are subject to an external refereeing process, is to stimulate comments and suggestions prior to possible publication in academic journals. As from 2009, the FEEI is published quarterly.

Editors in chief

Peter Mooslechner, Doris Ritzberger-Grünwald

General coordinator

Peter Backé

Scientific coordinators

Markus Eller, Philipp Schmidt-Dengler, Julia Wörz

Manuscript editing and editorial processing

Ingrid Haussteiner, Rena Mühldorf, Ingeborg Schuch, Susanne Steinacher

Technical production

Peter Buchegger (design)

Walter GROSSER, Erika Gruber (layout, typesetting)

OeNB Printing Office (printing and production)

Inquiries

Oesterreichische Nationalbank, Communications Division

Postal address: PO Box 61, 1011 Vienna, Austria

Phone: (+43-1) 404 20-6666

Fax: (+43-1) 404 20-6698

E-mail: oenb.info@oenb.at

Orders/address management

Oesterreichische Nationalbank, Documentation Management and Communications Services

Postal address: PO Box 61, 1011 Vienna, Austria

Phone: (+43-1) 404 20-2345

Fax: (+43-1) 404 20-2398

E-mail: oenb.publikationen@oenb.at

Imprint

Publisher and editor:

Oesterreichische Nationalbank

Otto-Wagner-Platz 3, 1090 Vienna, Austria

Günther Thonabauer, Communications Division

Internet: www.oenb.at

Printed by: Oesterreichische Nationalbank, 1090 Vienna, Austria

© Oesterreichische Nationalbank, 2009

All rights reserved.

May be reproduced for noncommercial and educational purposes with appropriate credit.

DVR 0031577

Vienna, 2009



Contents

Studies – Special Focus on W ages and Migration

Trade and W ages: W inning and Losing Sectors in the Enlarged European Union <i>Éva Katalin Polgár, Julia Wörz</i>	6
The D istributional Effects of Trade on A ustrian W ages <i>Wolfgang Pointner</i>	36
Rationality of Post-A ccession Migration <i>Katarzyna B. Budnik</i>	57
Southeastern Europe: Financial Deepening, Foreign Banks and Sudden Stops in Capital Flows <i>Adalbert Winkler</i>	84

Highlights

63 rd East Eur Fixe Financial Deepening and Macroeconomic Stability in Southeastern Europe <i>Compiled by Thomas Reininger with input from Sándor Gardó and Julia Wörz</i>	100
The O eNB's Conference on European Economic Integration 2008 The Integration of European Labor Markets <i>Compiled by Wolfgang Pointner, Philipp Schmidt-Dengler and Josef Schreiner</i>	104
SU ERF Workshop and Special O eNB East Eur Fixe Current Trends in the Russian Financial System <i>Compiled by Stephan Barisitz, Markus Eller and Catherine Keppel</i>	108
O lga Radzyner Award for Scientific W ork on European Economic Integration	112

Notes

Legend, A bbreviations and D efinitions	114
Periodical Publications of the O esterreichische N ationalbank	118
A ddresses of the O esterreichische N ationalbank	120

The views expressed are those of the authors and not necessarily those of the O esterreichische N ationalbank.

Visit our CEEC website
<http://ceec.oenb.at>



The screenshot shows the website of the Oesterreichische Nationalbank (OENB) with a focus on Central and Eastern Europe. The header includes the OENB logo and the text "OESTERREICHISCHE NATIONALBANK EUROSYSTEM". A navigation menu is visible, and a search bar is present. The main content area is titled "Central and Eastern Europe" and features several sections:

- About the CEEC**: A list of links including Monetary Policy and Economics, Fiscal Policy, Forecasts, International Comparisons, Central and Eastern Europe, Focus on European Economic Integration, Monetary Policy, Exchange Rates, Banking Sector and Financial Stability, Trade and Direct Investment, Fiscal Policy, Pension Systems, Real Economy, Labor Markets, Inflation, Institutional Topics, EU Enlargement, Country Information, Technical Cooperation and JTI Activities, Links, Contact us / Impressum, and Small Events.
- CEEC Research Platform (ceec.oenb.at)**: A section describing the research platform, which offers selected reports, analyses, and studies on economic developments in Central and Eastern Europe.
- Developments in Selected CEE/EE Countries**: A section with a sub-heading "Recent Economic Developments in selected CEE/EE Countries" and a small image of a globe.
- Focus on European Economic Integration**: A section with a sub-heading "Focus on European Economic Integration 2008" and a small image of a globe.
- OENB EuroSurvey**: A section with a sub-heading "The Euro in Credit, Exports and Inflationary Dispute" and a small image of the Euro symbol.
- Financial Stability Report**: A section with a sub-heading "Financial Stability Report II" and a small image of a globe.

Studies

Trade and Wages: Winning and Losing Sectors in the Enlarged European Union¹

Éva Katalin Polgár,
Julia Wörz²

This paper contributes to the abundant but as yet inconclusive literature on the effect increased openness to trade has on wages by presenting an analysis of industry-level data for 21 service and manufacturing industries in 25 EU countries covering the period from 1995 to 2005. By applying a cross-country and industry-specific approach, it is possible to control for unobserved heterogeneity at both country and industry levels. While we are able to identify some – often resource-based – industries as winners of increased trade integration, we find very few and comparatively small effects in general. The relation between trade and wages tends to be weaker in Western European countries (EU-15) than in the EU Member States in Central and Eastern Europe (EU-10). At the same time, greater trade openness appears to have increased the influence wage levels abroad – as opposed to productivity – have on wage setting in the EU-15. By contrast, wages in the EU-10 have become less responsive to foreign wages and more realigned with productivity developments as a result of trade openness.

1 Introduction

Globalization has gained unprecedented momentum in recent decades. Thus, it comes as no surprise that it also features prominently in theoretical and empirical papers that try to investigate or predict its impact. While some effects of globalization (e.g. lower consumer prices) are welcome, other effects generate resistance, given fears that cheap imports or the off-shoring of production to areas with lower input prices will cause firms to relocate and thus negatively affect labor markets by driving down wages and/or driving up unemployment.

The economic literature revolving around such fears is vast, but has delivered mixed results. It is almost impossible to draw general conclusions, as individual countries and regions differ substantially in terms of labor skills, trade and wage structures. Therefore, given the topic's unquestionable relevance, it makes sense to continue with careful analysis for different regions of interest. One such region is the enlarged European Union (EU), whose unprecedented economic integration recently took on a new dimension with the accession of ten (and subsequently two more) countries with distinctly lower average income levels and, therefore, lower wages. At the same time, due to their convergence process, these countries generally experience higher growth than their Western European neighbors, confronting them with enhanced competition in a very open environment.

For these reasons, we explore the effects of increased openness to trade on wages within the enlarged EU. Given the above-mentioned differences between pre- and post-2004 Member States, it appears appropriate to distinguish as often

¹ This paper was presented at the OeNB's Conference on European Economic Integration (CEEI) 2008, which focused on "The Integration of European Labor Markets" and took place in Vienna on November 17–18, 2008.

² European Central Bank, EU Neighbouring Regions Division, eva-katalin.polgar@ecb.int, and Oesterreichische Nationalbank, Foreign Research Division, julia.woerz@oenb.at. This paper was written during Éva Katalin Polgár's working visit at the OeNB's Foreign Research Division in 2008. The authors would like to thank Peter Backé, Markus Eller, Martin Feldkircher, Doris Ritzberger-Grünwald, the participants of the Conference on European Economic Integration 2008 and two anonymous referees for helpful comments. The views expressed are those of the authors and not necessarily those of the Oesterreichische Nationalbank.

as possible between the EU-15 and the EU-10.³ The fact that trade and wages often evolve differently across industries – as reflected by data at the sectoral level – could imply that the relation between the two depends, inter alia, on the type of economic activity. For example, increased import penetration may induce a reallocation of domestic resources, leading to changes in specialization patterns followed by different wage reactions in individual economic sectors. In addition, increased trade openness could drive up average wages in more skill-intensive sectors, but exert downward pressure on wages for low-skill activities, which tend to be displaced by imports. Therefore, in this paper we focus on the question whether there is a systematic relation between trade and real wage developments at the industry level in the EU-25. Another purpose of this paper is to identify the relevance of domestic versus international factors in determining sector-specific wage levels. While there is a strong co-movement of domestic and foreign wages in the EU-15, wages appear to respond more strongly to changes in domestic determinants in the EU-10. In this respect, we investigate the role that trade plays in bringing wages more closely into line with domestic productivity developments, which – following Persyn (2008) – we refer to as a disciplining effect of trade on wages.

This paper is structured as follows. Section 2 discusses some of the existing findings in the literature which constitute the background and motivation of our study. Section 3 provides a descriptive analysis of the data set employed, depicting the variables relevant for our analysis. Section 4 presents our econometric estimation, and conclusions are drawn in section 5.

2 Insignificant and Small Relation?

What the Literature Tells Us about Trade and Wages

The wage rate, i.e. the factor price of labor, is a crucial economic variable as it influences both labor supply and demand and therefore affects output, unemployment, consumption and welfare. Accordingly, wage developments may be analyzed from many different angles – a fact which makes the theory of wages rather complex. Taking an international perspective and including openness to trade in the considerations increases this complexity. While there is a general perception that trade could affect real wages by enhancing competition and thus pressing for lower production costs, it is surprisingly difficult to find clear-cut results in economic theory for the influence of trade on wages. We do not attempt to provide an exhaustive review of the relevant literature in this section, since it is indeed vast and analyzes these issues from many different perspectives. Instead, we try to concentrate on the directions that are relevant for the focus of this paper.

It is trade theory rather than labor economics that may serve as a starting point for theoretical predictions concerning the trade-wage nexus, since wage equations generally focus on the domestic determinants of wages (e.g. productivity and indi-

³ The EU-15 include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. The EU-10 comprise the countries which joined the EU on May 1, 2004, namely Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Finally, the EU-25 include all current Member States with the exception of Bulgaria and Romania.

vidual factors such as education, experience, etc.).⁴ Wage-relevant statements in trade theory include the theory of factor-price equalization or the Stolper-Samuelson theorem, which states a positive relation between the relative prices of goods and the relative returns of the factors used more intensively in their production. The locally scarce factor, supposedly capital in developing and labor in developed countries, would thus *ceteris paribus* suffer from trade liberalization in relative terms. It is difficult to apply these theories empirically or as a basis for policy implications because they rely on relatively restrictive assumptions⁵ and because the relative intensity of factors in the production of goods cannot be established based on available data. Overall, as opposed to the general perception mentioned above, theoretical statements include no straightforward predictions about the dependence of real wage developments on intensified trade.⁶ They deliver complex results depending to a large extent on the assumptions of the models and features that cannot be completely controlled for.

Empirically, the results are also rather mixed, and often it is hard to establish the exact relation to theoretical statements like the Stolper-Samuelson theorem, given that available data do not allow to completely control for factor intensities in production. In recent research, Krugman (2008) considers past trends in trade and their effect on our understanding of the trade-wage nexus. He discusses in detail the consequences of aggregation at the sectoral level and states that, with vertical integration, it has become very complicated to judge which sectors are labor-intensive and which are skill-intensive. Hence, it is not trivial to put the Stolper-Samuelson theorem to an empirical test. In particular, he states that “the changing nature of world trade has outpaced our ability to engage in secure quantitative analysis ... How can we quantify the actual effect of rising trade on wages? The answer, given the current set of data, is that we can’t.”⁷

Nonetheless, more current theoretical papers on wages and trade (based on different general equilibrium models) appear to coincide in the conclusion that international trade increases wage inequality within an economy (across different activities as well as across different skill segments, etc.), which is in line with the Stolper-Samuelson theorem. An earlier example, which focuses on the effects of globalization, is Manasse and Turrini (2001). In the trade model of Egger and Kreickemeier (2008), international trade also increases domestic wage inequality as well as involuntary unemployment. According to Amiti and Davis (2008), trade liberalization (reduction in tariffs) results in increased inequality. However, these papers often treat wage inequality as a rather abstract concept that is not easily adaptable to data. Empirical evidence concerning wage inequality is also ambiguous.

⁴ See e.g. Mason (1994), Wolpin (2000) or Belzil (2006).

⁵ Relaxing some of the assumptions and thus going beyond the standard 2-sectors, 2-factors of production, 2-countries framework can change the results. In his examination of theoretical results on the influence of a fall in import prices of labor-intensive imports on wages, Thompson (2007, p.12) concludes, “With more than the minimal number of inputs, there is no simple theoretical prediction regarding the wage.”

⁶ In the specific context of off-shoring, Hijzen et al. (2007, p.3) state that “In general, these studies conclude that almost anything can happen to wages depending on the configuration of sectoral factor-intensities, the relative factor-intensity of components relocated abroad and relative factor endowments.” See also Stehrer (2005).

⁷ Krugman (2008, p.27). As we said before the quotation, Krugman actually refers to the impact of trade on relative wages in the Stolper-Samuelson sense, and not to the impossibility of testing more straightforward statements, such as the relationship of trade and real wages, as is done in this paper.

Feenstra and Hanson (1996, 1999, 2001) have presented several contributions that focus on the impact of outsourcing on relative wages, generally arguing that outsourcing – and not only technology – is an important explanation behind the rising wage gap in the United States. However, the results of empirical papers on this topic are generally mixed.⁸

For the focus of the current study, it is also interesting to check the literature on European economies, not least because of the substantial differences between labor markets in Europe and in the U.S.A. However, only few studies are available regarding trade and wages, as many papers focus on some related, but distinct aspects.⁹ Wage effects are considered in two papers by Onaran that focus on the effect of off-shoring on employment and wages in Austria. Onaran (2008a) finds generally negative wage effects, while – when focusing on the Austrian manufacturing industry – Onaran (2008b) concludes that there is a negative impact on employment, but wages are actually positively affected by off-shoring to Eastern Europe, which indicates the dominance of scale effects. Empirical evidence on the trade-wage nexus is rather limited also with regard to transition economies. Again, most related papers investigate slightly different questions, such as the effect of foreign direct investment (FDI) on wages or the employment effects of trade.¹⁰ The trade-wage relation in the region is explicitly considered by Onaran and Stockhammer (2006), who analyze the manufacturing sectors in five countries (the Visegrád countries and Slovenia) for the period from 2000 to 2004. According to their findings, the long-term net effect of exports and imports was negative for the period under review.¹¹

Overall, empirical research has delivered ambiguous results so far. The few papers that explicitly consider the relation between trade and wages find that the effects of trade on wages are mostly insignificant and extremely small. Moreover, the literature is characterized by a case study approach, especially when based on microdata. Even papers analyzing more than one country run country-specific regressions, which in our view limits the validity of the results to the country in question. Our attempt is to explore the effects of increased openness to trade on industry-level wages for two European country groups, namely the EU-15 and EU-10. In the group of Central and Eastern European (CEE) transition countries,

⁸ Borjas and Ramey (1995) analyze the link between trade in concentrated industries and aggregate wage inequality, finding a small impact of trade on inequality. In general, a positive impact of trade on wage inequality is found by Amiti and Davis (2008) for Indonesia and by Rabbani (2005) for the United States. Positive, but small effects were established in Galiani and Sanguinetti (2003) in the case of Argentina and in Attanasio et al. (2004) for Colombia. By contrast, Mishra and Kumar (2005) find the opposite effect for India, suggesting that trade liberalization has led to decreased wage inequality.

⁹ Pula and Skudelny (2008) and Peltonen and Pula (2008) deal primarily with the impact of imports from low-cost countries on the demand for labor in some euro area countries. Rodriguez and Rodrik (2000) analyze the link between trade policy and economic growth. The employment effects of outsourcing to low-wage countries are analyzed by Falk and Wolfmayr (2005).

¹⁰ Bruno et al. (2005) focus on six manufacturing sectors in three countries (the Czech Republic, Hungary, Poland) in the period from 1993 to 2000 and try to relate FDI to the rising skill premium. Esposito and Stehrer (2007) focus instead on the sector bias of skill-biased technical change in the manufacturing sector in Hungary, the Czech Republic and Poland. Grotkowska (2008) investigates the impact of trade on employment in the Polish manufacturing sector. Onaran (2007) estimates a labor demand equation for some Central and Eastern European countries, using a country-specific panel data analysis.

¹¹ In particular, they found that exports had a negative and imports a positive effect on wages, but overall the impact of international trade was small and negative in net terms.

trade liberalization in the early 1990s boosted trade volumes with Western Europe. This boom was reinforced by the process of EU accession. This is therefore an interesting case for investigating the consequences of these increased trade flows. Is there any effect on wages, and if so, does it differ for the two country groups in the EU-25? Does the impact of trade differ at the sectoral level? Are there winners and losers among the industries?

We attempt to answer these questions by focusing both on the transition countries and on the group of pre-2004 EU Member States. While these two country groups share many characteristics (especially with regard to labor markets), trade patterns and trade dynamics are clearly different. In our contribution, we also try to assess whether trade raises wage discipline by bringing wages more into line with labor productivity – as stated in Persyn (2008) – or whether it rather leads to an intensified co-movement of domestic and foreign wages.

3 Wage and Trade Developments within the Enlarged EU

For our analysis, three main data sources are used and extended by a few data series from different sources. The main data set for all but trade variables is the EU KLEMS database. This database contains inter alia data on output, price developments, productivity, labor compensation and employment at the industry level for all EU-25 countries up to 2005.¹² As eight of the EU-10 countries are transition economies for which pre-1995 data are often lacking and whose economic developments before 1995 were often untypical, we use data for the period from 1995 to 2005 only. We complemented this data set by trade data at the industry level from the UN Comtrade database for the manufacturing sectors and from the Eurostat International Trade in Services (ITS) database for the services sectors.¹³ A description of all variables used and their construction is provided in appendix 1. Hence, we arrive at a comprehensive data set that links trade, output and wage data for the manufacturing and the services sectors, namely 15 manufacturing sectors (including agriculture) that are roughly at the two-digit NACE level and 6 services sectors at the one-digit NACE level. In total, our data set comprises information for 25 countries, 11 years and 21 economic activities.

Southeastern European EU candidate countries could not be included in the main analysis due to the incomparability or unavailability of data. Nevertheless, we did undertake a separate and smaller-scale examination of Croatia and the former Yugoslav Republic of Macedonia (FYR Macedonia).¹⁴ We used the same above-mentioned sources for the trade data of these two countries, while all other data series were provided by the respective central banks.

¹² The EU KLEMS database was established by a consortium led by the Groningen Growth and Development Centre. The time series start in 1970 and have currently been updated to include 2006 (2006 data were not yet available for this study, however). See Timmer et al. (2008).

¹³ Merchandise trade data were converted from five-digit SITC codes to two-digit NACE Revision 1 industries by using the correspondence keys implemented in the World Bank and UNCTAD WITS software. Services trade data were converted to match closely NACE Revision 1 one-digit codes following the UN Manual on Services recommendations.

¹⁴ There are currently three EU candidate countries. However, wages at the industry level could not be calculated for Turkey because available industry-level data only cover compensation of employees, but not the number of employees (or hours worked).

3.1 Wages and Productivity

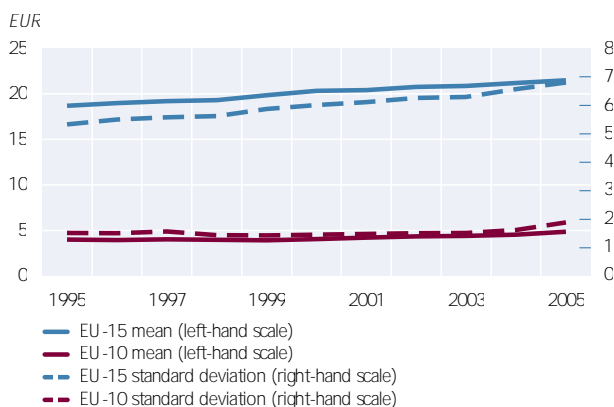
We calculate hourly wages (compensation of employees divided by hours worked) and hourly productivity (value added divided by hours worked) for each observation in our three dimensions (country, industry and year) from the EU KLEMS database. We decided to use hourly wages for three reasons. First, in terms of the skill composition of labor, we only have information on the hours worked. Second, if reliable, hours worked give a clearer picture of labor used in the production process than the number of employees. Last, in our case the correlation of the two variables is very strong for all countries and industries, so there is no reason to assume that using the number of employees would produce a more reliable comparison.

What do the data tell us? In terms of average hourly wages of the economy (i.e. averaged across industries and countries), one can see a significant level difference between the EU-15 and the EU-10. This is obvious from chart 1, where we took simple averages of the mean hourly wages in the respective countries. Both the mean and the standard deviation show a steady, but moderate upward trend in both country groups.¹⁵ Since the standard deviation is not dimensionless, cross-country comparisons are often based on the coefficient of variation, which is a normalized measure of dispersion. Here, we can see that during the entire period the variability of average hourly wages (as a percentage of the mean) is actually higher in the EU-10 than in the EU-15.¹⁶ But while it continuously increased in the EU-15, it actually declined in the EU-10 until roughly the time when these countries joined the EU, and subsequently rose to its highest level in 2005, which means that in these countries wage dispersion (across industries) went up significantly since their accession to the EU.

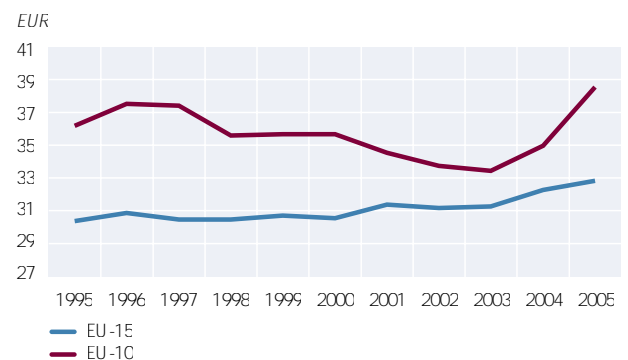
Chart 1

Evolution of Average Hourly Wage Levels in the EU -25 (1995- 2005)

Mean and Standard Deviation



Coefficient of Variation



Source: Authors' calculations based on EU KLEMS

Note: Hourly wages in EUR, CPI-deflated.

Source: EU KLEMS

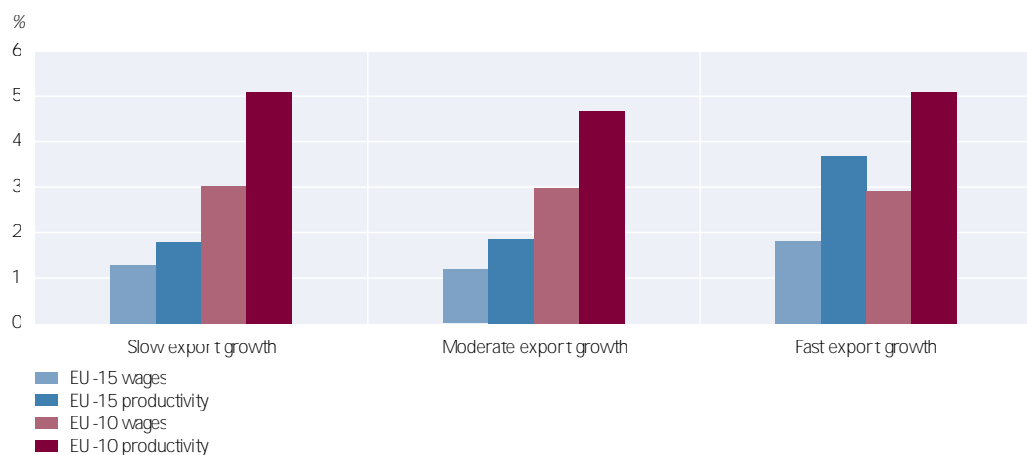
¹⁵ The only countries where the mean declined over time are Spain (EU-15) and Hungary and Slovenia (EU-10). It increased very significantly in the United Kingdom, the Baltic countries and the Czech Republic. However, average wages in Slovenia remained the highest in the EU-10 despite the decline, while the Baltic States still belonged to the lower half of the group in 2005. It is also worth mentioning that hours worked remained remarkably stable over time in most countries. The increase in wages is therefore due to the rising compensation of employees.

¹⁶ In the full sample, this figure is highest in Portugal and Hungary and lowest in Sweden and Denmark.

To take a different perspective, we calculated averages, standard deviations and coefficients of variation over time in all industries and for all countries. Since the EU-15 and the EU-10 retain distinct comparative advantages, the export performance of individual industries also differs greatly between the two country groups. To reflect this phenomenon, we identified slowly, moderately and fast growing industries separately for each group.¹⁷ For the EU-15, we identified chemicals, electrical and optical equipment, communication and financial services and utilities as industries with fast export growth. Their joint share in total exports averaged around 40% for the region over the past decade. For the EU-10, mechanical machinery, other manufacturing, paper, rubber, wood and transport equipment as well as electrical and optical equipment and utilities emerged as the industries with high export growth by international standards. In fact, the EU-10 were in general characterized by much stronger export growth than the EU-15 and most other world regions. On average, the fast growing industries accounted for nearly 50% of all exports in the EU-10.

Chart 2

Average Growth Rate of Hourly Wages and of Hourly Productivity by Industries' Export Performance



Source: Authors' calculations based on EU KLEMS

Across all industries, the EU-15 average wages were higher than those in the EU-10 group; for the coefficient of variation this relation was inverted. Moreover, we did not find much variability across the industry groups, except for the average real hourly wage in the EU-15, which was substantially higher in the group with the fastest export growth than in the other industry groups. To get a clearer picture of the dynamics, we calculated the average annual growth rate of our main variables in all industries and countries over the entire period. Chart 2 shows the average annual growth rate of hourly wages together with that of hourly productivity. Both wages and productivity have generally increased at a higher rate in the EU-10 than in the EU-15. Productivity growth exceeded wage growth in all industry and country groups.

¹⁷ The definition of these three groups and a complete list of industries are given in appendix 2.

The correlation of average hourly wages and productivity was generally very high, except for the oil sector, and typically somewhat higher in the EU-15 countries than in the other group. The opposite holds for the correlation of the growth rates of these variables, which was also generally lower than the correlation in levels. The two groups of countries differed substantially with regard to the distribution of wages and productivity. The distributions of both variables generally have a positive skew in both regions; in the EU-10, they are very dense whereas the EU-15 show a wide range of higher values for both variables in the data reflecting much higher wages and much higher productivity values than in the EU-10.

For Croatia and FYR Macedonia, we do not have fully comparable data. Therefore, it was not possible to calculate hourly wages; instead, monthly gross wages (for a shorter period) were used. Average real wages across industries in Croatia are at a level comparable to average monthly wages in the EU-10, while wages in FYR Macedonia are approximately half as high. While the average monthly wage jumped by about 31% in Croatia between 1996 and 2006, it even declined slightly in FYR Macedonia in this period. The dispersion of wages, as measured by the standard deviation, increased in both countries. This also holds for the coefficient of variation, but the increase was more pronounced in FYR Macedonia, where wages vary more across industries than in Croatia.

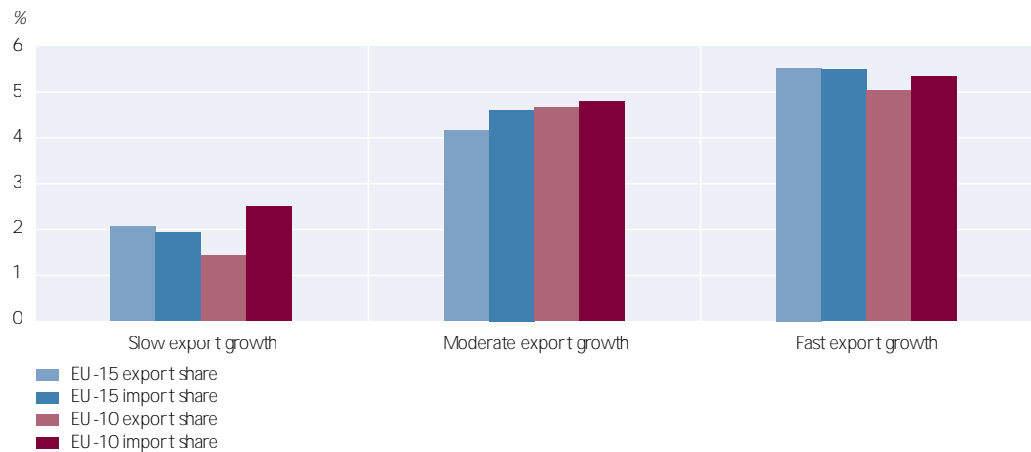
3.2 Trade Variables and the Openness of the Economy

Total exports and imports of goods and services (taken from the IMF World Economic Outlook – WEO) have risen substantially over time, with France, Germany and the United Kingdom as well as the Czech Republic, Hungary and Poland showing the highest rates of growth in the two country groups. Both the ratios of exports and imports to value added and trade openness increased moderately in the economies in general, as we would expect given the greater economic integration of these countries over the ten-year period. Export and import patterns are highly similar, reflecting the strong correlation between exports and imports. There is less dispersion across industries in the trade measures than in wages and labor productivity. Between the two country groups, we can observe highly diverse developments over time at the industry level; these developments are in line with distinct patterns of specialization in the two regions.

Given the paper's focus on individual industries, let us highlight some main features of the industry groups under observation with respect to trade. The share of an industry's exports/imports in total national exports/imports indicates the industry's relevance for the overall trade performance of the respective national economy. The industries with the highest (export as well as import) shares are electrical and optical equipment, chemicals and transport equipment. Among the sectors with somewhat lower but still significant trade shares, export performance typically matches import performance, except for mining and quarrying (which reveals high import shares only) and transportation and storage services (which is characterized by significant export shares only). The two country groups differ substantially when it comes to exports of chemicals and real estate and business services (where the shares are higher in the EU-15) and in electrical and optical equipment (which is more relevant in the EU-10). This also holds for imports, except for chemicals, where the difference is much smaller.

Chart 3a

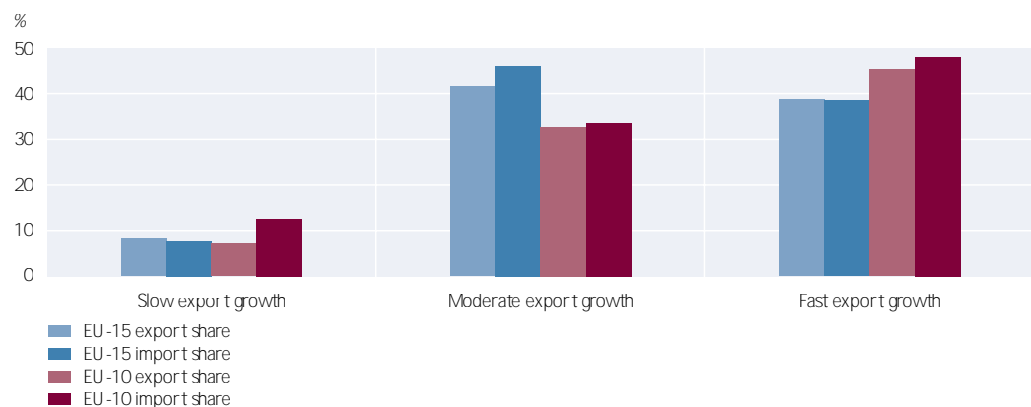
Average Share of Exports and Imports in Total Trade



Source: Authors' calculations based on UN Comtrade and Eurostat IIS

Chart 3b

Cumulated Share of Exports and Imports in Total Trade



Source: Authors' calculations based on UN Comtrade and Eurostat IIS

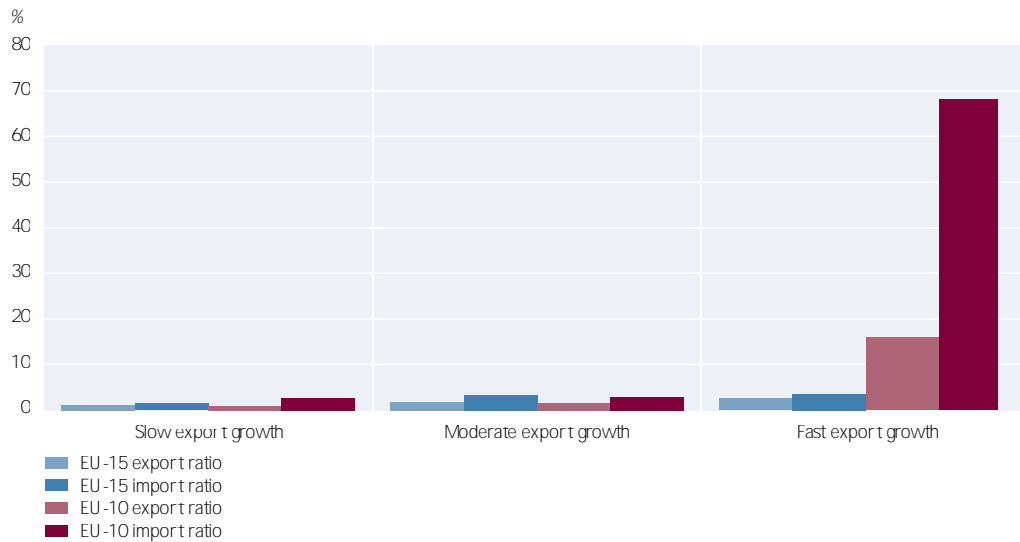
Chart 3a shows that by 2005, on average, the industries with more rapid export growth had grown to become the most important sectors in terms of both imports and exports. In the EU-10, this is also true for cumulated trade shares, while in the EU-15 – due to their larger weight – the moderately growing industries are dominant (chart 3b).¹⁸ In the EU-15, import shares are higher than export shares only in the sectors with moderate export growth, while the EU-10 are net importers in all industry groups.

Ratios of imports and exports to value added as well as trade openness (measured as the sum of imports and exports divided by gross output) reflect how important trade is for a specific sector, while the shares described above indicate the relevance of the respective sectors in trade. In the EU-15, the sectors with slow export growth are generally the most open industries, while in the EU-10,

¹⁸ The trade shares reported in charts 3a and 3b do not sum exactly to one, since two important sectors (hotels and restaurants and public services) are left out of the analysis given the lack of trade data.

Chart 4a

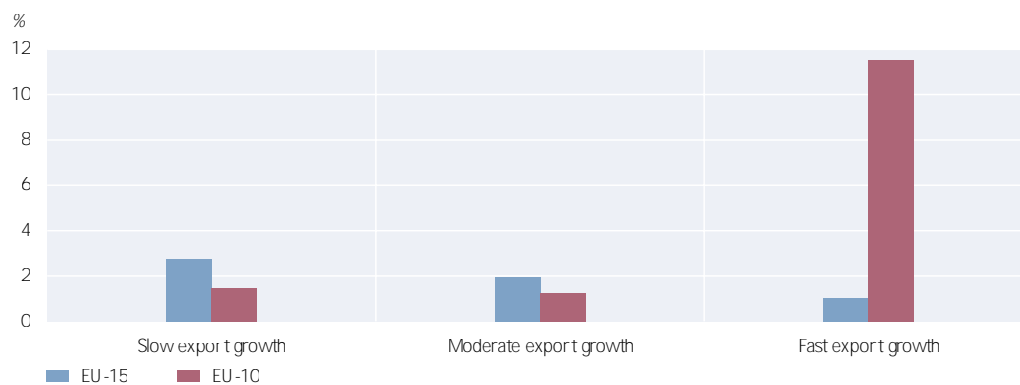
Average Ratio of Exports and Imports to Value Added



Source: Authors' calculations based on UN Comtrade and Eurostat IIS

Chart 4b

Average Trade Openness of Industry Groups



Source: Authors' calculations based on UN Comtrade and Eurostat IIS

trade ratios are by far the highest in the group with the most dynamic export growth (this is especially true for the import ratio, see chart 4a), reflecting the high trade (particularly import) penetration of the oil sector in the EU-10. Mining and quarrying is the only sector where both ratios are substantially higher in the EU-15 than in the EU-10, which means that only the industry group recording the fastest export growth is more open in the EU-10 than in the EU-15. In the EU-15, the ratio of oil imports does not seem to matter to this extent, and trade openness is lower, on average, in the fast growing sectors than in the other sectors (chart 4b).

Turning to Croatia and FYR Macedonia, trade ratios and openness have been increasing due to enhanced economic integration, but the export base is narrow. In absolute terms, total exports and imports of goods and services have risen

substantially over time in Croatia and less strongly in FYR Macedonia. Both the ratios of exports and imports to value added and trade openness went up in the economies in general, as we would expect given the increased economic integration of these countries especially with the EU economies. Interestingly, developments have been more diverse at the industry level. In terms of exports, the industries with the highest shares in total exports are hotels and restaurants in Croatia (over 30%) and textiles and metals in FYR Macedonia (over 25% and 20%, respectively). The dominance of these sectors reflects that the export base is very narrow in these countries, especially in manufacturing, and performance is highly dependent on developments in tourism (Croatia) or metal prices (FYR Macedonia).¹⁹ Imports are more broadly based, with transportation (over 10%) and electrical and optical equipment, machinery and chemicals accounting for the highest shares in Croatia, and food (over 10%), chemicals and metals in FYR Macedonia.

Trade seems to have been driven to a large extent by low production costs. On average and cumulatively, the low-wage sectors have the highest share in both countries. Both in terms of export and import ratios, as well as trade openness, the high-wage sectors show negligible trade penetration. This is in stark contrast to both EU-10 and EU-15 averages, where trade actually plays the greatest role in this industry group. Therefore, it seems that, as expected, in these countries exports are driven more strongly by low production costs than in the EU-10 or EU-15. Moreover, all industries are significantly more open in Croatia, where food leads in terms of imports and hotels and restaurants lead in terms of exports. However, trade augmented most in the medium-wage sectors, as a first sign for a changing composition of trade in the candidate countries.

4 The Trade-Wage Relation in the Enlarged EU – Some Econometric Evidence

We empirically test the relation of wage developments and trade at the sectoral level in the EU-25 for the period from 1995 to 2005. Using a panel data approach, we take both the cross-sectional and the time series components of the data set into account, whereas earlier studies generally analyze countries separately, often using more detailed national information. Given the European-wide coverage of our study, we do not provide these details on work force characteristics, which are only available for individual countries. Since the aim of this paper is not to explain wage formation as such, but to identify the wage response to changes in a country's external regime (i.e. increased trade openness), we consider our setting appropriate. By using country-specific fixed effects in the regression, we control for the unobserved heterogeneity of countries in the regression, avoiding biased results where idiosyncrasies such as geographic location, institutional differences in national systems of labor relations and collective bargaining are relevant. Econometrically we thus exploit only the cross-country dimension, while we allow for different elasticities of wages with respect to trade in individual activities by running the regressions separately for individual industries. We also group

¹⁹ For comparison, the highest export share in the EU-10 is 14% (electrical machinery). This is also the sector with the highest import share (16%).

industries according to their export performance, which allows us to identify certain common characteristics of individual activities concerning the trade-wage relation.

We follow a very general approach, which can be grounded on both a labor market and a trade background. We test the following equation:

$$\ln(\text{wage}_{c,i,t}) = \alpha + \beta_1 * ur_{c,t} + \beta_2 * lprod_{c,i,t} + \beta_3 * trade_{c,i,t} + \beta_4 * trade_other_{c,i,t} + \beta_5 * open_{c,t} + \gamma_c + \varepsilon_{c,i,t} \quad (1)$$

The dependent variable is the natural logarithm of the real hourly wage in country c , industry i and year t (see appendix 1 for a description of the exact calculation of all variables). We regress hourly wages on the unemployment rate and hourly labor productivity of the respective sector. Since we do not have sector-specific unemployment data, we use the country-wide unemployment rate to reflect the relative scarcity of the factor labor. We are aware that this is a rather restricted set of real economy- and labor market-relevant variables. Yet other variables, such as sector-specific employment (a very crude proxy at the sectoral level for labor supply conditions), GDP growth as well as a time trend were either insignificant or did not change the results. Furthermore, this simple specification already gave a relatively good fit. We expect a negative coefficient on unemployment, arguing that high unemployment – meaning an abundance of labor – should exert downward pressure on wages. The advantage of using the economy-wide unemployment rate is that it already incorporates changes in sector-specific unemployment levels attributable to intersectoral mobility. We find that wage growth in countries with high unemployment rates tends to be lower irrespective of the particular sector under consideration. This is a nonnegligible factor in wage formation.²⁰ As for labor productivity, we clearly expect a positive coefficient, since wages should equal the marginal product of labor. Working with data at the industry level, as we do here, also means that we cannot include variables that reflect workers' characteristics (such as age, experience, education or gender), as is common in micro-based wage equations.

Next, we include a set of trade variables. Trade can influence domestic wages on both the import and the export side. Imports affect wages by displacing otherwise domestically produced goods and services. However, the relation between imports and domestic wages depends on whether imports replace products involving low-productivity and low-wage activities or whether they compete with high-productivity, high-wage activities. In the former case, we should observe a positive effect on the average wage level of a sector while in the latter case we may well observe a negative relation between imports and wages on average. Thus, our expectation of the sign of the import variable is in fact open. Yet, as we expect the first effect to occur more often in more sophisticated activities, we rather expect a positive relationship in more technology- and skill-intensive industries. Turning to exports, we argue that greater exposure to the global market through exports would introduce more competition in a sector and hence again work in a positive

²⁰ We thank the referees for pointing this out. Of course, we are not able to capture intersectoral mobility explicitly in our approach, which is based on separate estimation of individual industries.

and a negative way: the quality of the products produced will have to rise with a subsequent positive effect on wages. Another positive relation between trade and wages can be an increase in product demand that arises from strong export demand. Resulting higher prices would also allow for higher wages. At the same time, more competition may exert stronger pressure on wages and reduce trade union power, thus driving wages down. Which effect dominates, remains an empirical question.

For the trade variables, we used the ratio of imports (and exports) to value added. Using trade shares (i.e. imports as a share of economy-wide imports) would give a different flavor to the analysis, especially since a rise in one sector's trade share must, by definition, imply a decline in another sector's trade share. Wages in a specific industry within a country are likely to be influenced by trade developments in other sectors. Therefore, we include two additional controls in the model: the trade ratio measured for the rest of the specific country's economy – i.e. in all sectors other than the one analyzed – to account for an influence of trade on wages in a specific sector (which occurs through trade in upstream or downstream industries) and general trade openness of the country as such. Individual sectors of an economy are strongly linked through inputs from upstream industries and intermediate demand by downstream industries. Through the trade ratio in the rest of the economy, we capture possible repercussions from increased import penetration in one sector in other sectors of the economy. For instance, in the case where imports in the same industry affect wages negatively due to higher competition pressures, higher imports by upstream industries could nevertheless boost wages to higher levels, not only by increasing productivity via cheaper and possibly also higher-quality inputs into production, but also through the composition effect mentioned above.

We also control for the general trade openness of a country by including the ratio of country-wide exports plus imports to GDP. By doing so, we allow for a differential impact of trade in very open economies as opposed to rather closed markets. Since we never include sector-specific import and export ratios simultaneously in a single specification in order to avoid a possible bias arising from the high correlation between the two series, controlling for a country's openness to trade seems adequate given that trade is always a two-way phenomenon. Moreover, rising trade openness may induce an entirely new pattern of specialization, which indirectly impacts again on the average wage level through changes in the composition of low- and high-wage tasks in the economy. We have also experimented with other trade variables – net exports, openness and import penetration in each industry – but these had low explanatory power and the results were mostly insignificant.

Our specification is similar to specifications often used in the empirical literature.²¹ However, we estimate the above model for a panel of countries, but separately for each industry, thus allowing for a different reaction of wages on trade in each sector. First results, based on a fixed effects estimation with clustered standard errors, showed that there was considerable autocorrelation left in the

²¹ See e.g. *Winter-Ebmer and Zimmermann (1998)*, *Hofer and Huber (2003)* or *Onaran and Stockhammer (2006)*.

residuals (as evidenced by the Wooldridge test for panel data models). Therefore we chose to estimate our model in a dynamic setting, using the general method of moments (GMM) estimator proposed by Arellano and Bond (1991).²²

4.1 Winning and Losing Industries in the EU -15 and EU -1C

The coefficients on the domestic variables are highly robust across sectors and yield the expected signs. Wages show a modest, but statistically significant and positive autocorrelation, justifying the use of the Arellano and Bond (1991) estimator. Unemployment correlates negatively with wages in all sectors, the regression coefficient is statistically significant in 10 out of the 21 sectors. An increase in the unemployment rate by 1 percentage point translates into a decrease in average wage levels of between 0.5% in communication services and 1.8% in construction services, with most sectors experiencing a decrease by roughly 1%. Also the productivity level exhibits the expected sign. Wages respond positively to higher labor productivity; the coefficient is almost always statistically significant. Increases in productivity are only partly reflected in higher wages. The elasticity between labor productivity and wages is far below 1, ranging between 0.14 (electrical and optical equipment) and 0.6 (other business services).

For the EU-25, only few industries actually show a statistically significant relation between wages and our trade variables, which are listed in table 1 below.²³ The relation is negative in the case of wood and oil products and positive in the remaining four activities (chemicals, metals, utilities and financial intermediation). However, economic significance is small on average, although it varies greatly from sector to sector. For the oil industry, the effect is negligible, and it is also very small in chemicals and metals. In the wood industry, a 10 percentage point increase in the import ratio is associated with a 0.7% decrease in the wage level, while it corresponds to a 5% rise in the wage level in electricity, gas and water supply. In some industries (i.e. oil and metals), the effects from increased imports within the sector are overcompensated by opposing effects from increased trade in the remaining sectors of the economy. The results for exports, though not reported here, are highly similar. To summarize, we can identify only a handful of industries that exhibit a statistically significant relation between trade and wages and even fewer sectors where this relation is also economically significant. Furthermore, the industries presented in table 1 do not appear to share many characteristics, except that they are mostly resource-based activities. Finally, although the general openness of the economy often shows a small, albeit negative effect on wages, this relationship is more often found in low-skill and labor-intensive industries (such as wood, paper, rubber, other manufacturing not included elsewhere, transport equipment and transportation services) and never in industries which exhibit a positive correlation with imports (or exports) in the same industry.

²² This dynamic, instrumental variable approach uses a large instrument matrix consisting of lags of the dependent variable as well as first differences of the exogenous variables. We use the two-step, robust estimator, applying the Windmeijer (2005) bias correction.

²³ Due to space limitations, we only present the results for selected industries in this paper. The full set of results for all industries is available from the authors upon request.

Table 1

Effects of Trade on Wages in the EU -25 – Breakdown by Individual Sectors

	Wood	Oil	Chemicals	Metals	Utilities	Finance
Lagged wages	0.309 *** 3.21	0.653 *** 3.97	0.1877 *** 2.80	0.2416 *** 5.00	0.285E *** 2.71	0.2034 0.92
Unemployment	- 0.0117 *** - 2.55	- 0.0086 - 1.40	- 0.0094 * - 1.65	- 0.0029 - 0.47	0.0074 1.54	- 0.012 *** - 2.77
Productivity	0.3689 *** 4.21	- 0.0213 - 0.65	0.4507 *** 4.26	0.5086 *** 5.57	0.2357 *** 3.35	0.4848 *** 4.75
Import ratio	- 0.0778 *** - 11.8E	- 0.0001 *** - 2.95	0.0113 ** 2.35	0.0227 *** 3.95	0.496E * 1.66	0.1079 ** 2.52
Import ratio/ rest of the economy	0.0024 0.16	0.0727 *** 2.74	- 0.0587 - 1.41	- 0.0932 *** - 3.95	0.0146 1.55	- 0.0168 - 1.23
Trade openness	- 0.1609 ** - 2.34	- 0.0529 - 0.35	- 0.1106 - 1.07	- 0.1335 * - 1.65	0.0187 0.42	- 0.0256 - 0.45
Constant	0.7588 *** 4.75	1.0621 * 1.77	0.7516 ** 2.21	0.5026 *** 2.80	0.916E *** 3.96	0.7524 1.64
Number of observations	213	190	213	213	197	216
Number of countries	24	22	24	24	24	24
Chi ²	1530.08	54.98	37.96	226.96	117.04	240.25
z-value (AR-1)	- 2.59	- 2.35	- 1.10	- 1.9E	- 1.61	- 0.51
z-value (AR-2)	- 0.82	1.48	- 0.81	- 0.5E	0.19	1.51

Source: Authors' estimates.

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient. (*)(**)(***) indicate significance at the 10% (5%) [1%] level or below. z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed [1.96] and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

Although we explicitly control for country-specific effects, it still seems inappropriate to impose the same model on all EU Member States. Therefore, we separated the sample into two groups: the smaller and considerably more open economies that joined the EU in 2004 (EU-10), and the remaining EU-15. The results for the EU-15 are displayed in table 2, the results for the EU-10 in table 3. In each subsample, a larger number of sectors emerges with a statistically significant relationship between trade and wages. Let us briefly discuss the domestic variables first. The relation between unemployment and wages remains negative; however, we see a stronger effect in the EU-10 (the coefficient ranges between 1% and 2%) as compared to the EU-15 (where the coefficient ranges between 0.5% and 1%). Also, productivity developments translate more strongly into wage developments in the EU-10, where a productivity increase by 1% is often associated with a 0.5% rise in wages and as much as 0.8% in other business services. In the EU-15, the wage elasticity to productivity is noticeably lower and lies between 0.1 and 0.45.

Turning to the variables of major interest, we find mixed results again in many respects. First of all, we observe positive and negative correlations between imports and wages. Second, the magnitude of the import coefficient varies greatly across individual sectors. What is most striking is that the results for the EU-25 were mostly driven by the EU-10. In particular, the large coefficient on imports in the electricity and gas sector arises from these countries. By contrast, the variation between industries is also much higher in the EU-10 when referring to the

Table 2

Effects of Trade on Wages in the EU-15 – Breakdown by Individual Sectors

	Agriculture	Food	Chemicals	Rubber	Minerals
Lagged wages	0.4211 * 1.67	0.3712*** 2.8E	0.404 *** 3.1E	0.3994*** 6.2E	0.2022*** 3.07
Unemployment	- 0.0103 *** - 3.1E	- 0.0054 - 1.64	- 0.0111 *** - 3.5C	- 0.0052 - 1.6Z	- 0.003 - 1.0Z
Productivity	0.4018 *** 2.6E	0.1981 ** 2.2E	0.1786 *** 2.7E	0.271 ** 2.4E	0.4559 *** 6.1E
Import ratio	0.1322 * 1.9Z	0.0927 ** 2.37	0.017E * 1.7E	0.095E *** 2.5E	0.1673 ** 2.2E
Import ratio/ rest of the economy	0.0882 0.6C	- 0.0284 - 0.2E	- 0.060E - 0.5E	- 0.0952 - 0.6E	- 0.2018 ** - 2.4Z
Trade openness	- 0.23E *** - 2.9E	- 0.046E - 0.77	- 0.106E - 1.2E	- 0.04E - 0.71	0.0461 0.74
Constant	- 0.195E - 0.4C	1.081E ** 2.47	1.340E *** 4.0E	0.808E ** 2.37	0.808E *** 3.91
Number of observations	123	123	123	123	123
Number of countries	14	14	14	14	14
Chi ²	364.87	135.2E	146.2E	207.5E	211.17
z-value (AR-1)	- 2.34	- 1.82	- 1.7E	- 1.82	- 2.50
z-value (AR-2)	- 1.44	0.6E	0.31	0.9E	1.80

	Metals	Electrical and optical equipment	Other manufacturing n.i.e.	Communica- tion services	Other services
Lagged wages	0.078E 0.84	0.4394*** 5.3E	0.3881 *** 3.4Z	0.361E *** 4.4E	0.738E *** 9.4E
Unemployment	- 0.0081 *** - 3.4C	- 0.0091 * - 1.8E	- 0.005E * - 1.94	- 0.009E - 1.5E	- 0.013E *** - 2.6E
Productivity	0.391E *** 3.2E	0.1314*** 4.17	0.1547 *** 2.8E	0.092E ** 2.1E	0.245E 1.5E
Import ratio	0.050E * 1.7E	0.017E * 1.7E	0.045E *** 3.1E	- 0.202E * - 1.6E	- 0.051E *** - 2.6E
Import ratio/ rest of the economy	- 0.05E - 0.67	- 0.2224 - 1.5E	0.132E ** 2.1E	- 0.019E - 0.2E	0.051 1.2E
Trade openness	- 0.030E - 0.4E	- 0.025E - 0.3C	- 0.177E *** - 4.37	0.143E 1.11	- 0.047E - 0.8C
Constant	1.403E *** 5.64	1.362E *** 6.0E	1.147E *** 4.51	1.613E *** 10.1C	- 0.1124 - 0.21
Number of observations	123	123	123	12E	12E
Number of countries	14	14	14	14	14
Chi ²	66.7E	117.9C	328.0E	401.27	606.94
z-value (AR-1)	- 0.61	- 2.31	- 2.5E	- 1.94	- 1.61
z-value (AR-2)	1.7E	1.8E	- 0.4C	- 0.7E	0.81

Source: Authors' estimates.

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient; (**)[***] indicate significance at the 10% (5%) [1%] level or below z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed |1.96| and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

economic impact of trade on wages with a very low wage response to imports in some sectors. In the EU-15, the import coefficients are often around 0.1. This means that a 10 percentage point increase in the import ratio in one sector (e.g. a rise in the import ratio from 4.5% to roughly 14.5% for the production of

Table 3

Effects of Trade on Wages in the EU-10 – Breakdown by Individual Sectors

	Wood	Chemicals	Metals	Electrical and optical equipment
Lagged wages	0.2932*** 3.13	0.1861*** 3.05	0.2735*** 4.50	0.4945*** 3.17
Unemployment	-0.0178*** -3.71	-0.0185** -2.21	0.0031 0.26	-0.0045 -0.94
Productivity	0.435*** 3.88	0.5403*** 4.85	0.5248*** 4.73	0.2327*** 4.76
Import ratio	-0.0745*** -8.65	0.0122** 2.47	0.03*** 2.75	-0.0011 -0.84
Import ratio/rest of the economy	-0.0012 -0.05	-0.053 -1.33	-0.1305*** -3.05	0.0355*** 2.81
Trade openness	-0.2365*** -2.92	-0.0124 -0.06	-0.01873* -1.65	-0.0381 -0.65
Constant	0.6386*** 4.36	0.2978 0.95	0.285 1.25	0.3302 1.58
Number of observations	90	90	90	90
Number of countries	10	10	10	10
Chi ²	1765.03	61.4164	211.3204	105.0135
z-value (AR-1)	-2.0349	-0.712	-2.2323	-1.3394
z-value (AR-2)	-1.0719	-1.0121	-0.545	0.2945
	Utilities	Communication services	Finance	Other services
Lagged wages	0.2363 1.41	0.436*** 3.76	0.3806 1.43	0.3607*** 3.18
Unemployment	0.0111*** 2.15	0.0042 1.06	-0.003 -0.63	-0.0045 -1.06
Productivity	0.2655** 2.38	0.283*** 3.66	0.5535*** 4.33	0.7952*** 9.86
Import ratio	0.8495** 2.25	0.0509 0.71	0.2302** 2.21	-0.2945 -1.21
Import ratio/rest of the economy	0.0135 0.91	0.0125** 2.38	-0.0024 -0.15	0.054*** 4.00
Trade openness	0.0099 0.05	0.0931*** 3.55	0.0842 0.92	0.4064*** 4.04
Constant	0.4283* 1.82	0.1106 1.37	-0.1095 -0.28	-1.3796*** -5.91
Number of observations	74	90	90	90
Number of countries	10	10	10	10
Chi ²	913.06	726.51	98.16	1054.46
z-value (AR-1)	-1.47	-1.70	-1.45	-2.20
z-value (AR-2)	0.53	-1.60	0.55	1.57

Source: Authors' estimates.

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient. (**)[***] indicate significance at the 10% (5%) [1%] level or below. z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed |1.96| and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

transport equipment – the second most open sector after the oil industry) is associated with a roughly 1% rise in wages. In the EU-10, this coefficient ranges between 0.03 and 0.85, meaning that a 10 percentage point rise in the import ratio of the metal industry would ceteris paribus imply a 0.3% rise in the wage level, while this effect would be 8.5% in the supply of electricity, gas and water.

Another interesting observation relates to the sector mix. The only services sectors yielding a significant coefficient between wages and imports in the EU-15 are communication and other business services. In both cases, we observe a negative relation, which is economically meaningful in communication services. For the EU-10, again communication, other business services, but also financial services show a statistically significant wage response to trade. However, here we observe a positive correlation between trade and wages. Overall, country trade openness also shows a positive sign. Thus, openness, especially on the import side, to trade in the services sectors is often associated with a positive wage effect in the EU-10.

Nevertheless, the composition of the group of industries with a significant correlation between trade and wages still seems to be rather coincidental. In the next section, we try to group industries by their export performance. Industries with higher export growth are more exposed to international markets and hence to international competition. As a result, we would also expect to see more significant results emerge in these industries.

4.2 Positive Wage Effects from Increased Trade in Industries with Strong Export Performance

Table 4 below shows the results we obtain for the EU-15 when we pool industries by their export growth performance into fast, moderately and slowly growing sectors. We now see very clearly that those industries which experienced fast export growth over the past decade (and hence are subject to the greatest trade exposure) also exhibit a positive correlation between trade and wages at the sectoral level. Both directly, through imports or exports within the same industry, and indirectly, through imports or exports in other industries, we can observe a statistically significant, albeit weak, positive correlation. At the same time, we observe a strong negative effect from the respective country's general openness. This latter effect is considerably stronger in economic terms than the direct impact of imports in the same industry on wages, and is manifest in all three industry groups. When interpreting the relative magnitude of the trade openness coefficients, it has to be kept in mind that the trade openness of a country as such is likely to change by a much smaller degree than the import or export ratios of individual sectors. Nevertheless, we find that the marginal effect for more open countries is negative and greater than the positive marginal effect of increased imports (or exports) at the sectoral level. A 10 percentage point rise in a country's trade openness (a rare phenomenon over the time period considered) would translate into a 1% decrease in wages, while a 10 percentage point rise in the import ratio of a fast growing sector would correspond to an increase in average wages of the sector by 0.01%. Similar results are obtained for export ratios. How can we reconcile these contradicting results? In general, greater trade openness is clearly associated with a lower general wage level. This was also an outcome of the industry-specific results above, when we often obtained a negative and statistically significant coefficient on country trade openness, even if no other trade variables proved to be significant. However, in the industries with a strong trade performance (and hence the industries that are able to compete successfully in international markets) this negative effect is partly offset by positive effects from trade.

Table 4

Effects of Trade on Wages in the EU -15 – Breakdown by Industries' Export Performance

	Import ratios			Export ratios		
	Export growth performance			Export growth performance		
	fast	moderate	slow	fast	moderate	slow
Lagged wages	0.4518*** 5.77	0.3518*** 7.06	0.4078*** 4.52	0.4322*** 5.48	0.3444*** 7.05	0.4377*** 5.42
Unemployment	-0.01*** -4.62	-0.0073*** -5.11	-0.0067*** -3.03	-0.0102*** -4.68	-0.0075*** -5.41	-0.0067*** -3.25
Productivity	0.0926** 2.35	0.2399*** 7.65	0.274*** 5.94	0.0947** 2.4	0.2414*** 7.41	0.2762*** 5.72
Trade ratio	0.0017*** 3.17	0.0011 0.73	0.0106 1.12	0.0028*** 2.72	0.0076 1.59	0.0012 0.22
Trade ratio/rest of the economy	0.06* 1.87	0.031* 1.76	-0.0167 -0.53	0.0604** 2.1	0.0137 0.66	-0.014 -0.51
Trade openness	-0.1018*** -2.75	-0.1097*** -4.9	-0.0527 -1.48	-0.0969*** -2.72	-0.1026*** -4.48	-0.0558 -1.55
Constant	1.4516*** 8.37	1.0838*** 8.45	0.8533*** 4.26	1.5023*** 8.55	1.1012*** 8.16	0.7741*** 4.42
Number of observations	861	1233	495	861	1233	495
Number of countries/industries	97	140	56	97	140	56
Chi ²	268.7419	270.5056	188.5845	260.629	259.1584	198.791
z-value (AR-1)	-4.2673	-5.1235	-3.3057	-4.199	-4.8948	-3.4766
z-value (AR-2)	-0.8348	1.7459	2.1277	-0.8754	1.7077	2.0493

Source: Authors' estimates.

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient, (***) [**] [***] indicate significance at the 10% (5%) [1%] level or below z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed |1.96| and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

For the EU-10 (see table 5), we cannot identify this general negative relation between country trade openness and wages. The EU-10 are characterized by a higher degree of openness, on average, and also by stronger trade growth over the past decade. Thus, even though these countries are more exposed to trade, we cannot identify a general negative relation between trade and wages. In particular, fast growing industries (in terms of exports) show positive indirect effects from trade (both through imports and exports in other sectors in the economy). The positive, even though economically small, coefficient on imports in the moderately growing industries, however, is more than offset by a negative coefficient on both other trade variables (imports in the rest of the economy and country trade openness), suggesting a negative net relationship in this segment.

Table 5 shows other interesting results as well. In both country groups (see also table 4), wage persistence is most pronounced in the most strongly growing export industries. In this industry group, the EU-10 show stronger wage persistence than the EU-15, while in all other industry groups the EU-15 are characterized by higher wage persistence. This means that wages in moderately and slowly growing export sectors in the EU-10 are more strongly determined by other factors than their EU-15 counterparts. One such factor is labor productivity. Productivity developments are more strongly reflected in wage developments in the EU-10. In the next subsection, we will look at the impact of trade on

Table 5

Effects of Trade on Wages in the EU -10- Breakdown by Industries' Export Performance

	Import ratios			Export ratios		
	Export growth performance			Export growth performance		
	fast	moderate	slow	fast	moderate	slow
Lagged wages	0.6786*** 5.67	0.2337** 2.19	0.0668 0.54	0.7053*** 5.68	0.2599** 2.42	0.062 0.5
Unemployment	-0.0052* -1.87	-0.0079** -2.14	-0.002 -0.58	-0.0065** -2.41	-0.0073** -2.02	-0.0024 -0.7
Productivity	0.1555** 2.34	0.577*** 9.01	0.6024*** 14.31	0.1478** 2.17	0.564*** 8.67	0.6052*** 13.42
Trade ratio	0.0 -0.3	0.0131*** 3.19	0.0082 1.21	-0.0001** -2.22	0.013 1.64	0.0168 1.09
Trade ratio/rest of the economy	0.0289*** 2.76	-0.0205* -1.91	-0.0031 -0.4	0.0496*** 3.41	-0.0189 -1.07	-0.0068 -0.5
Trade openness	0.0624 1.45	-0.0934* -1.72	-0.0573 -1.08	0.0523 1.28	-0.0744 -1.37	-0.0445 -0.87
Constant	0.1278 0.94	0.0709 0.37	0.3193* 1.65	0.1146 0.88	0.0471 0.26	0.3215* 1.72
Number of observations	780	630	450	780	630	450
Number of countries/industries	89	70	50	89	70	50
Chi ²	164.6839	158.2713	215.3288	192.3972	195.6902	193.3466
z-value (AR-1)	-3.4345	-1.7768	-1.1206	-3.4409	-2.0861	-1.0794
z-value (AR-2)	-0.474	-0.0469	1.7874	-0.4252	0.0327	1.8942

Source: Authors' estimates.

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient. *(**)[***] indicate significance at the 10% (5%) [1%] level or below z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed |1.96| and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

this mechanism, i.e. whether increased trade implies that developments of wages and labor productivity are more clearly decoupled or whether trade is able to reinforce the link between productivity and the theoretically predicted return to labor. If the latter is the case, we speak of a wage-disciplining effect of trade.

4.3 Does Trade Bring More Wage Discipline?

In the previous subsection, we tested for a direct relation between wages and imports as well as for a more general link between wages and trade openness. Trade could, however, also affect wages in a more indirect way. For instance, if trade aids the equalization of factor prices, wages in different countries will tend to move closer together when trade flows are higher. This can be investigated by simply examining the relationship between wages in different countries. Yet, in a recent contribution, Persyn (2008) argues that the results from such an analysis can be misleading since wages can actually become less interrelated despite such a co-movement. He proposes a – theoretically founded – framework where foreign wages and terms interacting trade openness with both foreign wages and productivity are added to a wage equation. In general, Persyn finds that trade enhances wage discipline in the sense that wages become more aligned with the marginal product of labor as expressed in the level of labor productivity. If this is the case and wages are set according to their domestic fundamentals, we may speak of

enhanced wage discipline. This corresponds to a lower impact of foreign wages on wage setting, with productivity becoming more important as trade costs decrease.²⁴

$$\begin{aligned} \ln(\text{wage}_{c,i,t}) = & \alpha + \beta_1 * ur_{c,t} + \beta_2 * lprod_{c,i,t} + \beta_3 * trade_{c,i,t} + \beta_4 * trade_other_{c,i,t} + \\ & + \beta_5 * open_{c,t} + \beta_6 * foreignwages_{i,c,t} + \beta_7 * foreignwages_{i,c,t} * open_{i,c,t} + \\ & + \beta_8 * lprod_{i,c,t} * open_{c,i,t} + \gamma_c + \varepsilon_{c,i,t} \end{aligned} \quad (2)$$

We tried to integrate this idea in our framework by adding three variables to the model specified in equation 2, namely foreign wages (i.e. the average hourly real wage in the respective sector in all other EU-25 countries²⁵) and two terms interacting the openness of the industry with foreign wages and productivity. The results (see tables 6 and 7) are robust for the variables in the earlier specification – productivity is significant and positive, its economic influence is higher in moderately and slowly growing export industries. Higher unemployment is associated with marginally lower wages (but the effect is again very small in economic terms).

For the EU-15, we again find a nonnegligible negative correlation between wages and openness, but import and export ratios within the same sector are more often associated with higher wage levels. There is also some evidence for positive effects through imports or exports in all remaining sectors, at least in industries with reasonably strong export growth. For the EU-10, we now find a positive (but again economically small) relation between imports and wages. This correlation is stronger for slowly growing export industries. More importantly, the negative coefficient on country trade openness cannot be confirmed for this region.

There is no evidence of a wage-disciplining effect of trade in the EU-15. In the EU-15, foreign wages are significant in twice as many sectors as in the EU-10 and have a positive sign in all cases, thus confirming the co-movement of wages. This might reflect a greater alignment of business cycles in the EU-15, which have shared a common market for much longer than the EU-10. The two interaction terms generally have opposite signs in each country group. While wages in the EU-15 seem to broadly reflect wage levels abroad (at least in the most successful export industries), this is also the case for a number of EU-10 industries (namely agriculture, mining, wood, mechanical machinery, transport equipment and financial intermediation). Here, wages are strongly aligned with labor productivity – a channel which is reinforced by increased trade openness. Many of the above-mentioned industries also exhibit a strong export growth performance, and this alignment effect is also evident in the slowly growing export industries. All in all, we find more evidence in the EU-10 for wage setting being in line with domestic productivity levels rather than with wage levels abroad. Finally, while foreign wages are rarely significant for the wage level, except in the fast growing

²⁴ Persyn (2008) uses a sample of 13 EU countries (the EU-15 excluding Greece and Luxembourg) for the period from 1980 to 2001 to test this hypothesis. Lower trade costs are reflected in higher values for a trade freeness indicator as defined in his paper.

²⁵ One of the referees suggested weighting foreign wages by import shares. This would require bilateral trade data, which were only available for trade in goods, but not for services.

Table 6

Wage-Disciplining Effect of Trade in the EU-15 - Breakdown by Industries' Export Performance

	Import ratios			Export ratios		
	Export growth performance			Export growth performance		
	fast	moderate	slow	fast	moderate	slow
Lagged wages	0.4334 *** 6.26	0.363 *** 7.41	0.4031 *** 4.66	0.4107 *** 5.74	0.3402 *** 7.1	0.4438 *** 5.57
Unemployment	-0.0071 *** -3.12	-0.0056 *** -3.59	-0.0043 ** -2.13	-0.0073 *** -3.18	-0.0059 *** -3.89	-0.0045 ** -2.52
Productivity	0.1079 *** 2.28	0.217 *** 7.06	0.2825 *** 5.65	0.1118 ** 2.31	0.2342 *** 7.3	0.2701 *** 4.98
Trade ratio	0.0013 *** 2.57	0.0009 0.12	0.046 ** 2.34	0.0026 ** 2.32	0.0218 *** 2.86	-0.0062 -0.76
Trade ratio/rest of the economy	0.0463 * 1.89	0.0414 ** 2.05	-0.0074 -0.3	0.0498 ** 2.16	0.0229 1.19	-0.0059 -0.26
Trade openness	-0.2533 *** -2.88	-0.238 *** -5.34	-0.1898 *** -3.16	-0.2442 *** -2.74	-0.2348 *** -5.28	-0.2014 *** -3.28
Wage (EU)	0.1726 ** 2.48	0.1482 *** 3.97	0.1602 *** 3.11	0.1666 ** 2.36	0.1416 *** 3.81	0.158 *** 3.09
Wage (EU) * trade openness	0.0127 *** 3.68	-0.0005 -0.08	0.0124 0.43	0.0134 *** 3.64	0.0067 1.58	0.0317 0.98
Productivity * trade openness	-0.0148 *** -3.07	0 0.01	-0.0257 -1.13	-0.0153 *** -3.12	-0.0085 ** -2.39	-0.0181 -0.79
Constant	0.9443 *** 3.78	0.7481 *** 4.42	0.4278 1.61	1.0127 *** 3.92	0.768 *** 4.24	0.3716 1.45
Number of observations	861	1233	495	861	1233	495
Number of countries/industries	97	140	56	97	140	56
Chi ²	403.5781	289.227	231.1303	380.3538	275.1158	290.6724
z-value (AR-1)	-3.9228	-5.2014	-3.169	-3.8094	-4.937	-3.4469
z-value (AR-2)	-0.7138	1.7024	2.3401	-0.7769	1.5762	2.3761

Source: Authors' estimates

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient, *(**)[***] indicate significance at the 10% (5%) [1%] level or below z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed [1.96] and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

industries, the interaction terms often are so – an observation which generally confirms the assumption that productivity gains in relevance against foreign wages when trade intensifies.²⁶

Thus, our results confirm Persyn's (2008) hypothesis that trade acts as a disciplining force on wages in the EU-10; but this does not hold for the EU-15. In the Western European countries, productivity seems to matter less – and foreign wages seem to matter more – for wage setting when the degree of trade openness rises. This is interesting, as we analyzed broadly the same group of countries as Persyn, although for different periods of time (1980–2001 versus 1995–2005), but came up with opposite results.²⁷ Also, our model applied to the EU-25 again

²⁶ Again, all individual sector results are available upon request.

²⁷ This difference remains valid when we replicate Persyn's analysis, using exactly the same variables as he does (i.e. building his measure of "trade freeness"), but applying a different estimation method (for the longer sample period, Persyn estimates an error correction model while we use a dynamic panel estimation as the time dimension in our sample is smaller).

Table 7

Wage-Disciplining Effect of Trade in the EU-10 – Breakdown by Industries' Export Performance

	Import ratios			Export ratios		
	Export growth performance			Export growth performance		
	fast	moderate	slow	fast	moderate	slow
Lagged wages	0.6613 *** 5.19	0.2574 ** 2.51	0.1291 1.1	0.7075 *** 5.56	0.2628 *** 2.58	0.1053 0.87
Unemployment	-0.0098 *** -3.55	-0.0086 ** -2.14	-0.0024 -0.75	-0.0086 *** -3.18	-0.0084 ** -2.16	-0.0025 -0.8
Productivity	0.1756 *** 2.77	0.5617 *** 6.48	0.5488 *** 12.42	0.1597 ** 2.5	0.5811 *** 6.64	0.552 *** 12.89
Trade ratio	0.0003 *** 4.21	0.0122 ** 2.38	0.034 *** 2.7	0.0008 1.61	0.0086 1.18	0.0171 1.09
Trade ratio/rest of the economy	0.0046 0.4	-0.0243 * -1.92	-0.0071 -0.55	0.0244 * 1.76	-0.0241 -1.3	0.0046 0.3
Trade openness	-0.0841 -1.41	-0.1437 * -1.83	-0.0011 -0.01	-0.048 -0.87	-0.1435 * -1.85	0.0109 0.14
Wage (EU)	0.2769 *** 2.96	0.1177 0.95	-0.0287 -0.26	0.221 ** 2.51	0.118 0.95	-0.0756 -0.69
Wage (EU) * trade openness	-0.0002 *** -3.25	-0.0006 -0.05	-0.0367 *** -3.25	-0.0001 ** -2.32	0.0122 1.19	-0.0115 -1.66
Productivity * trade openness	-0.0001 -0.42	0.0024 0.11	0.0261 *** 3.03	-0.0007 -1.38	-0.0142 -0.73	0.0192 ** 2.22
Constant	-0.5059 * -1.94	-0.2086 -0.81	0.392 * 1.8	-0.4313 -1.63	-0.2533 -0.97	0.5167 ** 2.11
Number of observations	780	630	450	780	630	450
Number of countries/industries	89	70	50	89	70	50
Chi ²	434.2955	215.9168	361.4122	576.9414	270.8576	257.8177
z-value (AR-1)	-3.1626	-2.0837	-1.6883	-3.5052	-2.2047	-1.4837
z-value (AR-2)	-0.1269	-0.0146	1.362	-0.0833	0.1069	1.7072

Source: Authors' estimates

Note: The dependent variable is the log real hourly wage, deflated by the CPI. t-ratios are reported below each coefficient, *(**)[***] indicate significance at the 10% (5%) [1%] level or below z-values indicate the significance of a test on autocorrelation (AR) in the residuals, whereby the first order z-value should exceed |1.96| and the second order z-value should be below this level in order to indicate that the dynamic estimation is appropriate.

reflects more closely the behavior in the EU-10, as in our previous trade-only model. This may be related to the generally greater trade openness of the EU-10, which makes them more responsive to trade developments.

To conclude, trade seems to strengthen wage discipline primarily in Eastern Europe by forcing wage setters to align wages with productivity rather than with wage developments recorded by the main trading partners. In other words, we find little support for factor price equalization. In fact, greater trade openness actually enhances wage discipline in the countries concerned. In contrast, no such evidence is found for the EU-15, where wages are strongly positively influenced by foreign wages, an effect which is reinforced by trade in the fastest growing industries.

In order to draw any conclusions from the above results for the two candidate countries Croatia and FYR Macedonia, we base our assessment on the results for the EU-10, given their greater structural similarity. Given the stylized facts for these countries obtained from section 3 and the wage response we can expect on the basis of the general results in this section, we cannot say much about how wages in Croatia might react to increased trade openness. Due to difficulties in

matching trade data to output data for the tourism sector, we have not included this sector in our analysis. However, the comparatively high wage increase in Croatia over the past decade, coupled with strongly increasing travel exports, suggests a rather positive relationship in this particular case. For FYR Macedonia, the picture is rather mixed: We would expect some positive effects on wages from opening up to trade in the metal industry, where a positive direct correlation could be observed in both subsamples (EU-10 and EU-15). However, trade openness in other economic sectors was often associated with downward pressure on wages in the same industry. Hence, the overall effect of a more open trade environment might well lead to a negative wage response in FYR Macedonia with its high export concentration on metals and textiles.

Furthermore, FYR Macedonia is heavily specialized in slow and moderately growing export industries that feature no significant relation between trade and wages (in the slowly growing sectors) or a negative net effect (in moderately growing sectors). Hence, increased trade openness most likely implies a challenge to redistribution policies and the need for successfully managing structural change in FYR Macedonia. The picture for Croatia is entirely different, given its completely different specialization patterns and the much higher importance of service activities.

5 Summary and Conclusions

In this paper we investigate the effects of increased economic integration on the labor market. More specifically, we examine the impact of higher import and export ratios on average wage levels in the EU-25, distinguishing between pre- and post-2004 Member States (i.e. EU-15 and EU-10). The literature on this topic is vast and, as a whole, inconclusive, pointing toward specific factors that condition the wage response to increased economic openness. Two large strands of empirical research can be distinguished. The first relies on microdata and is able to incorporate many individual-specific wage determinants, while the results often cannot be generalized to apply to countries other than the one under review. The second approach focuses largely on macroeconomic effects and may thus hide different relations within individual activities of an economy. In this paper, we investigate the relation between trade and wages for a comprehensive sample of 25 EU countries, with an explicit focus on individual industries.

Industry-specific heterogeneity seems to be extremely relevant in the context of international trade, with greatly diverse trade developments within countries in different industrial activities. A novelty of the present paper is that it takes a comprehensive view on all sectors of the economy, treating manufacturing and service activities alike. This adds value to the analysis as services sectors often turn out to exhibit a more positive relation between trade and wages in the EU-10. Furthermore, we work with a greater level of disaggregation at the macro level than many previous studies. Previous literature has often limited its focus to manufacturing industries as trade data are more easily available. At the same time, the inclusion of data on the services sectors in this paper likewise implies a limitation as good bilateral trade data for services are not available and it is thus not possible to investigate the differential impact of trade with specific trading partners (i.e. high-wage versus low-wage countries) on wages.

Given a certain inconclusiveness of both the theoretical and empirical literature, we take an agnostic view and use a simple model, which encompasses domestic wage determinants together with various measures of trade penetration. We find considerable differences in the relation between wages and trade in individual economic activities, which are not easy to generalize.

As a first result, trade often cannot be identified as a decisive factor in determining wage levels. What may appear to be a non-result is actually quite positive, since in public opinion, trade – and more generally “globalization” – is often associated with having a negative influence on the labor market. Resource-based industries appear to exhibit a statistically significant correlation between trade and wages more frequently than most other industries. However, a few exceptions aside, the economic impact of trade on wages is rather small.

Considerable differences exist between the EU-15 and the EU-10. First, the CEE Member States appear to have been dominating the average results for the EU-25 – which is less surprising when we consider that, in general, these countries are smaller economies and therefore more open to trade. In addition, the EU-10 have undergone a dynamic phase of restructuring accompanied by often high and persistent unemployment rates – all these factors would make wages more responsive to changes in the economic environment. Second, the aggregate net effect of trade on wages seems to be negative in a range of mostly labor-intensive and low-skill industries for the EU-15, since greater openness (at the macro-economic level) is usually associated with lower wage levels in this group. On average, an increase in openness by 10 percentage points would relate to a 1% decrease in wages. While this is certainly a negative, albeit minor effect, no such generally negative relation was observed in the EU-10 industries. Third, wages in fast growing industries (in terms of export performance) seem to profit from increased imports and exports in other sectors of the economy. In this respect, no discernible effects from intra-industry trade could be identified for the EU-10, whereas the EU-15 clearly show a positive – albeit very small – effect from both imports and exports in the respective industry in addition to positive cross-industry effects.

We also take up the idea of trade acting as a wage-disciplining device in the sense that through increased trade openness, wages more strongly reflect the marginal product of labor and become less strongly aligned with foreign wages. We observe little evidence of wage co-movement in the sense of foreign wages having a strong impact on domestic wages in the EU-10, while in Western Europe wages tend to move together in many sectors across countries. Moreover, trade

can enhance wage discipline, as with a higher degree of trade openness wages are set in line with productivity rather than with foreign wages. This observation only holds for the EU-10, however, while in the EU-15 we find opposite results.

Overall, we find that increased trade has both negative and positive effects on wages. Yet most of these effects are extremely small, which is why trade cannot be seen as a decisive factor in wage formation. This is in line with the results of previous studies. Furthermore, we can identify certain sectors where the significant effects prevail even when more sophisticated estimation techniques based on instrumental variables are used. In many studies, all trade effects vanish when instruments are used in the estimation. We would like to stress that even though the effects of trade on wages are small and specific to certain sectors only, more openness to trade cannot generally be associated with lower wages. In particular for the EU-10, but also in the results for the EU-25 and the EU-15, the number of sectors exhibiting positive direct wage effects from trade exceeds the number of sectors exhibiting negative effects. In many sectors (especially in those where no direct relation between trade and the wage level in the respective industry could be established), we note a generally negative relation between country openness and wages, however. Therefore, economic policy has to be carefully designed when addressing questions of increased trade integration and its wage effects. In particular, resource-based and network industries often emerge as winners from increased trade. However, losers emerge as well, especially when calculating the net effect from increased openness and sector-specific effects. Moreover, wage inequality across activities within a country is possibly reinforced by trade. This is to be expected as in general, sectors that are booming and are thus paying better wages are more likely to profit from increased trade integration, while stagnating and hence low-wage sectors are more likely to come under wage pressure.

Further research should carefully investigate the issue of wage inequality in response to economic integration. Wage inequality has different dimensions, such as wage dispersion across industries or across individual employees due to differences in human capital, etc. For instance, a useful distinction is often made between wages of low- and high-skilled workers. In our data set, we could not identify systematic differences – possibly because the informative value of industry-level data is limited with regard to the human capital of the labor force – and therefore we did not elaborate further on this issue, but this might be worth investigating further. Overall, before drawing detailed policy conclusions, we see a need for continued careful research as well as for an improvement of the available statistics to provide researchers with meaningful input for comparative analyses.

References

- Amiti, M. and D. Davis. 2008.** Trade, Firms, and Wages. Theory and Evidence. NBER Working Paper No. 14106.
- Arellano, M. and S. Bond. 1991.** Some tests of specification for panel data. Monte Carlo evidence and application to employment equations. In: *Review of Economic Studies* 58. 277– 297.
- Attanasio, O., P. Goldberg and N. Pavcnik. 2004.** Trade Reforms and Wage Inequality in Colombia. In: *Journal of Development Economics* 74(2). 331– 366.
- Belzil, C. 2006.** Testing the Specification of the Mincer Wage Equation. GATE Working Paper No. 06-08.
- Borjas, G. and V. Ramey. 1995.** Foreign Competition, Market Power, and Wage Inequality. In: *The Quarterly Journal of Economics* 110(4). 1075– 1110.
- Bruno, G., R. Crinò and A. Falzoni. 2005.** Foreign Direct Investment, Wage Inequality, and Skilled Labor Demand in EU Accession Countries. Working Paper University of Bergamo No. 1. Retrieved from <http://www.data.unibg.it/dati/bacheca/656/14524.pdf> on February 9, 2009.
- Egger, H. and U. Kreickemeier. 2008.** Fairness, Trade, and Inequality. CESifo Working Paper No. 2344.
- Esposito, P. and R. Stehrer. 2007.** The Sector Bias of Skill-biased Technical Change and the Rising Skill Premium in Transition Economies. wiiw Working Paper No. 43.
- Falk, M. and Y. Wolfmayr. 2005.** Employment Effects of Outsourcing to Low Wage Countries. WIFO Working Paper No. 262.
- Feenstra, R. and G. Hanson. 1996.** Globalization, Outsourcing, and Wage Inequality. In: *The American Economic Review*. 86(2). 240– 245.
- Feenstra, R. and G. Hanson. 1999.** The Impact of Outsourcing and High-Technology Capital on Wages. Estimates for the United States, 1979– 1990. In: *The Quarterly Journal of Economics* 114(3). 907– 940.
- Feenstra, R. and G. Hanson. 2001.** Global Production Sharing and Rising Inequality. A Survey of Trade and Wages. NBER Working Paper No. 8372.
- Galiani, S. and P. Sanguinetti. 2003.** The impact of trade liberalization on wage inequality. Evidence from Argentina. In: *Journal of Development Economics* 72(2). 497– 513.
- Grotkowska, G. 2008.** Impact of international trade on employment during transition period. The case of Polish manufacturing sector. Draft. Faculty of Economic Sciences, University of Warsaw. September.
Retrieved from http://coin.wne.uw.edu.pl/grotkowska/grotkowska_etsg_2008.pdf on February 9, 2009.
- Hijzen, A., M. Pisu, R. Upward and P. Wright. 2007.** Employment, Job Turnover and Trade in Producer Services. Firm-Level Evidence. GEP Research Paper 07/37.
- Hofer, H. and P. Huber. 2003.** Wage and Mobility Effects of Trade and Migration on the Austrian Labor Market. In: *Empirica* 30(2). 107– 125.
- Krugman, P. 2008.** Trade and Wages, Reconsidered. In: *Brookings Papers on Economic Activity* 1. 103– 154.

- Manasse, P. and A. Turrini. 2001.** Trade, wages, and 'superstars'. In: *Journal of International Economics* 54. 97- 117.
- Mason, P. L. 1994.** An empirical derivation of the industry wage equation. In: *Journal of Quantitative Economics* 10(1). 155- 170.
- Mishra, P. and U. Kumar. 2005.** Trade Liberalization and Wage Inequality. Evidence from India. IMF Working Paper No. 05/20.
- Onaran, Ö. 2007.** Jobless Growth in the Central and Eastern European Countries. A country specific panel data analysis for the manufacturing industry. Vienna University of Economics and Business Administration. Working Paper No. 103.
- Onaran, Ö. 2008a.** The Effect of Foreign Affiliate Employment on Wages, Employment, and the Wage Share in Austria. Vienna University of Economics and Business Administration. Working Paper No. 118.
- Onaran, Ö. 2008b.** The Effect of Import Penetration on Labor Market Outcomes in Austrian Manufacturing Industry. Vienna University of Economics and Business Administration. Working Paper No. 119.
- Onaran, Ö. and E. Stockhammer. 2006.** The effect of FDI and foreign trade on wages in the Central and Eastern European Countries in the post-transition era: A sectoral analysis. Vienna University of Economics and Business Administration. Working Paper No. 94.
- Peltonen, T. and G. Pula. 2008.** The Impact of Trade on Labor Demand in Euro Area Manufacturing Sector. ECB mimeo.
- Persyn, D. 2008.** Trade as a Wage Disciplining Device. LICOS Discussion Paper No. 210.
- Pula, G. and F. Skudelny. 2008.** Globalisation and Euro Area Prices and Labor Markets – Some Evidence on the Impact of Low-Cost Countries. ECB mimeo. Presented at the ECB conference on 'Globalisation and the macroeconomy' in July 2007.
- Rabbani, A. 2005.** Labor Market and International Trade. An analysis of Wage Inequality. Draft. Retrieved from <http://eco-nomics.uchicago.edu/download/An%20Analysis%20of%20Wage%20Inequality.pdf> on February 9, 2009.
- Rodríguez, F. and D. Rodrik. 2000.** Trade Policy and Economic Growth. A Skeptic's Guide to the Cross-National Evidence. NBER Working Paper No. 7081.
- Stehrer, R. 2005.** The effects of factor and sector biased technical change revisited. wiiw Working Paper No. 35.
- Thompson, H. 2007.** Prices and Wages in Trade Theory. Working Paper. Auburn University. Retrieved from <http://www.auburn.edu/~thomph1/trade&wage.htm> on February 9, 2009.
- Timmer, M., M. O'Mahony and B. van Ark. 2008.** The EU KLEMS Growth and Productivity Accounts. An Overview. University of Groningen & University of Birmingham. www.euklems.net.
- Windmeijer, F. 2005.** A finite sample correction for the variance of linear efficient two-step GMM estimators. In: *Journal of Econometrics* 126(1). 25- 51.
- Winter-Ebmer, R. and K. Zimmermann. 1998.** East-West Trade and Migration. The Austro-German Case. IZA Discussion Paper No. 2. April.
- Wolpin, K. I. 2000.** Wage Equations and Education Policy. Penn Institute for Economic Research Working Paper No. 01-017.

Appendix

Appendix 1: Definition and Calculation of Variables Used

Time series obtained from EU KLEMS were in national currency at current prices. We converted all data into euro first, using annual exchange rates from the IMF WEO database. Trade data as obtained from UN Comtrade and Eurostat ITS were reported in U.S. dollars and converted into euro by using the annual ECU-EUR/USD exchange rates from the Main Economic Indicators database of the OECD, since no conversion USD/ECU rates were available from the IMF WEO database for the period prior to 1999. Variables were then deflated as indicated in the table below.

Table A1

Description of Variables

Variable	Source	Calculation / Description	Unit
Real wage	EU KLEMS	Compensation of employees divided by hours worked, CPI-deflated	EUR
Productivity	EU KLEMS	Labor productivity = gross value added (GVA) in the respective sector deflated by the GVA price index and divided by hours worked	EUR
Import ratio	UN Comtrade/EU KLEMS	Imports from the world deflated by the gross output price index and divided by the gross value added deflated by the GVA price index	ratio
Import ratio/rest of the economy	UN Comtrade/EU KLEMS	Imports (deflated by the gross output deflator) summed across all sectors except the respective industry, divided by the GVA-deflated value added of all sectors except the respective industry	ratio
Export ratio	UN Comtrade/EU KLEMS	Same as import ratio, using exports	ratio
Export ratio/rest of the economy	UN Comtrade/EU KLEMS	Same as import ratio/rest of the economy, using exports	ratio
Trade openness	IMF WEO / EU KLEMS	Total export plus import volume vis-à-vis the world, divided by the GVA-deflated gross value added of all sectors	ratio
Wage (EU)	EU KLEMS	Sum of CPI-deflated labor compensation in all countries except the respective country, divided by hours worked	EUR
Unemployment	WEO	Unemployment rate	%
CPI	WEO	Consumer price index	2000=100

Appendix 2: Grouping of Industries by Export Performance

In order to classify industries as slowly, moderately and fast growing industries in terms of exports, we referred to the average growth of world trade volume in our observation period. Accordingly, our upper limit for slow growth was 30%, the rate at which real world exports grew cumulatively between 1995 and 2005 according to WTO figures, while anything beyond 100% was defined as fast growth performance. Consequently, growth figures of above 30% and below 100% were defined as moderate. The full list of individual industries and their growth performance within the regional average is given in table A2 below.

Table A2

Grouping of Industries by Export Performance

EU-15		EU-10	
NACE code	Industry	NACE code	Industry
Fast growing exports			
23	Oil refining and products	30t33	Electrical and optical equipment
64	Communication	34t35	Transport equipment
K	Other business services	2E	Rubber
.	Financial intermediation	E	Utilities
24	Chemicals	29	Mechanical machinery
E	Utilities	36t37	Other manufacturing
30t33	Electrical and optical equipment	23	Oil refining and products
		21t22	Paper and printing
		20	Wood
Moderately growing exports			
34t35	Transport equipment	26	Minerals
C	Mining	15t16	Food products
2E	Rubber	24	Chemicals
60t63	Transportation	K	Other business services
20	Wood	27t28	Metals
27t28	Metals	60t63	Transportation
36t37	Other manufacturing	A tB	Agriculture
29	Mechanical machinery		
A tB	Agriculture		
15t16	Food products		
Slowly growing exports			
21t22	Paper and printing	17t19	Textiles and clothing
26	Minerals	.	Financial intermediation
17t19	Textiles and clothing	64	Communication
F	Construction	C	Mining
		F	Construction

The Distributional Effects of Trade on Austrian Wages¹

Wolfgang Pointner²

To shed some light on the impact of the growing international division of labor on wages, this paper aims to assess the effect of trade on wage distribution in the Austrian manufacturing industry by estimating quantile wage regressions. In the regressions, we control for the share of imports and exports in the total production of industrial sectors and take into account the wage level of trading partners. A decomposition of wage changes from 1996 to 2002 shows that, while imports from low-wage countries had a dampening effect on manufacturing wages in Austria, wage growth was dampened above all by exports to high-wage countries. This could be interpreted as evidence for the “bazaar economy” hypothesis.

1 Introduction

Austrian exports and imports in general and cross-border trade with Central and Eastern European countries (CEECs) in particular have grown steadily in recent years. According to traditional trade theory, the gains from growing trade depend on the pattern of factor endowment in the involved economies and are not equally distributed among production factors. In a country achieving net gains from trade, the winners could in theory compensate the domestic losers; in real-world settings, such compensation arrangements are rather unusual, which may be one reason public opinion often expresses discontent about globalization.

This paper is aimed at assessing the effects of trade on wages in Austrian manufacturing sectors. To estimate the effects on wages of international trade with high-wage or low-wage countries, we first estimate Mincer-type wage regressions that include the share of imports and exports in total production. The disaggregation of the trade variables with respect to trading partners' wage levels allows us to analyze the effects of trade with high-wage and low-wage countries, respectively. In addition, we use quantile regressions to estimate wage equations, which we use to see whether the effects of trade are different over the Austrian wage distribution. In a second step, we decompose the changes in the wage distribution over time into effects of changes in determinants of the wage structure (e.g. changes in the import intensity of individual industries) and changes in the returns to these determinants (i.e. wage premiums). Again, we use quantile regressions to estimate different effects over the distribution.

The paper is structured as follows. Section 2 briefly reviews the related literature with special reference to research on the Austrian situation. In section 3, the data sources are described, with an emphasis on the European Structure of Earnings Survey (ESES), a restricted-access source, which has therefore not been used very often so far for economic analysis in Austria. The empirical results of the wage regressions and the decomposition exercise are presented in section 4; finally, section 5 provides some concluding remarks.

¹ This paper was presented at the OeNB's Conference on European Economic Integration (CEEI) 2008, which focused on “The Integration of European Labor Markets” and took place in Vienna on November 17–18, 2008.

² Oesterreichische Nationalbank, Foreign Research Division, wolfgang.pointner@oenb.at. The author would like to thank Alfred Stiglbauer, Julia Wörz (both OeNB) and two anonymous referees for valuable comments and Tamara Geisberger (Statistics Austria) for excellent cooperation on access to data from the European Structure of Earnings Survey. The views expressed are those of the author and not necessarily those of the Oesterreichische Nationalbank.

2 Trade Effects: Theoretical Background and Empirical Evidence

2.1 The Impact of Exports and Imports on Wages

The impact of trade on the distribution of income is usually analyzed in the framework of the Stolper-Samuelson theorem, which states that trade-induced changes in relative demand for goods will also change the relative prices of the factors used in the production of those goods. As firms specialize on producing goods for which factors are more abundant within their home country than abroad, the relative domestic prices of those factors also rise. The Stolper-Samuelson theorem has been used to explain the distribution of factor incomes, i.e. labor wages and returns on capital, but it can also be applied to analyze wage differentials between high- and low-skilled labor.

With regard to the effects of trade on the distribution of wages,³ it is assumed that countries differ with respect to their relative abundance of high- and low-skilled labor. Increasing trade between two countries should therefore cause the relative wage of low- (high-)skilled workers in a country with an abundance of high- (low-)skilled labor to decline. As high-skilled workers are on average better paid than low-skilled ones, more trade implies a more unequal wage distribution in high-wage countries and a less unequal one in low-wage countries.

In its 2007 Employment Outlook, the OECD (2007) documents an increase in the inequality of earnings in most high-wage countries. The rise in inequality was attributable mostly to large increases at the top of the distribution, measured by the decile ratio of earnings⁴. Therefore, the OECD concluded that imports from low-skilled countries had not been the major cause for the increase in inequality in OECD member states, because those imports should have resulted in rising inequality at the lower end of the distribution. Here, it may be useful to remember that the Stolper-Samuelson theorem only discusses relative wage changes between high- and low-skilled workers, and clearly the relative wage for low-skilled labor is declining. Furthermore, the argument holds only for trade with those emerging economies where the skill level on average is far below the OECD average. This most likely cannot be applied to Austria's trade with CEECs, as there is no reason to assume that the average skill level in CEECs differs much from the Austrian standard, especially in exporting industries. According to the OECD's Education at a glance (2008), the share of working-age population having attained at least upper secondary education was higher in the Czech Republic (90%), Estonia (88%), Slovakia and Slovenia (82%) than in Austria (80%) in 2006.

Furthermore, an increase in the trade volume between high-wage and low-wage countries is not a precondition for putting pressure on the low-wage sector in rich countries. Freeman (1995) stressed that the mere possibility of imports might be sufficient to depress wage growth for less skilled workers in high-wage countries. Credible threats to shift production abroad may reduce the bargaining power of unions, so that wage growth might stall without an observable increase

³ The wage distribution we are interested in is the nation-wide distribution across all sectors and firms.

⁴ Decile ratios compare the earnings at different deciles of the earnings distribution. The $D9/D1$ ratio can be decomposed into $D9/D5$ and $D5/D1$ ratios, which, when examined over time, allow us to trace changes in the distribution to changes below or above the median.

in trade flows. But, as Borjas, Freeman and Katz (1997) correctly state, such a threat effect is difficult to measure empirically.

One way of assessing the impact of trade on labor demand is to compute the factor content of exports and imports and then identify the net labor content as excess demand. The labor content of imports corresponds to a shift from domestic to foreign labor inputs. Wood (1995) proposes a method for taking into account the differences in skill intensity in the production of export and import goods in differently endowed countries. Previous research implicitly assumed that firms in high-wage and low-wage countries use the same technologies and thus have the same input ratio of high-skilled to low-skilled labor. Yet as skill endowments and hence returns to skills differ between those countries, it is rather implausible that factors are used in identical proportions. According to Wood's calculations, the imports from low-wage countries are a substitute for substantial employment in high-wage countries, and the additional demand created by export opportunities is much too low to compensate for that. In contrast, when Borjas, Freeman and Katz (1997) estimated the impact of trade between the U.S.A. and low-wage countries on relative labor supplies of different skill groups and on the wages of low-skilled U.S. workers, they found such trade to explain less than 10% of the observed decline in the relative wage of low-skilled Americans. This result may reflect the relatively closed economy of the U.S.A., which is hardly comparable with many small open economies in Europe.

A particular problem in working with trade data is the level of aggregation. The more disaggregated the trade data are, the more homogeneous the units of the trade statistics will be. Therefore, the probability that different countries use similar factors to produce traded goods is higher with more disaggregated statistics. Krugman (2008) features an example of how aggregation can explain an apparent contradiction to conventional trade theory. According to U.S. trade statistics, more than 75% of imported computers and electronic products come from China and other low-wage countries. While computer manufacturing is generally presumed to require a high skill level, the production of some computers no longer requires very high skills, especially if the more skill-intensive parts of production can be imported from elsewhere. So one solution to this conundrum would be to use more detailed disaggregated data on trade and skill content, but clearly the statistics on wages available so far place a limit to that approach.

In recent years, the impact of trade with very low-wage countries like China and other emerging economies in Asia has received more attention, especially in the U.S.A. The OECD (2007) reports that the share of Chinese imports in total OECD imports roughly doubled from 4% to 8% between 1996 and 2004. Could the acceleration of such exports to high-wage countries have increased the effects of trade on the wages of low-skilled workers in OECD countries? One counterargument refers to specialization. If low- and high-wage countries are so highly specialized that they cease to produce the same goods, increasing trade will not hurt workers in either of the two sets of countries, as imports are no longer substitutes for domestic production. Of course, during the process of specialization, workers may become redundant, as their output is replaced by imported goods, but once the countries have reached different "cones of diversification," workers in high-wage countries are shielded from negative effects of trade on wages or employment. This may be a realistic assumption for trade between the U.S.A. and

China, but between Austria and the CEECs, skill endowments and specialization patterns do not differ so much as to make production in different “cones of diversification” a very likely scenario.

Another source of rising inequality that is related to trade is outsourcing, the fragmentation of production processes which were previously performed within one firm into separate units traded across borders. Feenstra and Hanson (1996) have shown that such activities lead to increasing demand for skilled labor in high-wage countries and therefore make the wage distribution more unequal.

The effects of trade and FDI on the labor share in Europe have been analyzed by Breuss (2007) with separate panel regressions for old EU countries and CEECs. Both regressions include total net trade as an independent variable; in the case of EU countries, the equation also contains the trade share with CEECs and net FDI outflows to the rest of the world, whereas the equation for the CEECs contains the trade share with EU countries and FDI inflows. The results match theory only to some extent: For the EU countries, the regression coefficients coincide with theoretical expectations (i.e. all have negative signs), but for the CEECs, only net trade increases the labor share, whereas the EU’s trade share significantly depresses the labor share, and FDI inflows are hardly significant.

2.2 Trade Effects in Austria

In an early attempt to assess the effects of trade between Austria and selected CEECs,⁵ Aiginger, Winter-Ebmer and Zweimüller (1996) estimated employment and wage effects of such trade for the period from 1988 to 1991. Based on a sample of 2% of manufacturing workers from the Austrian social security records, they found the unemployment risk to have declined on average in sectors which export goods to the CEECs but not to have changed significantly as a result of imports from the CEECs. The unemployment risk differs significantly with respect to age, earnings and the type of occupation (i.e. blue-collar versus white-collar jobs). Wage increases were lower for employees in sectors with higher import growth from CEECs than for employees with unchanged CEEC import shares. The export share, in contrast, had a significant positive effect, but its size was much smaller, so the net effect of trade with CEECs was negative for the period in question. Aiginger, Winter-Ebmer and Zweimüller (1996) thus find the aggregate effects of trade with CEECs to be negative, but not very strong, while at the same time acknowledging that trade between Austria and the CEECs was still at very low levels in the period they studied.

Using comparable wage data for the period 1991 to 1994, Hofer and Huber (2003) assess the effects of trade and migration on earnings in Austria. That period differs from the one analyzed by Aiginger, Winter-Ebmer and Zweimüller (1996), as the boom of German unification was over and 1993 was a recession year, which substantially depressed average export and import growth rates; trade with the CEECs was, however, less affected than overall trade. Hofer and Huber (2003) find negative effects of imports on wages and positive effects of exports, whereas their results for migration are not significant.

⁵ *Trade between Austria and Hungary, Poland and the then still existing Czechoslovakia.*

The paper at hand tries to assess the impact of trade on wages in a more recent period. Earnings data are available for two years, 1996 and 2002, from the European Structure of Earnings Survey (ESES), a new and very accurate data source. Whereas the distributional effects of trade have generally been modeled so far by estimating different effects for blue-collar and white-collar employees, the differences in the effects of trade on wages are captured with quantile regressions in this paper. In addition, those effects are decomposed into changes of the trade pattern and changes in the returns to working in more or less trade-intensive sectors.

3 Data Description

Many data sets on wages or earnings typically face limitations. Data from household surveys suffer from a notorious reluctance of individuals to state their earnings correctly, or answer income-related questions at all. Administrative records are much more reliable, but the data sets are often truncated as a result of top-coding,⁶ e.g. data from social security records only contain wage levels up to the earnings cap for social security contributions.

The wage variables used in this paper are derived from the Austrian national branch of ESES, a structural survey on individual earnings harmonized EU-wide and compiled periodically in line with EU regulations. A substantial advantage of ESES over other earnings surveys is the fact that the questions on wages are answered by employers, and that earnings-related information is often matched with administrative data.⁷

ESES covers firms with more than nine employees in the private sector except agriculture, i.e. manufacturing, construction and market-based services (Austrian Statistical Classification of Economic Activities ÖNACE sections C through K). On the employers' side, it provides information on firm size, industry affiliation and regional location (at the NUTS 1 level)⁸. Data on employees reflect gender, age, education, tenure with the current employer, type of contract (full-time or part-time, temporary or permanent employment), type of occupation (ranging from managers to elementary occupations) or the type of collective agreement the employee is subject to. The survey provides information about employees' highest education degree according to the International Standard Classification of Education (ISCED) and according to the Austrian national grading system; this allows us to compute the mandatory years of education for each employee.

Most importantly, the data contain information on the gross earnings of employees and on various sources these earnings stem from, so we can discern between bonus payments or premiums and ordinary wages. As the number of hours worked is also included in the survey, we can compute alternative measures for hourly wages. We use a wage variable for average hourly earnings including

⁶ For example, the research by Aiginger, Winter-Ebmer and Zweimüller (1996) and by Hofer and Huber (2003) is subject to top-coding.

⁷ For a comprehensive overview on the Austrian branch of ESES, see Statistics Austria (2006).

⁸ NUTS stands for *nomenclature des unités territoriales statistiques*, or *Nomenclature of Territorial Statistical Units*. The three NUTS 1 regions in Austria are: Eastern Austria (Vienna, Lower Austria and Burgenland), Southern Austria (Carinthia and Styria) and Western Austria (Upper Austria, Salzburg, Tyrol and Vorarlberg).

overtime and shift premiums, regular bonus payments and full-rate paid absences. The 2002 wages are HICP-deflated to make them comparable with 1996 wages.

For this paper, the two ESES waves conducted in 1996 and 2002 were available, covering about 120,000 employees⁹ from 8,000 firms (1996) and 140,000 employees from 10,000 firms (2002). As the definitions of employment contracts suitable for inclusion in the survey were altered slightly between 1996 and 2002, we restricted the data for comparability reasons to those employees who had worked with their employer for the whole year and whose earnings were above a certain threshold. In addition, we excluded individuals with earnings below the first and above the 99th percentile as well as apprentices and persons younger than 16 and older than 65.

Statistics Austria keeps the Austrian ESES data strictly confidential; after all, the data contain detailed information about the wages of more than 100,000 individuals. Therefore, the regressions were executed by Statistics Austria, with codes transmitted by the author.

The trade data used in this paper are derived from Eurostat's ComExt database on the intra- and extra-EU trade of all EU Member States. The traded goods are aggregated into consistent production sectors. Here, the 2-digit NACE classification was used, as the ESES data also contain that information and the 2-digit level was the most disaggregated level available. As the data are restricted to goods trade, they represent only the manufacturing sector.¹⁰ In appendix table A1, the distribution of employees over the manufacturing industries at the two-digit level in 1996 and 2002 is displayed.

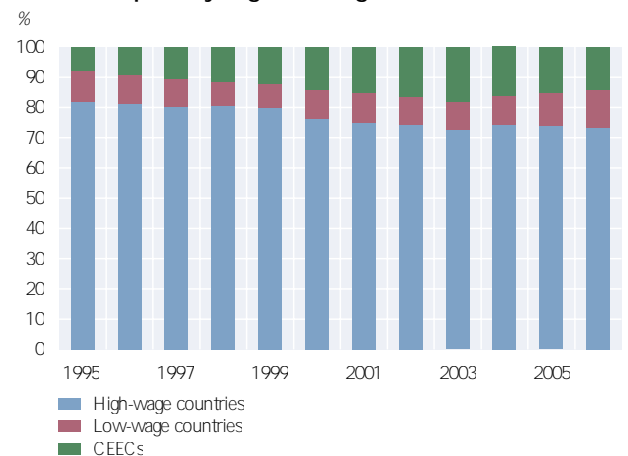
Chart 1

Austria's Trading Partners

Austrian Exports by Region of Destination



Austrian Imports by Region of Origin



Source: ComExt

⁹ Strictly speaking, that number refers to jobs, so anyone holding two jobs in the survey period may appear twice in the data.

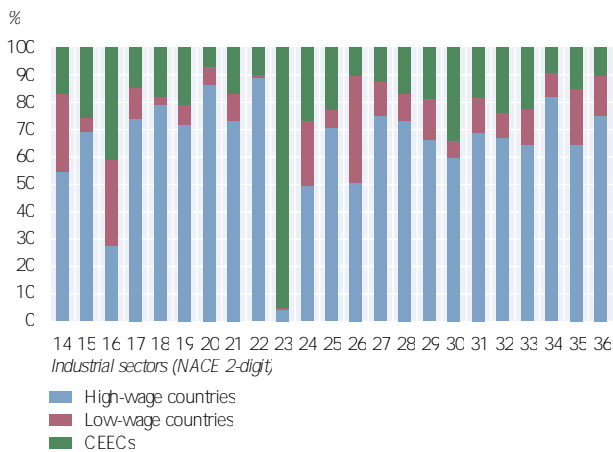
¹⁰ For NACE sector 30 (Manufacture of office machinery and computers) the Austrian exports amounted to multiples of 100% of domestic production in 1996 and 2002. Presumably, the re-export of imports has been accounted for as exports in this sector, which is by definition not a manufacturing activity, but trade service. Therefore, this sector has been excluded from the analysis.

For the purpose of this paper, the trading partners of Austria were aggregated in three groups: OECD countries except for new EU Member States, Korea, Turkey and Mexico are grouped together as “high-wage countries”; the countries that joined the EU in 2004 and 2007 together with the remaining Balkan countries, Belarus, Russia, Ukraine and Turkey form the “CEECs”; and the rest of the world is labeled “low-wage countries.” As chart 1 shows, the vast majority of Austrian trade volumes are still exchanged with high-wage countries. The change in the share of CEECs in Austrian trade was relatively dynamic; from 1996 to 2002 the share in imports doubled from 8% to 16% and declined somewhat afterwards. Export shares were relatively stable over time, and the increase in the CEECs’ share was smaller. For imports and for exports alike, the share of low-wage countries remained quite stable over time, causing the gains of the CEECs to result in a declining weight of high-wage countries in Austrian trade. But all in all, the variation over time is rather subdued.

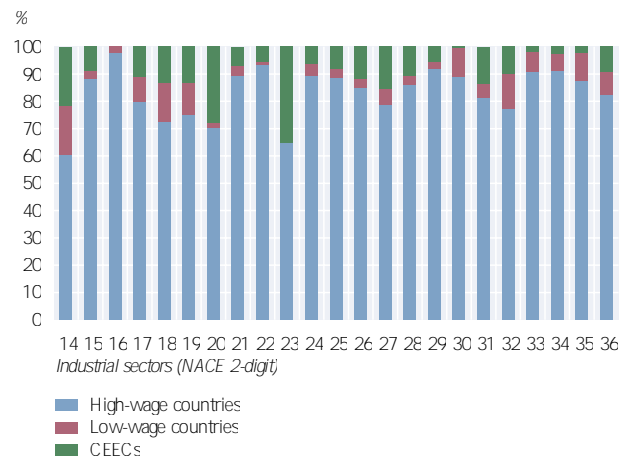
Chart 2

Composition of Austrian Trade by Sectors

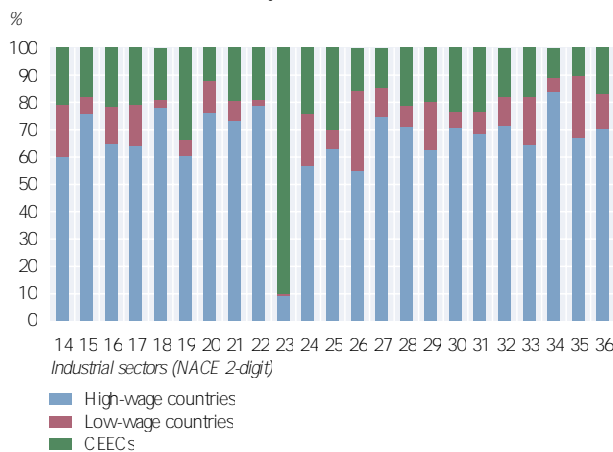
Sectoral Breakdown of Exports, 1996



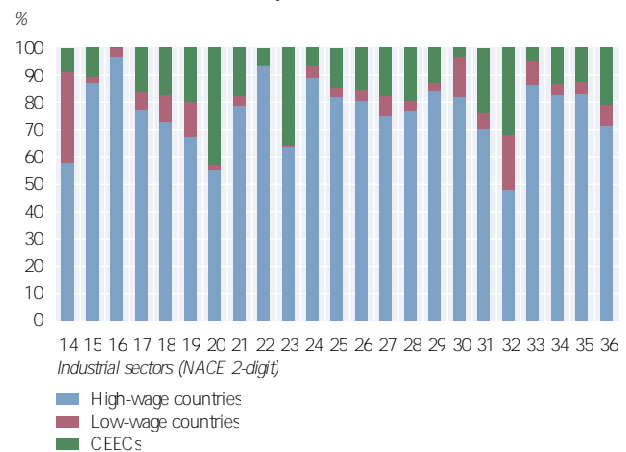
Sectoral Breakdown of Imports, 1996



Sectoral Breakdown of Exports, 2002



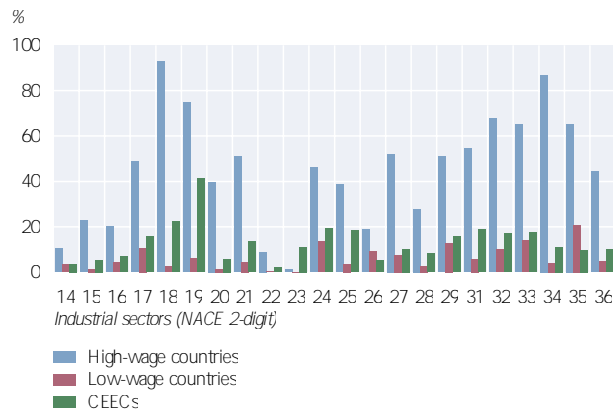
Sectoral Breakdown of Imports, 2002



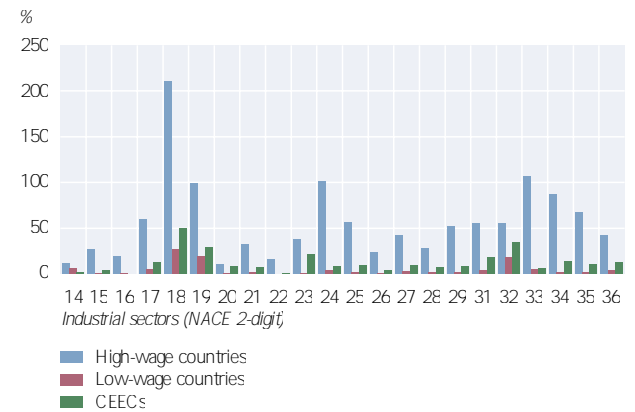
Source: ComExt

Trade and Domestic Production

Ratio of Exports to Total Domestic Production in 2002



Ratio of Imports to Total Domestic Production in 2002



Source: ComExt

At the sectoral level, the differences are more pronounced (see chart 2). For example, the CEEC shares in Austrian exports ranged from 95% to 7% and average 17% in 1996. The variation for imports is smaller, but still substantial. Based on trade flows at the sectoral level, the next step is to assess the effects of imports and exports on wages in Austria. In some sectors, exports to high-wage countries corresponded to 90% of domestic production, and imports of apparel even amounted to more than 200% of Austrian production (see chart 3). A list of the industrial sectors and their codes can be found in appendix table A1.

4 Empirical Estimation of Trade Effects

The wage distribution is determined by the qualitative composition of the workforce and the returns workers receive for different characteristics, such as returns to education. As high-skilled workers are usually better paid, a higher fraction of high-skilled workers will also drive up average wages. If demand for high-skilled workers goes up and supply is fixed in the short run, the returns to education will go up as well, thus changing the wage structure. Therefore, the data on wages derived from both ESES waves are first regressed on their main determinants to assess labor market returns such as skill premiums or wage premiums due to seniority. According to human capital theory, these main determinants are education and experience, but we also know that identical skills are not rewarded identically in different sectors or different regions within the same country.

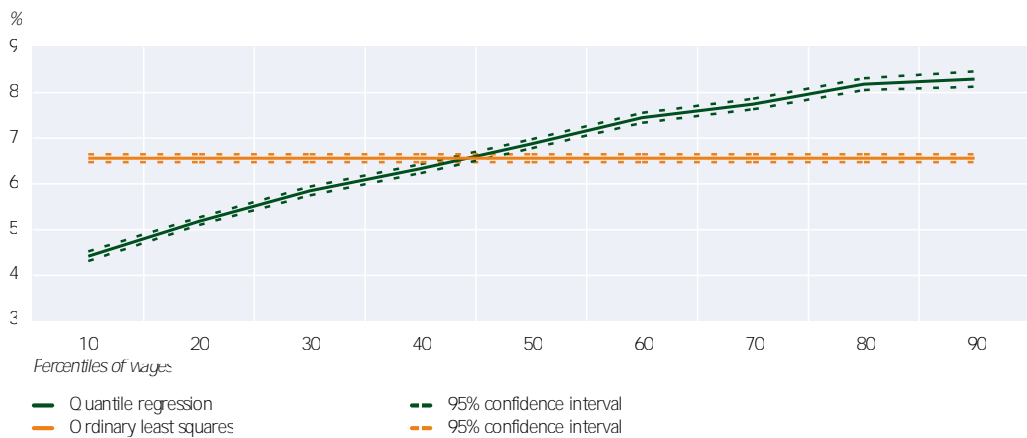
As the returns to characteristics are not distributed evenly, quantile regressions are implemented to test for these differences. Sectoral trade variables are included to estimate the impact of imports and exports at different wage levels. Finally, the changes in the wage structure over time are calculated and decomposed into the effects of changes in the returns to characteristics like education or the trade intensity of industrial sectors (returns effect) and changes in the characteristics themselves (composition effect) between 1996 and 2002.

4.1 Results from Wage Regressions

With the comprehensive ESES data on employees' characteristics, wage equations can be estimated to see whether the wage premium of education or tenure has changed. To estimate the effects of the explanatory variables on the wages of employees in different parts of the distribution, quantile regressions are used. In ordinary least squares (OLS) estimations, the coefficients represent the effects of the independent variables on the mean of the dependent variable. If, for example, we estimate the effect of years of schooling on wages, the OLS coefficient on education is 0.066. This coefficient assumes that the effect of education is the same for all quantiles of the distribution.

Chart 4

Effects of Years of Education on Wages



Source: Author's calculations.

As chart 4 shows, the coefficients from quantile regression offer a different view. The effects of an additional year of education on wages grow along the distribution, and the estimated coefficients are mostly significantly different from the OLS estimation, as the 95% confidence intervals around the estimated coefficients, indicated by the dashed lines, show. Therefore, the use of quantile regressions seems warranted in estimating the effects of trade on the wage structure, as they provide a better picture of the conditional distribution than do OLS estimations (see Koenker and Hallok, 2001).

In contrast to OLS estimations, quantile regressions are based on least absolute deviations (LAD) estimators. A simple quantile regression model of wage ω is given by

$$\omega_i = z_i \beta_\theta + u_{\theta i} \text{ with } Q_\theta(\omega_i | z_i) = z_i' \beta_\theta \quad (1)$$

where Q_θ is the estimated θ^{th} quantile of ω conditional on the data set z , which contains information on employees' and firms' characteristics. The θ^{th} regression quantile is defined within a range from 0 to 1 as a solution to the problem

$$\min_{\beta} \sum_i \rho_\theta(\omega_i - z_i \beta_\theta) \quad (2)$$

with the function $\rho_\theta(\omega_i - z_i\beta_\theta)$ assuming values of $2\theta(\omega_i - z_i\beta_\theta)$ if $(\omega_i - z_i\beta_\theta) \geq 0$ and $2(1-\theta)(\omega_i - z_i\beta_\theta)$ if $(\omega_i - z_i\beta_\theta) < 0$. If, for example the conditional median is to be estimated, θ equals 0.5 and β is chosen so as to minimize the identically weighted residuals, i.e. the deviations of observed ω from $z_i\beta_\theta$. If we were interested in the 75th quantile, the weights are not identical, but equal to 1.5 for positive residuals and 0.5 for negative ones. A useful feature of quantile regressions is their robustness to the problem of heteroscedasticity, which is often found in the analysis of wages. Typically, the variance of wages increases with education, which causes the OLS estimator to be inefficient. Quantile regressions take the possibility of changing variance into account, as they separately estimate the relation between dependent and independent variables for different points in the distribution and not just the conditional mean as the OLS estimator.

To assess the effects of employees' characteristics on the wage structure, wage regressions are estimated in OLS and in a quantile regression specification. In the literature, log wages are usually regressed on educational variables, age, age squared, experience, experience squared and a gender dummy. The ESES data contain information on highest completed education, from which the minimum years of formal education can be computed. This variable is labeled *yedu*. The *age* variable measures the age of employees, and *ten* the years of employment at the current employer (tenure). The variable *ten* is used as a proxy for firm-specific experience, and the *age* variable captures general work experience. The squared values of both variables are included because their marginal effect on wages is assumed to decrease; therefore, the coefficient on the squared values of *age* and *ten* is expected to be negative. Finally, we use a gender dummy, *fem*, which takes the value 1 for women and 0 for men.

$$\ln \omega_i = \beta_0 + \beta_1 yedu_i + \beta_2 age_i + \beta_3 age_i^2 + \beta_4 ten_i + \beta_5 ten_i^2 + \beta_6 fem \quad (3)$$

Estimating this equation in OLS yields coefficients presented in the left panel of table 1 (specification 1). The effects of education are found to have been rather stable over time; the coefficient is nearly identical in both years at 0.067, meaning that each additional year of schooling increases the hourly wage on average by 6.7%. The effects of age and tenure declined significantly between the two survey years. Especially the return of general work experience as measured by age declined, which also means that the practice of paying higher wages due to seniority lost importance. The squared age and tenure variables are small and significantly negative, as expected (not shown in table 1). The female dummy shows an increase in the gender pay gap; controlling for education and experience, the wages of women employees were 22.4% lower on average than the wages of their male colleagues in 1996. The average gender pay gap increased by 2.5% in the six years to 2002. Although specification 1 is rather parsimonious in terms of independent variables, it already explains about 40% of the variation in wages.

In a second specification of the wage regression, more explanatory variables were included. The location of a firm may have an effect on the wage level; firms in urban agglomerations tend to pay higher wages. Unfortunately, the regional variable available from the ESES data is aggregated at the NUTS 1 level, so we can only distinguish three regions within Austria. The firm's size with respect to its number of employees also plays a role for wage levels; therefore, dummy variables

for different size classes are included. And finally, to capture the impact of trade, the import and export shares of each industrial sector are added. The import (export) share is calculated as the ratio of imports (exports) of goods typically produced by that sector to the total output of that sector. If the independent variables of equation 3 are integrated in a set X , the new regression is given by

$$\ln \omega_i = \beta_0 + X' \beta_1 + \beta_2 east + \beta_3 south + \sum_j \beta_j size_{ij} + \beta_{10} imq + \beta_{11} exq, \quad (4)$$

where *east* and *south* are the two regional dummies for Eastern and Southern Austria and Western Austria is the reference category; *size_j* are dummies for the six different size classes, with firms with 25 or less as reference category; *imq* and *exq* are the import and export shares of industrial sectors. The central panel of table 1 shows the results of these regressions.

Table 1

OLS Regression of Hourly Wages in 1996 and 2002

Variables	Specification 1		Specification 2		Specification 3	
	1996	2002	1996	2002	1996	2002
Constant	0.9978***	1.3121***	1.02132***	1.30723***	1.03923***	1.33749***
Education	0.06679***	0.06869***	0.06708***	0.06709***	0.06509***	0.06616***
Age in years	0.02243***	0.00909***	0.0204***	0.00833***	0.01936***	0.008***
Tenure	0.01165***	0.00923***	0.01106***	0.00918***	0.01155***	0.00936***
Female	-0.22441***	-0.24955***	-0.21394***	-0.23511***	-0.2059***	-0.23568***
Eastern Austria			0.0073***	-0.08509***	0.00224***	-0.07947***
Southern Austria			-0.04872***	-0.01946***	-0.04481***	-0.02242***
Number of employees						
25- 50			0.03542***	0.05306***	0.03124***	0.05278***
50- 100			0.05903***	0.1073***	0.05423***	0.10346***
100- 250			0.09955***	0.15889***	0.08977***	0.15413***
250- 500			0.14525***	0.18606***	0.1257***	0.17833***
500- 1,000			0.14748***	0.22279***	0.13872***	0.22328***
> 1,000			0.21328***	0.27415***	0.19903***	0.28173***
Trade:						
Import share			-0.07882***	0.00264		
Export share			0.03133***	-0.09769***		
Shares of:						
High-wage imports					0.09823***	0.0762***
Low-wage imports					-1.45763***	-0.36462***
CEEC imports					0.29175***	0.11791*
High-wage exports					-0.2752***	-0.34601***
Low-wage exports					0.68394***	0.80849***
CEEC exports					0.56191***	-0.00438
R ²	0.4	0.36	0.43	0.41	0.45	0.42
Observations	45,367	29,325	45,367	29,325	45,367	29,325

Source: Author's calculations

Note: Dependent variable: log average hourly earnings include overtime, regular bonuses and full-rate paid absences.
* significant at 10%; ** significant at 5%; *** significant at 1%.

The wages in the southern part of Austria (Styria and Carinthia) were significantly lower than in the western part (Upper Austria, Salzburg, Tyrol and Vorarlberg) in both years, with the relative gap declining, whereas in Eastern Austria (Vienna, Lower Austria and Burgenland) wages in manufacturing declined relative to the western part after 1996 and were 8.5% lower in 2002.

With respect to wages, we find that size matters. The size dummies all point to the expected relation, i.e. bigger firms pay higher wages. This effect intensified over time, with the coefficient on each size dummy being higher in 2002 than in 1996. Firms with more than 1,000 employees pay wages that are on average 21.3% (1996) or 27.4% (2002) higher than the wages paid by firms with 25 employees or less.

The coefficients of the trade variables show the most pronounced changes over time. In 1996, the more goods typically produced by a sector were imported, the lower the wages of the employees in that sector. By 2002, however, this effect was not significantly different from zero. On the other hand, the positive impact of the export share in 1996 was reversed in 2002, when sectors with higher export-to-output ratios paid smaller hourly wages. However, it should be noted that the coefficients in both years, although statistically significant, are economically relatively small. The export shares are by definition bound between 0 and 1, and most import shares also have values in that range. For example, if in 1996 the import share in sector i was 10% higher than in sector j , according to the results in table 1, this would translate *ceteris paribus* to a 0.7% lower wage in sector i .

To assess the impact of trade with different partners, we run the wage regressions again and split up the trade variables with respect to trade partners. Instead of using the share of all imports or all exports relative to output in each sector, imports are grouped according to countries of origin and exports according to countries of destination. As described in section 2, we pool Austria's trading partners in high-wage countries, low-wage countries and CEECs and calculate imports from and exports to them as shares of sectors' output, i.e.

$$imq_k = \frac{\sum_i imports_{ik}}{\sum_i output_i} \quad \text{and} \quad exq_k = \frac{\sum_i exports_{ik}}{\sum_i output_i} \quad (5)$$

for k = high-wage countries, low-wage countries and CEECs.

So now all the independent variables from equation 4 except imq and exq are wrapped into X . We add some new explanatory variables: $imhw$ stands for sector i 's imports from high-wage countries relative to domestic production, $imlw$ for sector i 's imports from low-wage countries and $imce$ for sector i 's imports from CEECs; $exhw$, $exlw$ and $exce$ are the respective export shares. The new regression equation is given by

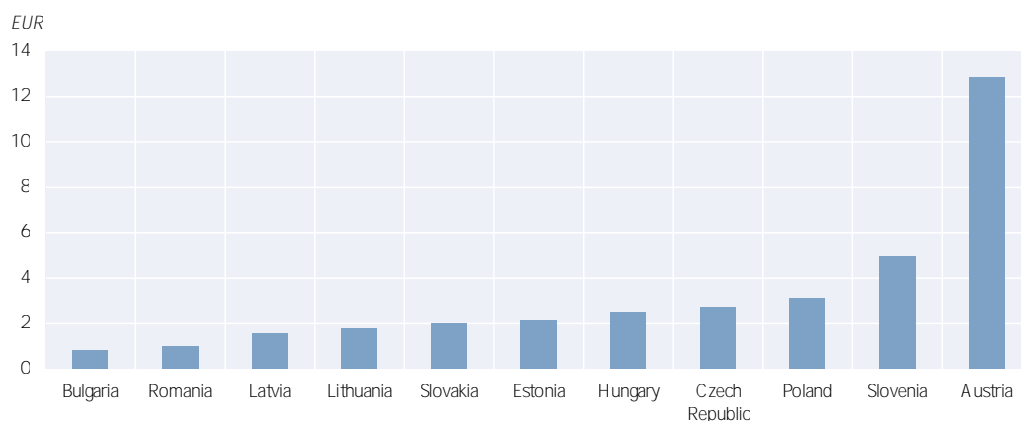
$$\ln \omega_i = \beta_0 + X' \beta_1 + \beta_2 imhw + \beta_3 imlw + \beta_4 imce + \beta_5 exhw + \beta_6 exlw + \beta_7 exce \quad (6)$$

The results from estimating equation 6 are shown in the right panel of table 1. The coefficients of trade with high-wage countries, which constitutes the largest share of Austrian trade, are comparatively stable over time. Sectors with more imports from high-wage countries on average paid higher wages in 1996 and 2002, but the effect declined over time. The division of labor with other high-wage countries seems to be productivity enhancing and therefore allows for higher wages.

Sectors with more imports from CEECs pay higher wages on average, which indicates low direct competition between domestic workers and foreign labor in those countries. Imports from CEECs are pronounced in the textiles and apparel

Chart 5

Average Hourly Wages in Manufacturing, 2002



Source: Eurostat

industries, and over time these imports also increased as a share of production. But the import share of that region in electronics, machinery and motor vehicles increased also between the two years. Although the skill levels in the CEECs do not differ so much from those in Austria, the average wage in manufacturing is much lower, as chart 5 shows. The depicted hourly wages for 2002 vary from 38% to 6% of the Austrian wage level, measured at current exchange rates.

The effect of low-wage countries' imports was negative in both years, but lower in 2002 than in 1996. The biggest change in the import structure of low-wage countries in this period was the increase in imported communication equipment (NACE 32). With respect to the aggregation of imported goods in trade statistics, Krugman (2008) observed that data on such equipment – which is usually considered high-tech and skill-intensive production – are probably subject to data limitations. For example, the Chinese share in Austria's imported communication equipment increased from 1.6% in 1996 to 6% in 2002, while total imports in that sector from low-wage countries jumped from 4% to 21% of Austrian production. So if Chinese manufactures represent only the less skill-intensive stages in the production of communication equipment, they cannot serve as substitutes for Austrian products but rather provide cheaper inputs, which is why such imports would increase average sectoral productivity and raise wages.

The results for exports to different destinations indicate that exports to high-wage countries depress the average wage. Here it should be noted that differences in skill levels are accounted for by the education and tenure variables. So if Austrian exports to high-wage countries are more skill-intensive than exports to low-wage countries and should therefore provide for higher wages, these effects are already captured by *yedu* and *ten*. Keeping that in mind, the negative coefficient of exports to high-wage countries could be interpreted as a sign that Austrian exporters have less market power in these markets, whereas in the low-wage countries and the CEECs, domestic firms have been able to demand higher markups. Whereas the effect of exports to low-wage countries increased over time, the positive impact of exporting to the CEECs has vanished.

To explore the relation between trade and the distribution of wages, we run quantile regressions for 1996 and 2002 (tables on the quantile regressions for 1996 and 2002 for three different specifications are available from the author on request). In both years and in all specifications, the coefficient on *yedu* increases over the whole distribution except for the highest decile. In specification 1, the returns to education range from 0.045 to 0.084 in 1996, which means that an additional year of education would have increased the hourly wage for employees in the first decile by 4.5% and for employees in the 8th decile by 8.4%. As shown in chart 4, the average effect calculated by OLS would be 6.6%. For 2002, the returns to education are virtually the same as in 1996; the tiny differences are not significant. Martins and Pereira (2004) find the returns to education¹¹ to be rather high in Austria compared to a sample of 16 OECD countries. Also, the difference between the 1st and the 9th decile is the second-largest in this group.

The returns to other characteristics are more evenly distributed, but changed more strongly over time. Interestingly, the gender bias is strongest around the median in both years. The coefficient on tenure was positive and rather stable over all deciles in 1996, which indicates that firm-specific human capital was valued at approximately the same rate for all wage levels. By 2002, the returns to tenure had decreased, especially for low-wage earners. The same holds for the returns to age, where coefficients were generally smaller in 2002 and were in particular below the median.

With regard to the trade variables, the impact of high-wage countries' imports on the wage distribution changed, as the effect was u-shaped in 1996, benefiting low- and high-wage earners more than employees with wages around the median. In 2002, the effect was positive for all deciles, but monotonously increasing in the wage level. So the benefits of imports from high-wage countries shifted from low-wage earners to middle-wage earners, with high-wage earners continuing to be the main beneficiaries. CEEC imports had positive effects on wages only for low-wage earners in both years; above the median, the effects are insignificant. The wage-diminishing impact of imports from low-wage countries was evenly distributed in 1996, but in 2002 the effect was less pronounced in the upper half of the distribution.

The exports to high-wage countries tended to dampen Austrian wages in both years, with the effect growing stronger for higher wages. In fact, the negative correlation of the effect with the wage level intensified over time. Working in an industry which exported to the CEECs was beneficial for wages in 1996, especially for middle-income earners; the coefficient of CEEC exports peaked around the median and was positive over the whole distribution. Yet by 2002, this positive effect of CEEC exports had dissipated; the coefficients were much smaller and insignificant. The estimated returns of exports to low-wage countries were significantly positive in both years, favoring Austrian low-wage earners in 1996 and appearing rather evenly allotted in 2002.

¹¹ Their specification includes years of schooling and experience as independent variables and they only used data on full-time working men; therefore, their results are not fully comparable to the findings of this paper, but they support our findings.

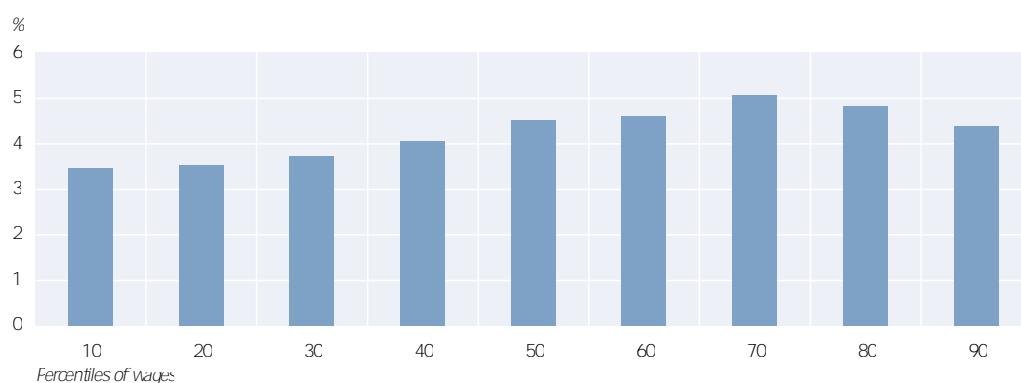
The wage regressions tell us how given characteristics of the workforce, like education, gender or the import intensity of an industry, are valued in the Austrian labor market in each year. However, the wage structure is determined not only by the returns to these characteristics, but also by the distribution of these characteristics among the workforce. And as Freeman (1995) put it, “[...] *no one can say with confidence what would have happened had imports from less-developed countries remained constant or at the same proportion of GDP over time.*” By decomposing the effects of changing wage premiums and changing characteristics of workers (e.g. changes of the trade intensity of the sectors they are employed in), we can proxy a counterfactual what-if analysis of wage changes in the way proposed by Freeman. The results of that exercise are presented in the next section.

4.2 Decomposition of Changes in the Wage Distribution

Real wage growth in the manufacturing sectors considered here was rather modest between 1996 and 2002. As depicted in chart 6, on average wages grew slightly more than 4%, with faster growth in the upper half of the distribution. To explain concomitant changes in the wage distribution, we want to relate the distributional changes to changes in the composition of the workforce or the trade structure and changes of the compensation of different groups within the workforce. In doing so, we follow the counterfactual decomposition approach of Machado and Mata

Chart 6

Real Wage Growth in Manufacturing 1996–2002



Source: Authors' calculations based on ESES

(2005). They extended the Oaxaca (1973) decomposition for the wage means on the whole distribution of wages by comparing the distribution of wages in a given year with a counterfactual distribution that would have prevailed if one or more explanatory variables had changed. Thereby, the effect of changes in single covariates on the wage distribution can be identified.

To decompose the wage changes between 1996 and 2002 to changes in characteristics z or changes in the returns to those characteristics, which are given by the β values of the wage regressions, we perform an application of the Machado and Mata (2005) decomposition developed by Albrecht, Björklund and Vroman (2003). Therefore, we compute the average characteristics of employees at each decile in both years by the following bootstrap procedure:

1. A random sample of 100 observations is drawn (with replacement);
2. the drawn observations are ordered by wage, so that each observation represents one percentile of the wage distribution;
3. this procedure is repeated 500 times, providing the basis for the computation of averages for each decile.

The average characteristics computed by this procedure and the estimated coefficients from the quantile regressions allow us to decompose the recorded wage changes into changes of characteristics and changes of coefficients for each decile. The counterfactual decomposition starts from equation

$$\ln(\omega_{\theta}^{2002}) - \ln(\omega_{\theta}^{1996}) = \bar{z}_{\theta}^{2002} \beta_{\theta}^{2002} - \bar{z}_{\theta}^{1996} \beta_{\theta}^{1996} \quad (7)$$

with $\ln(\omega_{\theta})$ being the log wage at the θ^{th} decile in the respective year, \bar{z}_{θ} the vector of average characteristics at the θ^{th} decile computed by the procedure described above, and β_{θ} the coefficients from the wage regressions.

Additionally, if we define

$$\Delta \bar{z}_{\theta} = \bar{z}_{\theta}^{2002} - \bar{z}_{\theta}^{1996} \quad (8)$$

and

$$\Delta \beta_{\theta} = \beta_{\theta}^{2002} - \beta_{\theta}^{1996} \quad (9)$$

we can rewrite equation 7 as

$$\ln(\omega_{\theta}^{2002}) - \ln(\omega_{\theta}^{1996}) = \Delta \bar{z}_{\theta} \beta_{\theta}^{2002} - \bar{z}_{\theta}^{1996} \Delta \beta_{\theta} \quad (10)$$

The first term on the right side gives us the effect of changed characteristics on the wage differential between the two years (*composition effect*); if only the characteristics of the employees had changed and the returns to these characteristics were the same in both years, that term would define the total wage change. The second term represents the impact of a change in the coefficients on the wage structure (*returns effect*). If the composition of the work force had been unaltered from 1996 on and only the returns to existing properties of the workforce had changed, we would end up with a wage change described by that term.

The results from this decomposition exercise can be seen in chart 7. The effects of increasing exports to low-wage countries or CEECs is negligible, whereas the growing share of exports to high-wage countries in total manufacturing output depressed wage growth between 1996 and 2002. Also, the wage premium of working in a sector with a higher export share decreased over time, but the negative effect of working for a sector exporting to CEECs is even bigger than for one exporting to high-wage countries. Again, the effect of exports to low-wage countries is negligible. With respect to wage distribution, exports seem to reduce wage inequality, as the dampening effects on wage growth are higher for wages above the median than below.

These findings disagree with the studies on trade effects on Austrian wages cited in section 2.2, where exports mostly had a positive impact on wage growth. From factor content analysis, one would also expect that rising exports in a skill-intensive economy like Austria should raise demand for better educated (and better paid) employees and therefore raise wages on average.

At the same time, it should be noted that this analysis is based on total exports and total imports, including re-exported imports. A rising import content of

exports is equivalent to a lower share of value added in exports (“bazaar economy”; see Sinn, 2005), which in turn means less scope for wage increases. The declining value added in exports has been the source of a discussion in Germany about the bazaar economy. For Austria, the input-output multiplier analysis by Bayerl et al. (2008) shows that value added in exports declined from 1995 to 2003, and this decline was more pronounced in manufacturing than in services. But they also find that export growth was sufficiently large to offset the smaller value added in exports. The negative effect of exports in the wage regressions represented in chart 7 indicates that the distribution of value added generated by export growth is skewed toward profits.

Another interpretation for the wage-dampening effects of exports would be that Austrian firms are trying to gain (or keep) export market shares by cutting wage costs. The negative composition effect of exports originates from growing exports to high-wage countries. These countries have similar factor endowments and produce similar goods, so competitive pressures for Austrian firms might be

Chart 7

Decomposition of Effects on Wages

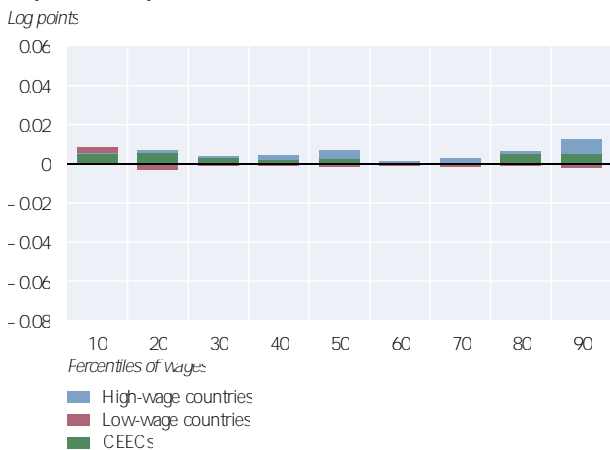
Exports Composition Effects



Exports Returns Effects



Imports Composition Effects



Imports Returns Effects



Source: Author's calculations.

higher in these markets. Similarly, the reduction in the wage premium of sectors exporting to CEECs can be interpreted as declining price-setting power of Austrian firms. The decline in the returns to CEEC exports is stronger in the upper half of the distribution, because employees in these sectors received higher wage premiums in 1996. The returns of both exports to CEECs and high-wage countries had a more dampening effect on the wage growth of well-paid employees and therefore contributed to making wage inequality in Austria smaller.

As for imports, the composition effects are rather small and mostly positive, so the increasing share of imports actually contributed positively (if at all) to wage growth. The returns to working in a sector with imports from low-wage countries increased across the whole wage distribution, whereas imports from high-wage countries caused the wages of low-wage earners to fall and those of high-wage earners to grow. Sectors with more imports from CEECs also paid lower wages in 2002 than in 1996, and the negative effect was particularly pronounced for low-wage earners; for higher wages, the results are positive but not significant. Overall, the returns effect of imports contributed to an increase in wage inequality between 1996 and 2002, as high-wage earners benefited from imports, whereas the effects for low-wage earners mostly canceled each other out. Imports from high-wage countries and from CEECs might more often work as substitutes for domestic production, causing some crowding out, whereas imports from low-wage countries might serve as complements and therefore rather increase efficiency and wages. Interestingly, imports from CEECs are more similar in effect to imports from high-wage countries than from low-wage countries, which indicates that Austrian trade with CEECs does not fully match traditional Stolper-Samuelson models of different endowments.

From the decomposition analysis, we conclude that the effects of trade on Austrian wages have been twofold. Industries with higher exports tended to pay lower wages over the period under consideration. In particular, industries with higher exports to high-wage countries reduced their wages *ceteris paribus*. As about 70% of all Austrian exports go to high-wage countries, this effect prevails. The reason for the negative effect of exports could be found in fiercer competition for Austrian products on these markets and the increasing import content of exports (the “bazaar economy” phenomenon). In fact, the value added of Austrian exports declined from the mid-1990s to the early years of this decade, as evidenced by Bayerl et al. (2008). Considering the effect on wage distribution, exports tended to reduce inequality, as the effect on the deciles above the median was more negative. The distributional effects of imports point in the other direction, with wages above the median clearly benefiting from imports whereas, for lower wages, the effects of imports mostly canceled each other out, with low-wage countries’ imports affecting wages positively and all other imports having negative effects. Neither the increase of CEEC imports relative to total production nor the increasing share of imports from CEECs seems to have affected Austrian wages in particular.

For the future some further research is warranted, especially about the reason for the wage-dampening effect of exports. It would be interesting to use more disaggregated firm data to see whether exports had a dampening effect on profits as well. It should also be noted that wage regressions on trade variables might be subject to an endogeneity bias, which could be overcome by instrumental

variables (IV) estimation if proper instruments can be found and the IV estimation can be implemented with quantile regressions. Finally, the analysis should be repeated when the next ESES wave (surveying the wage structure in 2006) is available to assess whether the results are stable over a longer period.

5 Summary and Conclusions

Austrian trade in manufacturing has increased in recent years, as have the shares of imports and exports from and to CEECs. Increased imports from countries with a lower wage level have occasionally been identified as a reason for diminishing wage growth for low-wage earners in Austria. Traditional trade models would predict a decline of relative wages for less skilled workers when trade with labor-abundant countries is growing.

Using firm survey data from the European Structure of Earnings Survey (ESES) in 1996 and 2002, we estimated wage regressions including trade variables to assess the impact of trade flows on Austrian wages. We find that manufacturing sector pay declines, the higher the imports of goods typically produced by these sectors from low-wage countries are. Sectors with more imports from high-wage countries or from CEECs pay higher wages on average. The effects work in reverse for exports. Sectors with more exports to low-wage countries pay higher wages and sectors with more exports to high-wage countries pay lower wages; exports to CEECs used to increase wages in 1996, but the effect had dissipated by 2002. The latter change could be interpreted as a result of catching-up, as the effect of CEECs as export markets became more similar to high-wage country effects.

We decomposed the effects of trade into a composition effect and a returns effect to analyze wage changes between 1996 and 2002. The rise in exports to high-wage countries dampened wage growth, and the wage premiums for exporting sectors declined as well, in particular for sectors exporting to high-wage countries or CEECs. This could be interpreted as evidence in favor of the “bazaar economy” hypothesis, which claims that a growing import content of exports reduces domestic value added generated by exports. Wage growth for employees in sectors importing from high-wage countries or CEECs has been reduced.

The changes in the wage distribution between 1996 and 2002 were slightly in favor of higher wage earners, but the contributions of trade to these changes were mostly in the opposite direction. The increasing exports to high-wage countries as well as negative changes in the wage premiums of exporting sectors dampened wage growth for high-wage earners more than for employees below the median. The effect of imports offset the leveling impact of exports somewhat, as the wage premiums for importing sectors declined more strongly for low-wage employees. According to our results, however, the increase in inequality cannot be attributed to the growing international division of labor.

References

- Aiginger, K., R. Winter-Ebmer and J. Zweimüller. 1996.** Eastern European Trade and the Austrian Labor Market. In: *Review of World Economics* 132(3). 476– 500.
- Albrecht, J., A. Björklund and S. Vroman. 2003.** Is There a Glass Ceiling in Sweden? In: *Journal of Labor Economics* 21(11). 145– 177.
- Bayerl, N., O. Fritz, R. Hierländer and G. Streicher. (2008).** Exports, Services and Value Added – A National, International and Regional Analysis for Austria. FIW Research Report 8.
- Borjas, G., R. Freeman and L. Katz. 1997.** How Much Do Immigration and Trade Affect Labor Market Outcomes? *Brookings Papers on Economic Activity* 1. 1– 90.
- Breuss, F. 2007.** Globalization, EU Enlargement and Income Distribution. WIFO Working Paper 296/07.
- Freeman, R. 1995.** Are Your Wages Set in Beijing? In: *Journal of Economic Perspectives* 9(3). 15– 32.
- Feenstra, R. and G. Hanson. 1996.** Globalization, Outsourcing, and Wage Inequality. In: *American Economic Review* 86(2). 240– 245.
- Hofer, H. and P. Huber. 2003.** Wage and Mobility Effects of Trade and Migration on the Austrian Labour Market. In: *Empirica* 30(2). 107– 125.
- Izquierdo, M. and A. Lacuesta. 2006.** Wage inequality in Spain: recent developments. Banco de España Working Paper 0615.
- Koenker, R. and K. Hallok. 2001.** Quantile Regression. In: *Journal of Economic Perspectives* 15(4). 143– 156.
- Krugman, P. 2008.** Trade and Wages, Reconsidered. In: *Brookings Papers on Economic Activity* 1. 103– 154.
- Machado, J. and J. Mata (2005).** Counterfactual decomposition of changes in wage distributions using quantile regression. In: *Journal of Applied Econometrics* 20. 445– 465.
- Martins, P. and P. Pereira. 2004.** Does education reduce wage inequality? Quantile regression evidence from 16 countries. In: *Labour Economics* 11. 355– 371.
- Oaxaca, R. 1973.** Male-Female Wage Differentials in Urban Labor Markets. In: *International Economic Review* 14(3). 693– 709.
- OECD. 2007.** OECD workers in the global economy: increasingly vulnerable? *Employment Outlook* Chapter 3. 105– 156.
- OECD. 2008.** To what level have adults studied? *Education at a glance* Chapter A. 28– 51.
- Sinn, H.-W. 2005.** Die Basar-Ökonomie. Deutschland: Exportweltmeister oder Schlusslicht? Berlin: Econ Verlag.
- Statistics Austria. 2006.** Verdienststrukturerhebung 2002 Struktur und Verteilung der Verdienste in Österreich.
- Wood, A. 1995.** How Trade Hurt Unskilled Workers. In: *Journal of Economic Perspectives* 9(3). 57– 80.

Appendix

Table A1

NACE Industrial Sectors and Their Share of Employees

NACE	Description	1996	2002
		%	
NACE 14	Mining and quarrying	2.5	3.9
NACE 15	Food products and beverages	22.6	17.1
NACE 17	Textiles	5.3	5.0
NACE 18	Apparel and furs	2.3	3.1
NACE 19	Leather, luggage, handbags	1.6	1.8
NACE 20	Wood and cork	8.0	10.6
NACE 21	Pulp and paper	2.8	2.9
NACE 22	Publishing and printing	5.5	6.6
NACE 24	Chemicals	4.7	6.2
NACE 25	Rubber and plastic	6.2	5.8
NACE 26	Other non-metallic mineral products	4.2	5.0
NACE 27	Basic metals	2.2	8.7
NACE 28	Fabricated metal products	15.1	6.6
NACE 29	Machinery and equipment	5.8	5.9
NACE 31	Electrical machinery and apparatus	3.8	3.4
NACE 32	Radio, television and communication equipment	1.8	1.4
NACE 33	Medical, precision and optical instruments	2.2	2.8
NACE 34	Motor vehicles	2.4	1.0
NACE 35	Other transport equipment	0.8	1.9
Total		100	100

Rationality of Post-Accession Migration¹

Katarzyna B. Budnik²

Given large-scale Polish migration to the U.K. following EU enlargement in 2004, this study evaluates market efficiency in sorting Polish-born workers to the locations offering the highest returns to their skills. To establish whether Polish workers that emigrated to the U.K. did so on rational premises, wage regressions are run to identify the wage gains individuals may have expected to realize when migrating and when staying; and the Heckman (1979) self-selection model is used to tie up the migration decision with the decision to work and to identify returns to unobservable skills (e.g. motivation). Whereas the results support the rationality of migration from Poland to the U.K. (those who left gained in nominal and real terms), they are less conclusive about the optimality of staying (some of those who stayed might have earned more abroad). The outcomes suggest that the anticipated wage gains do not fully explain the intensity of observed migration and underline the importance of including nonincome factors, i.e. social costs, in exploring post-accession migration.

1 Introduction

Workers from Central and Eastern European countries (CEECs) that joined the EU in 2004 remain temporarily shut out of most “old” EU countries’ labor markets, given concerns that the large income disparity might facilitate an unprecedented movement of labor from east to west. Only the U.K., Ireland and Sweden introduced an open-door policy right away, followed after some time by Southern European countries and the Netherlands. Even though Germany and Austria, which had expected to attract the highest share of migrants, retain a closed-door policy, the outflow of workers from the CEECs greatly outpaced earlier estimates (Zaiceva, 2006). Thus, EU enlargement in 2004 constituted a “natural experiment” that encourages testing the hypothesis about the rationality of migration choice, i.e. evaluating to what extent migration movements may have been explained by expected earnings differentials.³

While the rationality of internal migration has been verified by a few studies, including Kaun (1970), Tunali (2000) and Dostie and Leger (2006), no study to my knowledge has so far focused specifically on the rationality of EU post-accession cross-border migration. I assess temporary migration from Poland to the U.K. to test whether migration, once barriers to cross-country labor force mobility were removed, improved the welfare of Polish natives by leading to an optimal selection of those staying and those migrating. The underlying data stem from labor force surveys (LFS) conducted in the U.K. and Poland. Although not designed for migration studies, such surveys contain relevant information about skills and wages. Moreover, the survey schedule enables tracking trends and changes over time.⁴

¹ This paper was presented at the OeNB’s Conference on European Economic Integration (CEEI) 2008, which focused on “The Integration of European Labor Markets” and took place in Vienna on November 17–18, 2008.

² Narodowy Bank Polski, Katarzyna.Budnik@nbp.pl. The author would like to thank Bernhard Hammer for research assistance, and Philipp Schmidt-Dengler for valuable comments. The views expressed are those of the author and not necessarily those of Narodowy Bank Polski or the Oesterreichische Nationalbank.

³ Assessing the role of disparities in the expected income differentials in triggering migration might also be restated as examining the validity of the neoclassical view on labor force movements according to which individuals attempt to maximize their anticipated income.

⁴ A more popular approach used in migration research is to merge population census data, as census data usually include more detailed information about individuals and cover larger subsamples of migrants (see Aydemir, 2002; Mishra, 2007; and Chiquiar and Hanson, 2008). For this study, the census approach was not an option, however, as neither Poland nor the U.K. have as yet conducted a population census since EU enlargement in 2004.

To evaluate the rationality of migrate-or-stay decisions, this study measures the wage gain individuals may have expected to achieve by either migrating or staying, given the different pricing of workers' observed and unobserved skills on different labor markets. In addition, the study assesses the difference in the valuation of unobserved skills on the two labor markets among observationally identical individuals, building on the presumption that rational workers with identical observed characteristics should have chosen the location allowing them to maximize their income via higher returns to unobserved skills.

Expected wage differences between countries may be easily derived through consistent estimates of wage regressions. To identify the value of unobserved characteristics, I follow the idea of Tunali (2000), who studied internal migration across Turkish regions. He used the popular Heckman (1979) self-selection scheme, first to arrive at consistent estimates of returns to observable characteristics of workers; and second to establish the expected value of returns to unobservables, which allows an ex post assessment of the impact unobserved heterogeneity had on expected income profiles.⁵

The intuition behind the approach is clear-cut. If earnings depend on observed and unobserved human capital characteristics, assuming unbiased wage anticipations and rational decision-making, individuals should have chosen the option allowing them to reap the highest return to their skills. Two conclusions follow. First, migration propensity assessed ex post should be correlated with returns to the full set of workers' skills. Therefore migration propensity might be used as an instrument in the wage regression controlled for observable characteristics, with a view to rendering consistent estimates of returns to observables. Second, sustaining the assumed correlation between observables and unobservables from the first stage of the Heckman procedure, expected differences in returns to unobservables might be approximated effectively by the difference in correction terms of observationally equivalent individuals.

As wage figures are available only for those employed, it was necessary to deal with the additional problem of nonrandom selection into employment, and in particular with the interdependence of self-selection into employment with self-selection into migration. To alleviate bias problems in wage equation parameter estimates resulting from the simultaneous action of the selection mechanisms, I developed a sequential Probit model of joint selection, where the emigrate-or-stay decision is followed by a labor force participation decision⁶ dependent on labor

⁵ The alternative would have been to adopt a productivity-based approach following Dostie and Leger (2006), who employ data on Canadian physicians and approximate their unmeasured productivity by calculating how much wages deviated from "the average" wages of observationally equal physicians prior to migration decisions. However, the data used in this article delivered insufficient information on past productivity to implement that approach.

⁶ The selectivity issue constitutes the core problems that are usually addressed in empirical studies of migration movements, particularly those that refer to wage data. The issue of self-selection into migration goes back to the article of Borjas (1987; for male U.S. immigrants; Cobb-Clark (1993) delivered corresponding results for women), who showed that the selection of unobservables such as migrants' motivation need not be related to the selection of observables. Among recent studies that explicitly addressed the problem, Constant and Massey (2002) estimated wage equations, controlling them for effects of selective outmigration. Their main concern was to check the robustness of earlier estimates of assimilation effects on wages. Rabe (2006) attempted to measure earnings gains of couples following their decision to migrate to Britain. She studied migration decisions and earnings of couples in Britain in a self-selection framework taking account of double selectivity in couples' mobility and labor participation. The main novelty of the approach used here is that I use the self-selection correction method developed by Heckman not only to arrive at unbiased estimates of the wage regressions but also to identify wage effects tied to unobservable characteristics of individuals.

market-specific factors. Tying up the migration decision with an employment decision seemed a natural extension of Tunali's (2000) approach, as unequal employment probabilities in different destinations may impact the emigration decision.

The contribution of the present study to the existing literature lies in the systematical application of the above rationality tests to (temporary) international migration.⁷ Contrary to earlier works on the rationality of migration, the study explicitly deals with double selectivity regarding migration and employment, thus allowing the sample to include the nonworking population. Finally, as the data structure allows to track the evolution of wage differentials and rationality measures over time, some conclusions may be derived from the evolution of migration, and some forecasts may be formulated on the intensity of future migration flows.

In what follows, the article describes the wage and selectivity model (section 2), defines earnings differentials and rationality measures (section 3) and explains model implementation (section 4). Section 5 provides an overview of the data used, and section 6 an outline of the regression estimates. The main results are presented in section 7 and discussed in section 8. Conclusions close the paper.

2 Model

In the model, individuals are allowed to move freely between the two labor markets and may remain employed or not. The decision to migrate is influenced by the distribution of wage offers and employment prospects on the two markets. Observed wages are denoted as w_0 on the source country labor market and as w_1 on the foreign labor market (where wage rates are given in logarithms). To facilitate understanding of the analysis in the empirical section, observed wages w_M for $M \in \{0,1\}$ are decomposed into three components after Vijverberg (1995):

$$w_M(i) = \mu_M(i) + \eta_M(i) + \varepsilon_M(i) \quad (1)$$

where μ_M is interpreted as the "wage norm" or market-determined average productivity that depends on a worker's education or particular labor market-relevant job experience and is assumed to be observed by workers and econometricians. η_M represents person-specific productivity factors summarizing work attitude or skills and is observed imperfectly by workers and employers but is not observable by econometricians. ε_M is a random variation in productivity and $E(\varepsilon_M) = 0$.

Individuals anticipate having the earnings prospects w_0^* and w_1^* . The star indicates their subjective expectations based on information available when choosing to migrate or not and when taking on a job. If the variables describing a person's observed characteristics are summed up in a vector $x(i)$, then:

$$\mu_M(i) = \alpha_M x(i) \quad (2)$$

⁷ The decision to focus on short-term migration in this study reflects the predominance of temporary movements across EU national borders following enlargement in 2004. Establishing drivers of short-term labor force movements therefore seemed a promising avenue for understanding labor market developments following the removal of immigration restrictions between Poland and the U.K. Second and partly tied to the former point, data on short-term migrants to the U.K. of Polish origin were relatively abundant while the sample of longer-term migrants was significantly smaller, which might have hampered the reliability of results derived for long-term migrants.

where α_M are vectors of wage equation parameters with some set of nonzero elements. Individuals elicit information about η_M on the basis of past realizations of $\eta_M + \varepsilon_M$ under additional assumptions that $\varepsilon_M^* = 0$ and that they know the correlation between the two η_M . The model describes subjective wage expectations of individuals who are aware of the wage distribution in both countries conditional on a given education or work history but have incomplete information about the worth of their nonmeasurable skills. They derive the latter information observing the “smoothing-out” effects that unpredictable events like sickness (contained in ε_M) have had on productivity in the past. An important point is the assumption that individuals who know how much unobservable skills acquired in the past are worth are able to predict the value of their unobservable skills on another labor market. Hence:

$$E(w_M^*(i)) = \alpha_M x(i) + E(\eta_M^*(i)) = \alpha_M x(i) + \eta_M(i) = E(w_M(i)) \quad (3)$$

where E is an expectation operator denoting values expected by econometricians, or:

$$w_M(i) = w_M^*(i) + v_M(i) \quad (4)$$

The prediction error fulfills the condition $E(v_M) = 0$. Unbiasedness of the wage rate predictions, stated in (3), is a strong identifying assumption in the model. Forecast errors of individuals originate in a false assessment of the valuation of unobservable skills.

People who are not employed expect to have a shadow income of b_0^* (on the home labor market) or b_1^* (on the foreign labor market). It is further assumed that the shadow income may be decomposed similarly to (1) and (4), and that individuals know the correlation structure between the valuation of person-specific productivity factors across different labor market states and labor markets.

The probability of being employed depends on individuals’ labor supply decision given their wage prospect w_M^* and fallback position b_M^* , worker selection by employers, and the influence of labor market institutions on matching efficiency. A worker living in M will decide to work if the difference between w_M^* and b_M^* (denoted by δ_M^*) is above zero, or else withdraw from the labor market. Job creation is observed only if the labor supply condition stated above is fulfilled concurrently with the labor demand condition, which is not explicitly specified. The reduced-form employment equation is of the form:

$$V_M(i) = \begin{cases} 1 & \text{if } V_M^*(i) > 0 \\ 0 & \text{if } V_M^*(i) \leq 0 \end{cases} \quad (5)$$

where V_M^* is a latent variable corresponding with the dichotomous outcome of individuals’ V_M actual employment:

$$V_M^*(i) = \beta_M x(i) + \zeta_M(i) \quad (6)$$

and $E(\zeta_M(i)) = 0$.

Individuals will choose to move abroad when the anticipated gain from migration outweighs a plausible gain from staying. Namely:

$$M = \begin{cases} 1 & \text{if } M^* > 0 \\ 0 & \text{if } M^* \leq 0 \end{cases} \quad (7)$$

and the latent variable M^* measuring the propensity to emigrate is expected to be proportional to the expected gain from moving:

$$M^*(i) = (V_1(i)\delta_1^*(i) + b_1^*(i)) - (V_0(i)\delta_0^*(i) + b_0^*(i)) \quad (8)$$

Here, the propensity to emigrate is described as a combination of anticipated shadow incomes and expected labor market-specific surpluses over shadow wages (δ_M^*). Further, I assume that the reduced form of (8) may be expressed as:

$$M^*(i) = \pi x(i) + e(i) \quad (9)$$

The reduced-form equation ignores the nonlinearity of the model expressed in (8) and assumes that the shadow value of migration may be linearized without loss of generality. The advantage of this specification is that it keeps the selectivity model simple while enabling a relatively detailed treatment of the limited transferability of skills and education between countries, as vector x may contain different variables for education or job experience gained in different countries. In line with the mechanism of the model, it follows that employment decisions are generally taken jointly with the location decision. This in turn implies that (5) and (6) have to be estimated jointly with equations (7) and (8) determining the propensity to migrate or stay.

Wages are observed only for those who have joined the labor market and are employed. Therefore:

$$\begin{aligned} E(w_0(i)) &= \alpha_0 x(i) + E(\eta_0(i) + \varepsilon_0(i) \mid M(i) = 0, V_0(i) = 1) \\ &= \alpha_0 x(i) + E(\eta_0(i) \mid M(i) = 0, V_0(i) = 1) \neq \alpha_0 x(i) \end{aligned} \quad (10)$$

$$\begin{aligned} E(w_1(i)) &= \alpha_1 x(i) + E(\eta_1(i) + \varepsilon_1(i) \mid M(i) = 1, V_1(i) = 1) \\ &= \alpha_1 x(i) + E(\eta_1(i) \mid M(i) = 1, V_1(i) = 1) \neq \alpha_1 x(i) \end{aligned} \quad (11)$$

If the above equalities hold, then it would be possible to derive individuals' potential wages based on the actual distribution of wages in each of the two countries and a set of individual characteristics. In fact, unobservable characteristics of individuals are likely to impact not only measured wages but also the probability that wages are actually observed (propensity of a person to be employed). Therefore, the self-selectivity problem may emerge. Information on wages in each of the labor markets that applies to all individuals can be obtained with a migration selection model, controlling for the self-selection mechanism in order to deliver consistent estimates of wage equation parameters.

3 Earnings Differentials and Rationality Measures

In this section a range of measures are developed that illustrate the expected change in income following workers' migrate-or-stay decision.⁸ Importantly, formulas for the anticipated earnings differential or gain are derived for the entire population of workers even though earnings are observed only for those employed.

⁸ In fact, measures of expected income gains from staying developed here, under the salient assumption imposed in the paper that movement costs other than accounted for by wage differentials are insignificant, may also represent income differences in favor of return migrants.

3.1 Earnings Differentials

The income differential in favor of migrants z_1 is defined as income gains expected abroad over income anticipated in the home labor market. It may be expressed as:

$$\begin{aligned} z_1(i) &= E(w_1(i) | M(i) = 1) - E(w_0(i) | M(i) = 0) \\ &= (\alpha_1 - \alpha_0)x(i) + E(\eta_1(i) | M(i) = 1) - E(\eta_0(i) | M(i) = 0) \end{aligned} \quad (12)$$

Similarly, earnings differentials expressing a foregone option for persons that did not migrate z_0 are defined as:

$$\begin{aligned} z_0(i) &= E(w_1(i) | M(i) = 0) - E(w_0(i) | M(i) = 1) \\ &= (\alpha_1 - \alpha_0)x(i) + E(\eta_1(i) | M(i) = 0) - E(\eta_0(i) | M(i) = 1) \end{aligned} \quad (13)$$

Significant differences in α_M across countries are likely to introduce selection in observables (contained in vector x), which should result in different wages for emigrants and stayers. The second component of wage differentials corresponds with the different valuation of individuals' unobserved characteristics. Earnings differentials for employed individuals (for whom wages are observed) closely correspond with a traditional Blinder (1973) and Oaxaca (1973) decomposition of the average wage rate observed in two subpopulations. Here, the Blinder and Oaxaca scheme is useful for distinguishing between the effect of the different distribution of migrants' observed and unobserved characteristics versus different returns to the same characteristics, on different labor markets. Calculating the average wage rates for stayers and migrants (or alternatively, averaging z_1 across individuals) and ignoring nonrandom selection to reporting wages and employment:

$$\begin{aligned} \bar{w}_1 - \bar{w}_0 &= \alpha_1 \bar{x}_1 + E(\eta_1 | M = 1) - (\alpha_0 \bar{x} + E(\eta_0 | M = 0)) \\ &= (\alpha_1(\bar{x}_1 - \bar{x}_0) + (\alpha_1 - \alpha_0) \bar{x}_0 + E(\eta_1 | M = 1) - E(\eta_0 | M(i))) \end{aligned} \quad (14)$$

where $\alpha_1(\bar{x}_1 - \bar{x}_0)$ is part of the wage gap between migrants and stayers that may be explained by differences in their average characteristics (\bar{x}_1 is the vector of average characteristics of migrants and \bar{x}_0 of stayers). $(\alpha_1 - \alpha_0) \bar{x}_0$ is a fraction of the wage gap that may be explained by different returns to characteristics across labor markets, and $E(\eta_1 | M(i) = 1) - E(\eta_0 | M(i) = 0)$ is the average selection-into-migration effect on wages.

3.2 Rationality Measures

Following Tunali (2000) I refer to a set of measures that allow for evaluation of the rationality of migration where rationality is understood as earnings-enhancing behavior of migrating individuals. Here, the framework used by Tunali is extended to allow for a nonemployment outcome that is partly the result of self-selectivity. Thus the rationality of labor force movements between countries can be evaluated for those in jobs as well as – a novel feature of this study – for those out of jobs.

The first measure of rationality compares ex ante optimal and nonoptimal choices, expressing the income individuals stand to gain abroad over the income they would earn at home, and vice versa. The returns to migration κ_1 for employed individuals may therefore be defined as:

$$\begin{aligned} \kappa_1(i) &= E(w_1(i) | M(i) = 1) - E(w_0(i) | M(i) = 1) \\ &= (\alpha_1 - \alpha_0)x(i) + v_1(i) \end{aligned} \quad (15)$$

and returns to staying κ_0 as:

$$\begin{aligned}\kappa_0(i) &= E(w_0(i) | M(i) = 0) - E(w_1(i) | M(i) = 0) \\ &= (\alpha_0 - \alpha_1)x(i) + v_0(i)\end{aligned}\quad (16)$$

Correspondingly, the left-hand expressions in (15) and (16) can be separated as sorting gains from migration and staying (v_1 and v_0):

$$v_1(i) = E(\eta_1(i) | M(i) = 1) - E(\eta_0(i) | M(i) = 1) \quad (17)$$

$$v_0(i) = E(\eta_0(i) | M(i) = 0) - E(\eta_0(i) | M(i) = 0) \quad (18)$$

Rationality implies that the average mover anticipated higher earnings abroad than the average stayer, and vice versa. That interpretation of rationality delivers another measure of rationality, namely the selection of migrants h_1 :

$$\begin{aligned}h_1(i) &= E(w_1(i) | M(i) = 1) - E(w_1(i) | M(i) = 0) \\ &= E(\eta_1(i) | M(i) = 1) - E(\eta_1(i) | M(i) = 0)\end{aligned}\quad (19)$$

and a similarly defined selection of stayers h_0 :

$$\begin{aligned}h_0(i) &= E(w_0(i) | M(i) = 0) - E(w_0(i) | M(i) = 1) \\ &= E(\eta_0(i) | M(i) = 0) - E(\eta_0(i) | M(i) = 1)\end{aligned}\quad (20)$$

4 Model Implementation

The selectivity model described by equations (5), (6), (7) and (9) could be estimated jointly with (11) and (12). However, using Maximum Likelihood methods could prove tedious. We refer instead to Heckman's (1979) two-step selection procedure, which was extended by Behrman, Wolfe and Tunali (1980) and by Tunali (1986) to double selectivity. Here I adjust the method to the observation of employment outcomes on one of the two labor markets only.

The population in the model is defined as Polish-born residents of Poland and the U.K. The first Probit equation, corresponding with (7) and (9), represents the selection of Polish natives into one of the two labor markets. Further equations represent the process governing employment decisions where factors influencing the propensity to be employed in one of the two countries can be heterogeneous:

$$M(i) = \begin{cases} 1 & \text{if } M^* > 0 \\ 0 & \text{if } M^* \leq 0 \end{cases} \quad (21)$$

$$M^*(i) = \pi x(i) + e(i) \quad (22)$$

$$V_M(i) = \begin{cases} 1 & \text{if } V_M^* > 0 \\ 0 & \text{if } V_M^* \leq 0 \end{cases} \quad (23)$$

$$V_M^*(i) = \beta_M x(i) + \varsigma_M(i) \quad (24)$$

V_1 is observed only if $M=1$, and V_0 only if $M=0$. The above equations represent the four mutually exclusive options of employment in Poland, nonemployment in Poland, employment in the U.K., and nonemployment in the U.K. Further, it is assumed that random variation in wage rates ς_M and a random variation in the emigration propensity e are jointly normally distributed with the two covariance matrices:

$$\begin{bmatrix} \sigma_{e_M}^2 & \sigma_{e_M e} & \sigma_{e_M \zeta_M} \\ & \sigma_e^2 & \sigma_{e \zeta_M} \\ & & \sigma_\zeta^2 \end{bmatrix} \quad (25)$$

for $M \in \{0,1\}$. The assumption of normal distribution of errors, similarly to the assumption of unbiasedness of workers' anticipations, constitutes an identifying assumption for the empirical model. Importantly, the correlation coefficient between ζ_0 and ζ_1 remains unidentified in the model due to the inability to jointly observe V_0 and V_1 . In the estimation process, diagonal matrix elements are normalized to 1. The corresponding correlation coefficients between ζ_M and e are denoted by $\rho_0 = \sigma_{e \zeta_0} / \sigma_e^2$ and $\rho_1 = \sigma_{e \zeta_1} / \sigma_e^2$.

Based on the selection mechanism described by (21) to (25), inverse Mills ratios are derived to control wage regressions (and nonwage income regressions) estimated in the next step of the procedure. Assuming that $\rho_0 = \rho_1 = 0$, the inverse Mills ratio would read

$$\lambda_{M=1}(i) = \phi(\pi x(i)) / \Phi(\pi x(i)) \quad (26)$$

for the emigration decision, and

$$\lambda_{M=0}(i) = -\phi(\pi x(i)) / \Phi(-\pi x(i)) \quad (27)$$

for the staying decision.

ϕ is the univariate standard normal density function and Φ the univariate cumulative standard normal distribution function. Selection terms into employment would in turn take the form

$$\lambda_{V_{M=1}}(i) = -\phi(\beta_M x(i)) / \Phi(\beta_M x(i)) \quad (28)$$

The wage regressions for residents of the U.K. and for residents of Poland thus read:

$$E(w_1(i)) = \alpha_1 x(i) + \varphi_{1,1} \lambda_{M=1}(i) + \varphi_{1,0} \lambda_{V_1=1}(i) \quad (29)$$

$$E(w_0(i)) = \alpha_0 x(i) + \varphi_{0,1} \lambda_{M=0}(i) + \varphi_{0,0} \lambda_{V_0=1}(i) \quad (30)$$

where $\varphi_{1,M} = \sigma_{e_1}$ and $\varphi_{0,M} = \sigma_{e_0}$ for $M \in \{0,1\}$. For nonzero correlation between the two selection mechanisms into emigration and employment, relations (26) to (28) are replaced by:⁹

$$\lambda_{1,1} = \phi(\beta_1 x(i)) \Phi\left(\frac{\pi x(i) - \rho_1 \beta_1 x(i)}{(1 - \rho_1^2)^{1/2}}\right) F(\pi x(i), \beta_1 x(i), \rho_1)^{-1} \quad (31)$$

$$\lambda_{1,0} = (\phi(\pi x(i)) \Phi\left(\frac{\beta_1 x(i) - \rho_1 \pi x(i)}{(1 - \rho_1^2)^{1/2}}\right) F(\pi x(i), \beta_1 x(i), \rho_1)^{-1} \quad (32)$$

$$\lambda_{0,1} = (\phi(\beta_0 x(i)) \Phi\left(-\frac{\pi x(i) - \rho_0 \beta_0 x(i)}{(1 - \rho_0^2)^{1/2}}\right) F(-\pi x(i), \beta_0 x(i), -\rho_0)^{-1} \quad (33)$$

⁹ Derivations can be obtained from the author upon request.

$$\lambda_{0,0} = -(\phi(\pi x(i))\Phi\left(\frac{\beta_0 x(i) - \rho_0 \pi x(i)}{(1 - \rho_0^2)^{1/2}}\right)F(-\pi x(i), \beta_0 x(i), -\rho_0))^{-1} \quad (34)$$

where F is a bivariate cumulative standard normal distribution function. However, selection terms in (31) to (34) do not allow for a straightforward interpretation of effects on wages of self-selection into emigration (corresponding with λ_1) and into employment (corresponding with λ_{V_1}). Let $\chi_{1,1}$, $\chi_{1,0}$, $\chi_{0,1}$ and $\chi_{0,0}$ be parameters of the wage equations defined as below:

$$E(w_1(i)) = \alpha_1 x(i) + \chi_{1,1} \lambda_{1,1}(i) + \chi_{1,0} \lambda_{1,0}(i) \quad (35)$$

$$E(w_0(i)) = \alpha_0 x(i) + \chi_{0,1} \lambda_{0,1}(i) + \chi_{0,0} \lambda_{0,0}(i) \quad (36)$$

Then the estimated regressions (35) and (36) may be rewritten as in (29) and (30) with $\lambda_{M=1} = \lambda_{1,1} + \rho_1 \lambda_{1,0}$; $\lambda_{M=0} = \lambda_{0,1} + \rho_0 \lambda_{0,0}$; $\lambda_{V_1=1} = \lambda_{1,0}(i) + \rho_1 \lambda_{1,1}$ and $\lambda_{V_0=1} = \lambda_{0,0} + \rho_0 \lambda_{0,1}$. The parameters φ are functions of correlation coefficients ρ_1 and ρ_0 and selection regressions parameters. They might be derived based on wage regression estimates as:

$$\varphi_{1,1} = \frac{\chi_{1,1} - \rho_1 \chi_{1,0}}{1 - \rho_1^2} \quad (37)$$

and:

$$\varphi_{1,0} = \frac{\chi_{1,0} - \rho_1 \chi_{1,1}}{1 - \rho_1^2} \quad (38)$$

$$\varphi_{0,1} = \frac{\chi_{0,1} - \rho_0 \chi_{0,0}}{1 - \rho_0^2} \quad (39)$$

and:

$$\varphi_{0,0} = \frac{\chi_{0,0} - \rho_0 \chi_{0,1}}{1 - \rho_0^2} \quad (40)$$

Tests of rationality were conducted based on model parameter estimates as well as derived predictions. See the appendix for a summary of the formula used to derive measures of “wage gaps” needed to test the income-maximizing behavior of Polish-born workers.

Separate Probit regressions were specified to alleviate biases in wage regressions originating in nonreporting of wages by some of individuals. On the assumption that nonreporting is not correlated with employment or migration decisions, we were able to derive separate Mills ratios.

5 Data

The sample used in the empirical section is based on labor force surveys (LFS) conducted between Q1 2004 and Q1 2008. It is restricted to working-age individuals and, in the case of Polish migrants, truncated to those staying abroad for less than three years because the main focus of the paper is on the rationality of short-term migration. Multiple observations – resulting from the fact that households selected for LFS are interviewed five quarters in a row in the U.K.¹⁰; and

¹⁰ Unlike the Polish LFS, the U.K. survey covers not only residents living in individual households but also students living in residence halls and people living in National Health Services accommodation.

twice for two consecutive quarters, with an annual break, in Poland – were dropped from the sample as they would have violated the identical and independent (i.i.d.) assumption. Taking into account that in the U.K. LFS, wages are reported in the first and the fifth wave only, the U.K. sample was restricted to individuals interviewed either in the first wave, or in the fifth wave if the corresponding observation for the first wave was missing. The Polish sample was restricted to observations from the first and third wave, to mimic the annual break between the first and fifth wave in the U.K. scheme. The sample thus covers over 172 000 working-age Polish natives, of which less than 1500 were British residents (constituting under 1% of the total sample).¹¹

5.1 Descriptive Analysis of Variables

In the U.K., the employment rate of Polish-born workers was almost twice as high as in Poland (83% versus 55%). U.K. residents tended to be employed in service sectors like trade, hotels and transport, whereas those who stayed in Poland more often had jobs in smaller enterprises, in agriculture and public services (public administration, healthcare, education). Migrants to the U.K. also tended to be younger than stayers (mean age of 28 years versus over 38 years). Migrant men marginally outnumbered migrant women. There were significantly fewer disabled persons among migrants (less than 2%) than among stayers (around 10%). Migrants

Table 1a

Data Description for Selection Model

Statistics	Pooled				Polish residents				British residents			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max
U.K. residence	0.005	0.093	0	1								
Employment	0.556	0.497	0	1	0.553	0.497	0	1	0.832	0.374	0	1
Male	0.505	0.5	0	1	0.508	0.5	0	1	0.558	0.497	0	1
Age	38.465	13.384	16	64	38.561	13.385	16	64	28.064	7.454	16	55
Disability	0.101	0.301	0	1	0.101	0.302	0	1	0.0174	0.131	0	1
Married	0.626	0.484	0	1	0.628	0.483	0	1	0.382	0.486	0	1
Number of kids	0.22	0.659	0	11	0.22	0.66	0	11	0.146	0.461	0	3
Number of kids under 5 years	0.053	0.259	0	5	0.053	0.259	0	5	0.076	0.295	0	2
Number of kids over 4 years	0.167	0.547	0	7	0.168	0.548	0	7	0.07	0.323	0	3
Time of residence	0.012	0.153	0	3					1.366	0.908	0	3
Higher education	0.124	0.33	0	1	0.124	0.33	0	1	0.095	0.299	0	1
Postsecondary education	0.25	0.431	0	1	0.249	0.432	0	1	0.297	0.235	0	1
Secondary education	0.097	0.294	0	1	0.095	0.294	0	1	0.23	0.261	0	1
Vocational education	0.31	0.461	0	1	0.311	0.463	0	1	0.183	0.176	0	0.738
Primary education	0.22	0.414	0	1	0.22	0.414	0	1	0.15	0.393	0	1
Years in education	12.082	3.649	1	27	12.077	3.654	1	27	12.624	3.066	3	27
Number of observations	163,728				162,290				1,438			

Source: Author's calculations

¹¹ Information on Polish migrants in the U.K. collected in the LFS may be impaired by plausibly limited coverage of migrant workers in the survey. This may reflect migrants' unsatisfactory English proficiency, interviewers' reluctance to enter marginal neighborhoods or the design of the sampling scheme, which accommodated changes in the population structure following introduction of the open-door policy in 2004 only with a certain lag. Evidence on the representativeness of LFS migrant data in Ireland recently documented by Barrett and Kelly (2008), even though not yet reproduced for the U.K., provided a positive valuation of the LFS data for migration research.

were also less frequently married, and less frequently reported having dependent children. Migrants were better qualified on average. Among migrants, there were fewer workers with primary or vocational education but also fewer workers with higher education; most migrants had achieved secondary or postsecondary education (including secondary vocational education). For detailed descriptive statistics, see tables 1a and 1b.

Table 1b

Data Description for Wage Regressions

Statistics	Pooled				Polish residents				British residents			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max
U.K. residence	0.01	0.102	C	1								
Employment	0.428	0.495	C	1	0.424	0.494	0	1	0.819	0.385	0	1
Reporting wages	0.781	0.4132	C	1	0.782	0.412	0	1	0.733	0.443	0	1
ln(Nominal wage rate)					6.968	0.513	3.689	9.616	6.762	0.416	3.075	8.365
Male	0.496	0.5	C	1	0.496	0.5	0	1	0.55	0.498	0	1
Age	38.127	14.016	16	64	38.234	14.03	16	64	28.061	7.554	16	59
Disability	0.1	0.301	C	1	0.101	0.302	0	1	0.017	0.131	0	1
Married	0.626	0.484	C	1	0.628	0.483	0	1	0.382	0.486	0	1
Number of kids	0.22	0.659	C	11	0.22	0.66	0	11	0.146	0.461	0	3
Number of kids below 5 years	0.053	0.259	C	5	0.053	0.259	0	5	0.076	0.295	0	2
Number of kids over 4 years	0.167	0.547	C	7	0.168	0.548	0	7	0.07	0.323	0	3
Time of residence in the U.K.	0.012	0.153	C	3					1.366	0.908	0	3
Higher education	0.124	0.33	C	1	0.124	0.33	0	1	0.099	0.299	0	1
Postsecondary education	0.25	0.431	C	1	0.249	0.436	0	1	0.297	0.235	0	1
Secondary education	0.097	0.294	C	1	0.095	0.294	0	1	0.23	0.261	0	1
Vocational education	0.31	0.461	C	1	0.311	0.463	0	1	0.183	0.176	0	0.738
Primary education	0.253	0.435	C	1	0.254	0.435	0	1	0.196	0.397	0	1
Years in education	12.114	4.481	1	57	12.103	4.494	1	57	13.128	2.949	3	40
Total job experience in years	19.539	14.005	C	52	19.656	14.007	0	52	8.472	8.154	0	42
U.K. job experience in years									1.242	0.925	0	3
Duration of current employment relation in years	10.304	10.063	C	50.167	10.496	10.073	0	50.167	0.881	0.826	0	7
Number of observations	163,728				162,290				1,438			

Source: Author's calculations.

5.2 Comparability of Information on Education Levels

More than 60% of Polish residents in the U.K. reported education levels other than the categories used in the Polish survey (higher education or more, postsecondary education or secondary vocational education, secondary education, vocational education, primary education or less¹²). For persons who reported “other” education, an imputation procedure was run, using data on Polish migrants to the U.K. from the Polish household survey, which is conducted concurrently with the LFS survey and also covers former residents now living abroad but still affiliated with the household. This survey provides a crude set of emigrants’ characteristics, such as age and education level. A key advantage of using the sample is its lack of redundancy with the data used in the further analysis.

¹² Qualifications earned in the U.K. based on ISCED 97 categorization were aligned with the above categories.

On the assumption that those reporting “other” education were in one of the three “middle” education groups, i.e. postsecondary or secondary vocational education, secondary education and vocational education, the data from the Polish household survey were used to run multivariate Probit regressions where the dependent variable took different values for persons in the three different education groups. Regressions were run on respondents’ age and gender as well as on the year of the survey variables, accounting for interaction between them. The estimated regression was next used to predict the odds with which those reporting “other” education were in one of the three educational groups that replaces values for individuals’ dummy variables representing different levels of education.

The imputation procedure may have introduced a bias into the final results. Moreover, it does not deal with a plausible misclassification of the education level of workers for whom an ISCED 97 education level was reported. To check the robustness of the results (on regression estimates as well as on the evaluation of rationality of migration) alternative specifications of regressions were therefore introduced with an education level approximated by years in education.

6 Model Estimates

6.1 Independent Selection into Emigration and Employment

When the three selection equations – selection into emigration; selection into employment for Polish residents; selection into employment for Poles resident in the U.K. (see table 2, columns 1 to 3) – are estimated separately, men are not found to have a significantly higher propensity to emigrate than women. The propensity to emigrate was highest for those around 30 to 35 years and falling for older workers. The propensity to emigrate increased with the level of education. Emigrants were more often single than married and less probable to report the presence of dependent children in their household.

Regarding the propensity to work, most of the variables in the U.K. Probit proved to be insignificant, which may reflect the significantly narrower sample of migrants that hinders statistical inference about model parameters. This notwithstanding, most of the characteristics tested were found to have similar effects on labor market participation in Poland and in the U.K. The propensity to work was highest for individuals aged 40 to 45. Disability and the presence of dependent children in a household reduced the probability of staying in employment. Interestingly, the presence of dependent children had a stronger negative effect on the working propensity of Poles living in the U.K. than of Polish residents, possibly reflecting the lower availability of childcare of any kind for migrants. Males were characterized by a higher propensity to work than females, even more so if they were married. A higher education level had a positive impact on working activity in Poland, but it proved to be insignificant for Poles staying abroad. In fact, the results correspond with a loss of a relative edge that better educated workers had over less skilled workers on the home labor market when migrating. Consistent with expectations, a longer stay in the U.K. increases the probability of being employed.

Table 2

Selection into Emigration and Employment

Variable	U.K. residence	Employment: Polish residents	Employment: U.K. residents	U.K. residence	Employment: Polish residents	Employment: U.K. residents
	Separate estimates			Joint estimates		
Male	0.124*** (0.029)	0.172*** (0.027)	0.459*** (0.133)	0.119*** (0.029)	0.183*** (0.029)	0.32*** (0.158)
Married	-0.156*** (0.036)			-0.151*** (0.036)		
Male*married		0.505*** (0.031)	0.185 (0.167)		0.468*** (0.031)	0.217 (0.140)
Disability	-0.402*** (0.088)	-1.092*** (0.033)	-0.579** (0.285)	-0.427*** (0.088)	-1.131*** (0.035)	-0.253 (0.319)
Number of kids	-0.129*** (0.026)			-0.122*** (0.026)		
Number of kids under 5 years		-0.130*** (0.036)	-1.333*** (0.141)		-0.148*** (0.036)	-0.992*** (0.321)
Number of kids over 4 years		-0.052*** (0.018)	-0.512*** (0.120)		-0.045** (0.018)	-0.339** (0.167)
Age	0.172*** (0.012)	0.283*** (0.006)	0.262*** (0.049)	0.170*** (0.012)	0.281*** (0.007)	0.117 (0.094)
Age ²	-0.002*** (0.000)	-0.003*** (0.000)	-0.004*** (0.001)	-0.002*** (0.000)	-0.003*** (0.000)	-0.002 (0.001)
Higher education	1.133*** (0.233)	1.427*** (0.119)	0.829 (0.656)	1.063*** (0.238)	1.430*** (0.133)	0.137 (0.707)
Postsecondary education	1.672*** (0.146)	1.343*** (0.085)	1.194 (1.108)	1.563*** (0.147)	1.057*** (0.109)	-0.169 (1.071)
Secondary education	1.006*** (0.145)	0.280*** (0.097)	1.758** (0.711)	0.875*** (0.143)	0.357*** (0.106)	0.991 (0.792)
Vocational education	0.482*** (0.159)	1.169*** (0.086)	-1.268 (1.306)	0.492*** (0.164)	1.241*** (0.088)	-1.316 (1.086)
Age*higher education	-0.044*** (0.007)	-0.008*** (0.003)	-0.023 (0.021)	-0.042*** (0.007)	-0.010 (0.003)	0.003 (0.023)
Age*postsecondary education	-0.055*** (0.005)	-0.020*** (0.002)	-0.063 (0.044)	-0.051*** (0.005)	-0.013*** (0.002)	-0.008 (0.042)
Age*secondary education	-0.024*** (0.005)	-0.000*** (0.002)	-0.035 (0.024)	-0.019*** (0.005)	-0.003 (0.003)	-0.019 (0.023)
Age*vocational education	-0.026*** (0.005)	-0.021*** (0.002)	0.050 (0.037)	-0.026*** (0.005)	-0.024*** (0.002)	0.049 (0.031)
Time of residence in the U.K.			0.409*** (0.143)			0.345** (0.138)
Time of residence in the U.K. ²			-0.071 (0.049)			-0.060 (0.043)
Constant	-3.994*** (0.186)	-5.576*** (0.107)	-3.652*** (0.783)	-3.940*** (0.186)	-5.620*** (0.117)	-0.375 (1.875)
Correlation coefficient		C	C		-0.388** (0.175)	-0.625** (0.300)
Number of observations	25,666	24,228	1,438	25,663		
LR χ^2	1711.1E	9,015.79	288			
AIC	9,401.08E	24,309.39	1,051.3	34,903.7E		
BIC	9,523.382	24,438.92	1,146.178	35,319.57		
Pseudo R ²	0.1544	0.2708	0.221			

Source: Author's calculations.

Note: *** = statistically significant at the 1% level and ** = statistically significant at the 5% level. Key to abbreviations: LR = likelihood ratio; AIC = Akaike's information criterion; BIC = Bayesian information criterion.

6.2 How Results Change when Emigration Decisions are Interrelated with Employment Decisions

To account for interdependence between emigration and employment decisions, trivariate Probit regressions with partial observability were estimated using the Simulated Maximum Likelihood method (see table 2, columns 4 to 6). I referred to the Geweke-Hajivassiliou-Keane (GHK) simulator of multivariate normal probabilities along the lines proposed by Cappellari and Jenkins (2006). Identification of multivariate Probit is assured by a set of exclusion restrictions imposed already while running Probit equations separately. The emigration decision is assumed to depend on individuals' civil status, with marital status in the equation approximating the costs of separation or joint migration (which are assumed to be symmetrical for men and women). The employment propensity equations exclude the marital status variable and include a dummy for married men only. Female labor market participation is assumed to be influenced by the presence of children in a household but not by marital status. Still, married males can be expected to have a higher propensity to work than single men. Finally, the duration-of-stay variable is present only in the U.K. employment propensity equation. To save on calculation time, only a randomly drawn 15% subsample of stayers (but the complete subsample of migrants) was used in the process estimation.

The correlation between factors influencing the employment and migration decision but not included in the regressions was significant. Those who were more likely to stay were also more likely to become employed on the home labor market as indicated by the negative estimate of ρ_0 (-0.38). In turn, individuals with a high propensity to emigrate, after controlling for observable characteristics, had a significantly lower propensity to become employed in the U.K. (negative estimate of ρ_1 of -0.63). The significant correlation of residuals across equations justifies the use of joint estimation methods.

The estimates of emigration and of employment-in-Poland equations do not differ significantly between single Probit and trivariate Probit specifications. Some differences can be pinpointed only for the estimated employment-in-the-U.K. regression parameters. The basic difference lies in a loss of explanatory power by age variables. If anything, the estimates indicate that those who are most probable to work in the U.K. are somewhat younger than those who would be most probable to work in Poland. The standard errors of estimates of variables tied to education also increase, lending stronger support to the hypothesis that they do not provide significant information about the propensity to work in the U.K. (given the decision to migrate). The effect the presence of children in a household has on women's labor market activity is slightly lower than the results from independently run Probit regressions for U.K. employment participation.

Results showing age and education variables to be insignificant in the U.K. employment regression are supported by an alternative specification of the model approximating education levels by years spent in education. That specification saves on degrees of freedom, which is helpful as the sample of Polish migrants is relatively small. These results (not included in the article) broadly confirm the pattern found in the baseline model. Although not only age but also the education (and interaction) variables enter significantly the independently run regression for propensity to work in the U.K., they lose their explanatory power once the three model equations are estimated simultaneously. The outcomes suggest that above

all those with higher employment chances in the destination country opted for migration.

6.3 Accounting for the Propensity to Report Wages

High income earners and individuals more likely to earn at least part of their income in the shadow economy were presumed to be more reluctant to report their earnings. Therefore the propensity to report wages was regressed on a range of variables like gender, education and labor market experience that could have a significant impact on wages; and moreover on variables referring to the unit in which an interviewed person was employed.¹³ As expected, the personal characteristics which were most likely to positively affect wages were negatively correlated with the propensity to report wages for Polish residents. Firm size and industry mattered also with those employed in small enterprises and/or services, which had a lower probability to report wages. In fact, the Probit regression for Poland described the probability to report wages well with a pseudo R^2 of almost 64%. The results are less clear for the propensity to report wages in the U.K. Most variables included in the regression proved statistically insignificant. The propensity to report wages could be systematically linked mostly to firm and sector characteristics. In line with expectations, those employed in small enterprises indicated a lower probability to report wages than those in larger units. Employment in the trade sector could also lower the propensity to emigrate. Although all independent variables are jointly significant (as indicated by likelihood tests), the fit of the regression as described by R^2 statistics is rather poor (with only 4% of variation in the dependent variable explained by the regressors).

6.4 Wage Equations

The estimated wage regressions, based on variables relating to education and labor market experience other than those used in the selection equations, were run on nominal monthly wage rates expressed in national currency. To account for a plausible trend in the dependent variable, time dummies were added. To control for the effect of firm-specific experience on earnings, the duration of stay with the present employer was included. To control for different working hours, the number of hours worked (in the reference week) enters the wage regressions in both linear and squared form. The specification of the wage regressions was kept as simple as possible to ensure close correspondence across countries and facilitate counterfactual predictions. Therefore, wage equations contain (almost) no region- or employer-specific variables, which would be difficult to impute in counterfactual routes. In fact, the absence of variables describing regional or employer choices by Polish-born workers would imply that additional emigrating or staying workers are expected to display “the average” behavior of emigrants or stayers observed in the period.

The specifications for education and labor market experience are more detailed in the case of the U.K. (see table 3). I distinguish between total labor market experience (approximated by years since finishing education) and country labor market experience (approximated either by years since finishing education if a

¹³ Estimates may be obtained from the author upon request.

Wage Regressions

	ln(Nominal wage rate): Polish residents	ln(Nominal wage rate): U.K. residents	ln(Nominal wage rate): Polish residents	ln(Nominal wage rate): U.K. residents	ln(Nominal wage rate): Polish residents	ln(Nominal wage rate): U.K. residents
Male	0.254*** (0.004)	0.173*** (0.032)	0.177*** (0.006)	0.148*** (0.038)	0.130*** (0.005)	0.134*** (0.033)
Disability	-0.234*** (0.012)	-0.252** (0.112)	0.015 (0.018)	-0.325*** (0.122)	0.042** (0.017)	-0.229* (0.117)
Total job experience in years	0.034*** (0.001)	0.002 (0.009)	-0.001 (0.002)	0.018* (0.011)	-0.028*** (0.002)	-0.013 (0.014)
U.K. job experience in years		0.035 (0.050)		-0.052 (0.052)		-0.051 (0.052)
Total job experience in years ²	-0.001*** (0.000)	-0.000 (0.000)	0.001** (0.000)	-0.001*** (0.000)	0.000*** (0.000)	-0.000 (0.000)
U.K. job experience in years ²		-0.011 (0.016)		0.007 (0.017)		0.011 (0.017)
Higher education	1.011*** (0.018)	0.031 (0.086)	0.484*** (0.034)	0.114 (0.100)		
Postsecondary education	0.545*** (0.017)	0.057 (0.137)	0.188*** (0.026)	0.347* (0.159)		
Secondary education	0.567*** (0.020)	-0.001 (0.091)	0.347*** (0.023)	0.185 (0.117)		
Vocational education	0.405*** (0.017)	0.145 (0.186)	0.103*** (0.024)	0.166 (0.183)		
Years in education					0.026*** (0.002)	0.020** (0.010)
Total job experience in years*higher education	-0.006*** (0.001)	0.028*** (0.008)	0.010*** (0.001)	0.007 (0.011)		
Total job experience in years*postsecondary education	-0.007*** (0.001)	0.000 (0.015)	0.003*** (0.001)	-0.010 (0.015)		
Total job experience in years*secondary education	-0.009*** (0.001)	-0.005 (0.007)	-0.002** (0.000)	-0.014* (0.008)		
Total job experience in years*vocational education	-0.010*** (0.001)	-0.006 (0.011)	-0.001 (0.001)	-0.035*** (0.012)		
Total job experience in years*years in education					0.001*** (0.000)	0.001*** (0.001)
Duration of current employment relation in years	0.020*** (0.001)	0.116*** (0.043)	0.019*** (0.001)	0.105** (0.043)	0.021*** (0.001)	0.117*** (0.042)
Duration of current employment relation in years ²	-0.000*** (0.000)	-0.029** (0.016)	-0.000*** (0.000)	-0.025 (0.016)	-0.000*** (0.000)	-0.032** (0.016)
λ_M			-0.358*** (0.048)	-0.503*** (0.116)	-0.308*** (0.052)	-0.491*** (0.143)
λ_{VM}			-0.015 (0.075)	0.328** (0.140)	0.166*** (0.073)	-0.069 (0.132)
λ_{REP}			-0.181*** (0.006)	0.284** (0.125)	-0.193*** (0.007)	0.277** (0.127)
Constant	4.884*** (0.022)	6.346*** (0.108)	5.679*** (0.049)	5.225*** (0.315)	5.833*** (0.052)	5.687*** (0.298)
Number of observations	41,760	801	41,760	801	41,760	801
F	1,674.26	19.299	1,545.03	31.352	1,725.44	39.553
AIC	38,171.33	6,821.121	37,052.91	6,547.717	40,537.92	6,499.453
BIC	38,352.76	7,945.727	37,260.26	7,781.29	40,693.43	7,483.483
Adj-R ²	0.4449	0.2322	0.4596	0.2607	0.4125	0.2597

Source: Author's calculations

Note: *** = statistically significant at the 1% level; ** = statistically significant at the 5% level; and * = statistically significant at the 10% level. Key to abbreviations LR = likelihood ratio; AIC = Akaike's information criterion; BIC = Bayesian information criterion.

person attended school in the U.K. or years since arrival if not). Moreover, a dummy variable is added for the presence of U.K. education if information on the duration of stay and year of graduation of a Polish immigrant in the U.K. indicates that an individual attended school or university in the U.K. The separate treatment of foreign labor market experience and education was inspired by previous results on the limited transferability of human capital between countries. Friedberg (2000) found significant differences to returns to source and host country education among Russian immigrants in Israel. Chiswick and Miller (2005, 2007) showed that those with foreign education and experience are at a disadvantage of those with human capital endowment acquired on the host labor market. Sanroma et al. (2008) provided similar evidence for immigrants in Spain.

Estimates of the wage regression parameters are generally similar for regressions non-accounting and accounting for selection effects (columns 1 and 3 of table 3) and with selection effects accounted for (column 3). In Poland, men earned more than women. Wages increased both with years of total and firm-specific experience. Once the wage regression is controlled for unobserved characteristics of workers, the effect of education on earnings appears slightly lower, even though increasing (and not decreasing) with years of experience for those in upper education groups. The selection term to staying is significantly different from zero, which implies a selection bias due to endogenous selection into staying. Interestingly, selection into employment does not enter the regression significantly, reflecting the strong correlations between two controlling variables. It follows that skills which increased employment probability should have remained in close relation with skills which outweighed the location decision of workers in favor of staying in their native country. Signs of the coefficient on the Mills ratio controlling regression for selective nonreporting of wages indicate that the higher income workers tended not to report wages.

In regressions on U.K. wages, without and with controlling for selection effects respectively (see columns 2 and 4 of table 3), country-specific variables on education and experience are statistically insignificant. However, at the same time the estimates indicate that the wage rate of Polish immigrants was a strongly increasing function of time spent in current employment, and the effect of firm-experience on wages was much more pronounced in the U.K. than in Poland. These results might be driven by strong correlation between country-specific and firm-specific experience of short-term migrants. The sample covers Polish born immigrants who arrived in the U.K. not earlier than three years before the reference week (most of the respondents had been staying in the U.K. for much longer at the time the interview was conducted). The time in current employment could simply overtake the joint effect of firm- and country specific-experience.

Similarly to the results on Polish wages, being a male had a positive impact on the wage earned by an employed. A positive impact of total experience on wages could be identified only in the specification where the endogeneity of the staying and working choice was explicitly taken into account. Returns to education for Polish immigrants seemed to be lower than returns to education at the source labor market. Still, immigrants with lower education earned less than the better educated, mostly due to age-related depreciation of their skills.

Interestingly there were meaningful differences in the pattern of dependency of wages on the number of hours worked on the two labor markets. Earnings increased monotonously with the number of hours worked in the U.K. but started to decrease after crossing a threshold of around 60 hours in Poland. On the one hand, this may reflect national differences in income taxation (and different degrees of tax avoidance for migrants and stayers). On the other hand, this suggests a stronger incentive to work more in the U.K. than in Poland. Finally, wages of Polish immigrants to the U.K. were roughly stable throughout 2004 to 2008 while continuing to trend upward in Poland.

6.5 Counterfactual Routes

Comparing earnings of migrants and stayers with measures that exploit counterfactual routes required a number of assumptions. In all predictions the number of hours worked is set to 40. Predictions are run on a selection term to reporting wages, with employment set to zero. Hence, for those reporting income and employment, predictions are systematically biased, even though they remain unbiased for the whole population of workers. These assumptions might be classified as normalization of predictions run on the estimated wage regressions.

Running counterfactual predictions also required taking assumptions about variables that are observed neither for migrants nor for stayers. These assumptions might have had a nonnegligible impact on final results, therefore we evaluate their robustness in the next section. It is assumed that migration or return migration is coupled with a depreciation of firm-specific human capital. Polish residents are assumed to have no firm-specific experience when entering the U.K. labor market, and no U.K.-specific experience, where the U.K. experience is fully portable.

Given my focus on short-term migration, assumptions taken in counterfactual routes were aimed at delivering “average” gains or losses from migrating or staying when the decision is made sequentially and independently in each period. Still, the measurement of wages expected at the point of entering the labor market in counterfactual predictions might be judged as unsatisfactory. I further discuss that issue in the next section and check the robustness of results to different assumptions about the time horizon taken into consideration by Polish workers when choosing a place of residence.

Measures of relative income and measures of rationality are expressed in nominal and real terms. Wage differences expressed in nominal terms might be thought to better correspond with the problem of rationality of temporary migration. However some share of migrants’ income is supposed to cover the cost of living that depends on the host economy price level. Measures expressed in nominal and real terms might therefore be thought of as the “brackets” for the actual gains from migration (or staying). To calculate nominal measures, income on both labor markets is recalculated to euro. Measures in real terms are derived with reference to purchasing power parity (PPP) data and ratios of GDP deflator to private consumption deflator for the U.K. and Poland from the AMRO database.

Table 4

Wage Differentials Measured in Nominal Terms

Migrants

Year	Earnings differences in observables	Earnings differential in favor of migrants (ex ante optimal)	Earnings differential in favor of migrants (ex ante nonoptimal)	Returns to migration	Sorting gains into migration	Selection into migration	Number of observations
2004	1.782 (0.253)	2.521 (0.293)	1.036 (0.321)	1.910 (0.249)	0.128 (0.044)	0.874 (0.210)	66
2005	1.626 (0.235)	2.331 (0.283)	0.923 (0.259)	1.752 (0.225)	0.125 (0.036)	0.825 (0.186)	182
2006	1.548 (0.253)	2.270 (0.292)	0.832 (0.281)	1.678 (0.236)	0.130 (0.040)	0.846 (0.197)	359
2007	1.458 (0.281)	2.190 (0.330)	0.725 (0.293)	1.587 (0.260)	0.129 (0.042)	0.862 (0.212)	570
2008	1.075 (0.239)	1.818 (0.272)	0.335 (0.275)	1.205 (0.219)	0.131 (0.042)	0.870 (0.196)	154
Pooled	1.477 (0.309)	2.204 (0.345)	0.752 (0.333)	1.606 (0.294)	0.129 (0.041)	0.854 (0.203)	1,331

Stayers

2004	1.990 (0.625)	2.793 (0.604)	1.169 (0.731)	-1.837 (0.608)	0.153 (0.099)	-0.668 (0.257)	28,198
2005	1.884 (0.650)	2.673 (0.611)	1.074 (0.778)	-1.732 (0.638)	0.152 (0.098)	-0.658 (0.269)	30,759
2006	1.733 (0.674)	2.518 (0.621)	0.961 (0.794)	-1.602 (0.662)	0.131 (0.089)	-0.641 (0.253)	32,361
2007	1.643 (0.698)	2.436 (0.642)	0.861 (0.823)	-1.505 (0.686)	0.134 (0.091)	-0.648 (0.261)	27,433
2008	1.333 (0.709)	2.131 (0.648)	0.531 (0.852)	-1.190 (0.699)	0.143 (0.096)	-0.658 (0.279)	7,108
Pooled	1.785 (0.686)	2.578 (0.644)	0.989 (0.802)	-1.643 (0.672)	0.142 (0.095)	-0.654 (0.261)	125,859

Source: Author's calculations

7 Results

7.1 Wage Differentials Explained by Observables

The earnings differentials in observables (see tables 4 and 5, column 1) would be a valid measure of rationality if migrants and stayers were randomly drawn from the native Polish population. Hence, this “wage gap” measure cannot be directly used as a basis for rationality testing but might imply the character of selection of emigrants and stayers in observables.

The market value of observable skills and characteristics of the average migrant was 140% higher in nominal terms and around 80% higher in real terms in the U.K. than in Poland. Returns from migration to observable characteristics of those who stayed in Poland would be even higher (160% in nominal terms and 90% in real terms respectively). The income of a randomly drawn Polish born worker might have been expected to roughly double after moving from Poland to the U.K.

Chart 1 plots the wage differentials in favor of migrants for employed Polish and U.K. residents, and chart 2 illustrates the corresponding returns to staying (see page 77). Returns to observables in nominal terms were significantly higher for all Polish workers abroad than at home. Only less than 2% of those who stayed

Wage Differentials Measured in Real Terms

Migrants

Year	Earnings differences in observables	Earnings differential in favor of migrants (ex ante optimal)	Earnings differential in favor of migrants (ex ante nonoptimal)	Returns to migration	Sorting gains into migration	Selection into migration	Number of observations
2004	0.977 (0.250)	1.717 (0.281)	0.232 (0.330)	1.106 (0.246)	- 0.676 (0.071)	0.759 (0.209)	66
2005	0.920 (0.234)	1.625 (0.281)	0.216 (0.260)	1.045 (0.224)	- 0.581 (0.041)	0.710 (0.187)	182
2006	0.842 (0.252)	1.564 (0.292)	0.126 (0.281)	0.972 (0.236)	- 0.576 (0.042)	0.693 (0.198)	359
2007	0.781 (0.276)	1.512 (0.324)	0.048 (0.291)	0.910 (0.255)	- 0.548 (0.056)	0.699 (0.211)	570
2008	0.575 (0.239)	1.314 (0.272)	- 0.165 (0.275)	0.705 (0.219)	- 0.374 (0.042)	0.807 (0.196)	154
Pooled	0.802 (0.277)	1.529 (0.316)	0.077 (0.304)	0.931 (0.260)	- 0.546 (0.085)	0.714 (0.206)	1,331

Stayers

2004	1.146 (0.621)	1.949 (0.601)	0.325 (0.728)	- 0.994 (0.605)	0.996 (0.115)	0.0529 (0.261)	28,198
2005	1.177 (0.651)	1.966 (0.611)	0.367 (0.778)	- 1.025 (0.638)	0.860 (0.100)	- 0.067 (0.268)	30,759
2006	1.030 (0.674)	1.815 (0.621)	0.258 (0.794)	- 0.899 (0.662)	0.834 (0.090)	- 0.088 (0.254)	32,361
2007	0.966 (0.696)	1.759 (0.640)	0.184 (0.823)	- 0.832 (0.685)	0.811 (0.102)	- 0.134 (0.261)	27,433
2008	0.828 (0.709)	1.627 (0.648)	0.027 (0.852)	- 0.689 (0.699)	0.647 (0.096)	- 0.217 (0.279)	7,108
Pooled	1.067 (0.671)	1.859 (0.628)	0.270 (0.791)	- 0.924 (0.658)	0.861 (0.133)	- 0.069 (0.273)	125,859

Source: Author's calculations

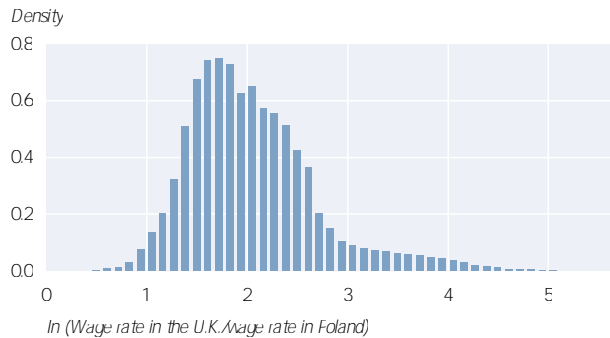
had higher returns to their observable characteristics in Poland than they might have expected to get abroad. Interestingly, the predicted wage differences were weakly correlated with the expected return to observables on the home labor market (and strongly positively correlated with the predicted return to observable traits on the host labor market). The expected returns to observables did not systematically differ for those with different valuation of their skills and experience on the source labor market.

The average time differential in observables was shrinking throughout the period under consideration. The first factor that contributed to the falling nominal gains from emigration was the significant appreciation of the Polish currency toward the British pound (by almost 33% from Q1 2004 to Q1 2008). The second factor, which is reflected in the reduction of both nominal and real wage differentials, was the apparent divergence in the national wage growth trends. The average wage rate kept increasing in Poland while it was almost stable (for Polish immigrants) in the U.K.

Chart 1

Returns to Migration

Returns in Nominal Terms (EUR)



Returns in Real Terms (PPP)



Source: Author's calculations.

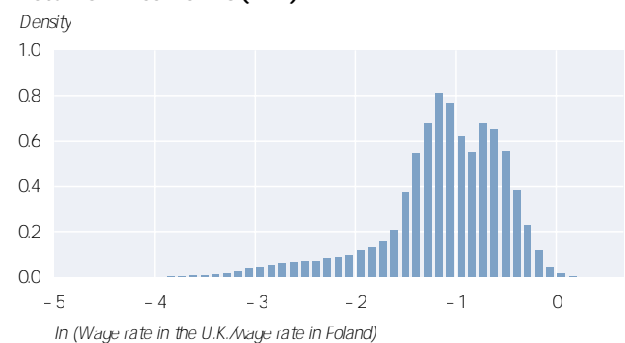
Chart 2

Returns to Staying

Returns in Nominal Terms (EUR)



Returns in Real Terms (PPP)



Source: Author's calculations.

7.2 Wage Differentials with Endogenous Selection

The gap between average wages predicted for Polish migrants to the U.K. and for Polish residents by accounting for returns to unobservables is significantly higher than the wage gap we would find for migrants randomly drawn from the population. A measure comparing the experience of average migrants and average nonmigrants indicates a wage gap between the U.K. and Poland in a range of 180% to 250% (nominal terms) or 130% to 170% (real terms). The pronounced gap between wage differentials in favor of migrants and differences in the “wage norm” reflect the importance of unobserved heterogeneity as a determinant of wages.

When the skills of those whose observable and unobservable traits paid off better in Poland are priced according to U.K. standards, and vice versa – assuming adverse (nonoptimal) selection of migrants (see tables 4 and 5, column 3) in order to compare foregone earnings – I find a strong income advantage for migrants over stayers in nominal terms and less so in real terms. Time trends in the measures of ex ante optimal and ex ante nonoptimal income differentials resemble trends observed in the wage differences. The earnings differential in favor of migrants was positive but strongly declining.

7.3 Effects of Migration on Wage Income

As is evident from chart 1, the distribution of the returns to migration, reflecting the market value of migrants' unobservable traits abroad, is clearly skewed to the right, namely above zero both for nominal and real values. The result is hardly surprising as the dominant share of the returns to migration is tied to the returns to the observable characteristics, which were strongly positive for migrants. The difference in the valuation of migrants' unobservable characteristics was significantly positive for most migrants in nominal terms (yet negative in real terms; see chart 3).

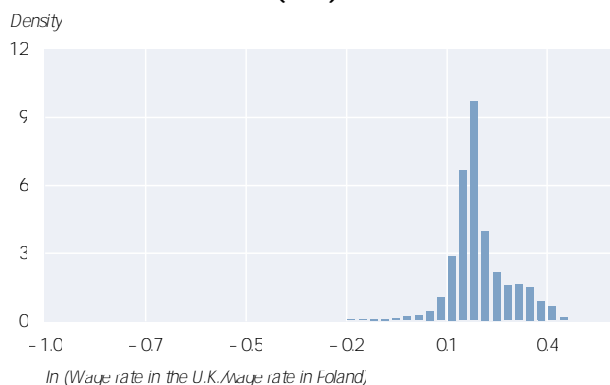
While the returns to staying (see chart 2) were overwhelmingly negative, the difference in the valuation of nonobservable skills between home and destination labor markets was positive for the entire subpopulation of nonmigrants (see chart 4). Hence, the returns to staying turned negative mostly due to the lower value their observable skills would have abroad.

The second measure of rationality proposed in this paper refers directly to nonobservable skills and is more restrictive. It is based on the presumption that

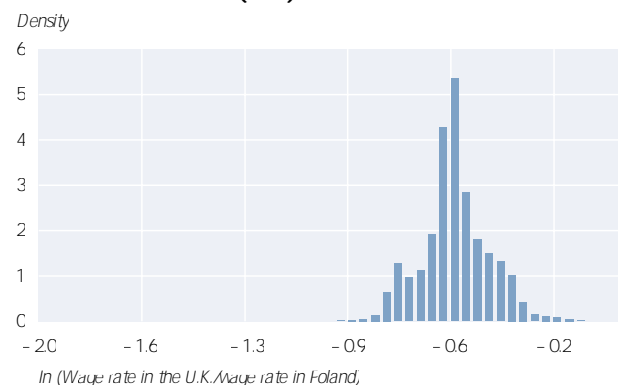
Chart 3

Sorting Gains into Migration

Returns in Nominal Terms (EUR)



Returns in Real Terms (PPP)

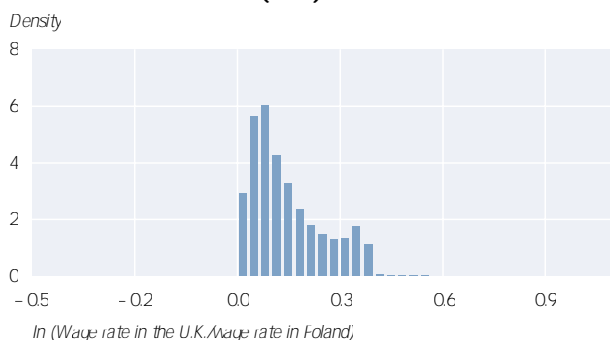


Source: Author's calculations.

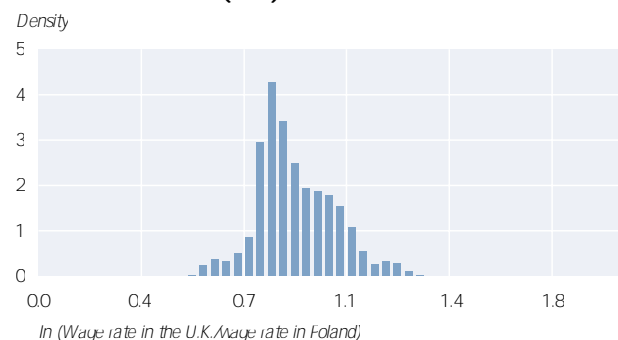
Chart 4

Sorting Gains into Staying

Gains in Nominal Terms (EUR)



Gains in Real Terms (PPP)

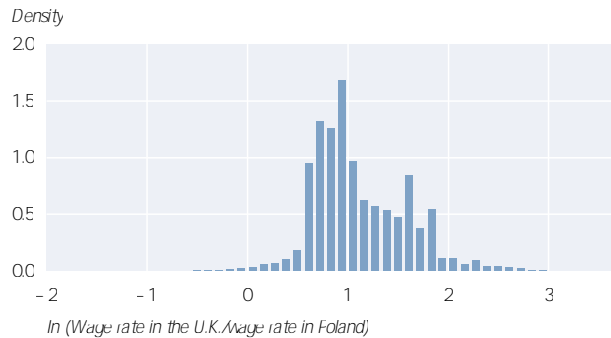


Source: Author's calculations.

Chart 5

Selection into Migration

Selection in Nominal Terms (EUR)



Source: Author's calculations.

Selection in Real Terms (PPP)

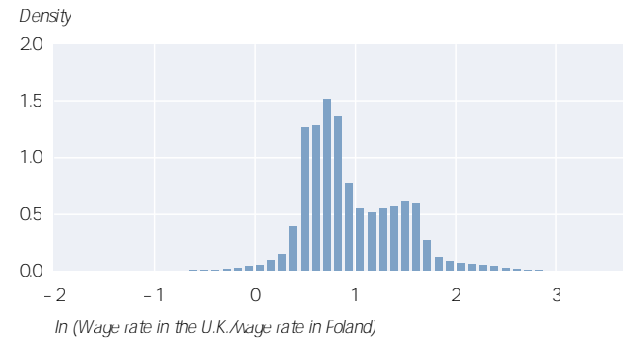
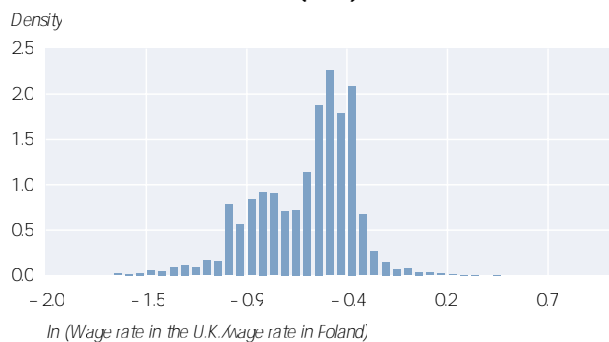


Chart 6

Selection into Staying

Selection in Nominal Terms (EUR)



Source: Author's calculations.

Selection in Real Terms (PPP)



out of two observationally equivalent workers, the one who actually migrates might expect higher gains than the other. Analogously, the worker who stays on the home labor market stands to earn more at home than the migrant would have earned at home. Therefore, observationally identical workers are optimally selected between labor markets. In this respect, the results are strongly supportive for the rationality of migration decisions. Chart 5 illustrates the selection into migration in nominal and real terms, which was significantly higher than zero for all migrants. The rationality test is less conclusive about the rationality of stayers (see chart 6). Only a negligible fraction of stayers recorded a positive selection into staying in nominal terms. Still, selection to staying proved to be positive for around 50% of stayers in real terms.

8 Discussion of Results

The robustness of earlier results was checked in respect of the underlying data and assumptions about the time horizon relevant for cross-country income comparison. Given the limited comparability of the respective education systems, the education level of Polish immigrants in the U.K. was imputed based on Polish

household survey data. Conclusions from the estimated selection models and the wage regressions run on the education level approximated by years in education remain in parallel with results with dummy education variables. Similarly, the rationality of migration and staying measures closely resemble outcomes reported earlier.

Throughout the analysis I maintained the simplifying assumption that the migrate-or-stay decision reflects anticipated earnings differences on the two labor markets for the reference period. This route is a useful working device for analyzing temporary migration. However, it is possible that some migrants (and stayers) in the sample were, at the point of forming anticipations, in fact considering to stay abroad for a longer period. Moreover, returns particularly to human capital accumulated abroad increase sharply within the first years of stay. To check the robustness of the results to changes in assumptions about the time horizon I calculated the expected discounted streams of income over two years and three years on the two labor markets.¹⁴ Based on income differentials and rationality measures thus recalculated, the conclusions about the rationality of migrating or staying remained broadly unchanged, however. The statistics strongly support the rationality of migration to the U.K. while leaving the rationality of staying unsettled. The selection into staying indicated that a significant share of the stayers indeed took an optimal decision, whereas evidence on the returns to staying contradicted such a conclusion.¹⁵ Still, in the exercise no account was taken of the fact that the optimal strategy may consist of repeat migration, where country-specific human capital is accumulated during consecutive stays abroad.

Negative returns to staying for a high share of Polish-born (and strongly positive returns to migration) may be tied to biased anticipations due to information frictions. Individuals that were misinformed about wages and job opportunities in the U.K. may have undercounted possible gains from moving, as suggested by Tunali (2000). Another restriction likely to bias gains of migrants upward and gains of stayers downward is the fact that, while accounting for costs tied to a loss of value of accumulated human capital and education, I largely ignored the fixed costs of relocating to a new place. These were assumed to be a negligible fraction of the total earnings, which seemed plausible given low cost flights and bus tickets, job agencies as well as evolving migrant networks in the U.K. Violation of either of these assumptions can lead to a rejection of the rationality hypothesis even though Polish workers were indeed income maximizers. When the impact of biased anticipations on the results may be generally ambiguous, the absence of fixed migration costs could render misleadingly favorable results for the rationality of migration and against the rationality of staying.

¹⁴ The discount rate of 5% was assumed. Individuals were supposed to stay with the same employer for the relevant time horizon.

¹⁵ The other possibility to check robustness of the results and render some additional insight into the dynamic aspect of migrate-or-stay decisions would be to use available data to calculate the expected wage rate in the reference period as well as the expected growth rate of wages within a year and use both values to establish the expected gain of a migrant or a stayer one year ahead. This approach would correspond with the one which was actually implemented to calculate the expected income streams over a year to the degree to which cross-section data on workers appropriately reflect the dynamic dimension of wage gains on source and host labor markets. However, a dataset of longitudinal observations on wages (foremost for Polish migrants in the U.K.) was too narrow to be used in the exercise.

If neither of the assumptions is strongly violated, the rationality-of-staying choice may be questioned. Factors other than economic considerations may prevent a stronger outflow of labor force from Poland. The new theory of migration underlines the importance of family and community effects. Polish workers may be faced with high noneconomic costs of migration, a need to leave family and friends and the need to adapt, at least temporarily, to a new environment. Further, workers may care not only about earnings but also about job status, and migration often involves a downgrading of the latter. These factors may outweigh economic gains attached to migration.

9 Summary and Conclusions

In this paper I establish the importance of expected earnings gains in driving cross-border migration and in the process of selecting those who stay. The rationality of international migration was verified using data on Polish-born workers resident in Poland or the U.K. following Poland's accession to the EU in 2004. Anticipated earnings gains were approximated by national differences in predicted wages. Wages were derived using a switching regression model with double selectivity regarding emigration and employment. Direct treatment of the simultaneity of employment and location choices constitutes a novel feature of the study. This allowed us to extend the rationality test to workers who were unemployed either before or after migration. Following a method proposed by Tunali (2000) to identify the actual and counterfactual returns to nonobservable skills based on the correlation of emigration probability with differences in valuation of the complete set of skills of individuals, the measures used to scrutinize the rationality hypothesis encompass the expected income gains from nonobservables.

The results robustly validate the hypothesis of rationality of migration. Even though the returns to education are flat across education groups for Poles resident in the U.K. and steeply increasing with both education levels and experience in Poland, the lion's share of those who temporarily emigrated from Poland between 2004 and early 2008 benefited from the move in nominal and real terms. Testing the rationality-of-staying decision did not deliver unambiguous answers. Stayers could on average expect to reap higher returns abroad than at home. However, among observationally identical workers, a great share of those who stayed would possibly have earned more at home than those who emigrated. Moreover, even though not in themselves constituting an argument for the rationality of staying, returns to the unobserved characteristics were clearly higher on the home labor market than on the foreign labor market for stayers.

The preferred interpretation of unequivocal results on the sorting efficiency of labor market mechanisms refers to noneconomic costs of migration. Workers are not only income maximizers but may also attach high values to family and friendship networks and factors such as job status they are likely to lose when migrating. These noneconomic costs have to be taken into consideration when modeling migration movements. Establishing their importance and proposing policies that address these barriers for labor force movement might prove a fruitful avenue for further research on intra-EU migration.

References

- Aydemir, A. 2002.** Effects of Selection Criteria and Economic Opportunities on Characteristics of Immigrants. Statistics Canada Research Paper 182.
- Barrett, A. and E. Kelly. 2008.** Using Census to Assess the Reliability of a National Household Survey for Migration Research: the Case of Ireland. IZA Discussion Paper 3689.
- Behrman, J.R., B.L. Wolfe and F.I. Tunali. 1980.** Determinants of Women's Earnings in a Developing Country: A Double Selectivity Extended Human Capital Approach. Institute for Research on Poverty Discussion Paper. 596- 80.
- Blinder, A.S. 1973.** Wage Discrimination: Reduced Form and Structural Estimates. In: The Journal of Human Resources 4(8). 436- 455.
- Borjas, G.J. 1987.** Self-Selection and the Earnings of Immigrants. In: American Economic Review 77. 531- 553.
- Cappellari, L. and S.P. Jenkins. 2006.** Calculation of Multivariate Normal Probabilities by Simulation, with Application to maximum Simulated Likelihood Estimation. IZA Discussion Paper 2112.
- Chiquiar, D. and G.H. Hanson. 2002.** International Migration, Self-Selection, and the Distribution of wages: Evidence from Mexico and the United States. Mimeo.
- Chiswick, B.R. and P.W. Miller. 2005.** Why Is the Payoff to Schooling Smaller for Immigrants? IZA Discussion Paper 1731.
- Chiswick, B.R. and P.W. Miller. 2007.** The International Transferability of Immigrants' Human Capital Skills. IZA Discussion Paper 2670.
- Cobb-Clark, D.A. 1993.** Immigrant Selectivity and Wages: The Evidence for Women. In: The American Economic Review 83(4). 986- 993.
- Constant, A. and D. Massey. 2003.** Self-Selection, Earnings, and Out-Migration: a Longitudinal Study of Immigrants to Germany. In: Journal of Population Economics 16. 631- 653.
- Dostie, B. and P.T. Leger. 2006.** Self-Selection in Migration and Returns to Unobservable Skills. Cahier de Recherche IEA- 06- 01.
- Friedberg, R.M. 2000.** You Can't Take It with You? Immigrant Assimilation and Portability of Human Capital. In: Journal of Labour Economics 18(2). 221- 251.
- Heckman, J.J. 1979.** Sample Selection Bias as a Specification Error. In: Econometrica 47(1). 153- 161.
- Kaun, D.E. 1970.** Negro Migration and Unemployment. In: The Journal of Human Resources 5(2). 191- 207.
- Mishra, P. 2007.** Emigration and Wages in Source Countries: Evidence from Mexico. In: Journal of Development Economics 82.
- Oaxaca, R. 1973.** Male-Female Wage Differentials in Urban Labor Markets. In: International Economic Review 14. 693- 709.
- Rabe, B. 2006.** Dual-Earner Migration in Britain: Earnings Gains, Employment, and Self-Selection. ISER Working paper 2006- 01.
- Sanroma, E., R. Ramos and H. Simon. 2008.** The Portability of Human Capital and Immigrant Assimilation: Evidence for Spain. IZA Discussion Paper 3649.
- Tunali, I. 1986.** A General Structure of Models with Double-Selection and an Application to Joint Migration/Earnings Process with Remigration. In: Research in Labour Economics 8B. 235- 283.
- Tunali, I. 2000.** Rationality of Migration. In: International Economic Review 41(4).
- Vijverberg, W.P.M. 1995.** Dual Selection Criteria with Multiple Alternatives Migration, Work Status, and Wages. In: International Economics Review 36(1).
- Zaiceva, A. 2006.** Reconciling the Estimates of Potential Migration into the Enlarged European Union. IZA Discussion Paper 251.

Appendix

Measure	Expression	Relevant subpopulation
Wage differences in observables	$(\hat{\alpha}_1 - \hat{\alpha}_0) x(i)$	All
Wage differentials in favor of migrants (ex ante optimal)	$(\hat{\alpha}_1 - \hat{\alpha}_0) x(i) + \hat{\varphi}_{1,1} \hat{\lambda}_{M=1}(i) - \hat{\varphi}_{0,1} \hat{\lambda}_{M=0}(i)$	All
Wage differentials in favor of migrants (ex ante nonoptimal)	$(\hat{\alpha}_1 - \hat{\alpha}_0) x(i) + \hat{\varphi}_{0,1} \hat{\lambda}_{M=1}(i) - \hat{\varphi}_{0,0} \hat{\lambda}_{M=0}(i)$	All
Returns to migration	$(\hat{\alpha}_1 - \hat{\alpha}_0) x(i) + (\hat{\varphi}_{1,1} - \hat{\varphi}_{0,1}) \hat{\lambda}_{M=1}(i)$	Migrants
Returns to staying	$(\hat{\alpha}_0 - \hat{\alpha}_1) x(i) + (\hat{\varphi}_{0,1} - \hat{\varphi}_{1,1}) \hat{\lambda}_{M=0}(i)$	Stayers
Sorting gains into migration	$(\hat{\varphi}_{1,1} - \hat{\varphi}_{0,1}) \hat{\lambda}_{M=1}(i)$	Migrants
Sorting gains into staying	$(\hat{\varphi}_{0,1} - \hat{\varphi}_{1,1}) \hat{\lambda}_{M=0}(i) + (\hat{\varphi}_{0,0} - \hat{\varphi}_{1,0}) \hat{\lambda}_{V_0=1}(i)$	Stayers
Selection into migration	$\hat{\varphi}_{1,1} (\hat{\lambda}_{M=1}(i) - \hat{\lambda}_{M=0}(i))$	Migrants
Selection into staying	$\hat{\varphi}_{0,1} (\hat{\lambda}_{M=0}(i) - \hat{\lambda}_{M=1}(i))$	Stayers

Let $\hat{\alpha}_M, \hat{\varphi}_{M,M'}$ with $M, M' \in \{0,1\}$ be the estimated coefficients of (22) and (23). Further let $\hat{\lambda}_{M=0}, \hat{\lambda}_{M=1}, \hat{\lambda}_{V_0=1}$ and $\hat{\lambda}_{V_1=1}$ be variables measuring selection effects to unobservables derived based on x and estimated parameter of wage equations.

Southeastern Europe: Financial Deepening, Foreign Banks and Sudden Stops in Capital Flows

Adalbert Winkler¹

Over recent years, rapid financial deepening has been observed in Southeastern Europe. While originally welcomed as a sign of financial development spurring growth, macrofinancial stability concerns emerged as inflationary pressures rose and current account deficits came close to or surpassed double-digit levels. However, until autumn 2008, stability risks remained contained. Since then, Southeastern European countries appear to have been confronted with a sudden stop of capital flows, creating an Asian-crisis-like scenario. While this seems to vindicate warnings that financial deepening had taken an unsustainable course, the drying up of capital flows has largely been reflecting contagion from the financial turmoil in mature markets. Against this background, the most recent events indicate that the strategy of fostering financial development based on fit and proper foreign banks does not automatically provide a guarantee for financial stability.

1 Introduction

More than one year after the start of the financial market turmoil in mature economies, the crisis reached the emerging countries of Southeastern Europe.² Given strong credit growth, rising inflationary pressures and large current account deficits, it seems that also for this region the “unsustainable has run its course” (BIS, 2008), validating the macrofinancial stability concerns expressed over the last years.

Against this background, the paper starts out by reviewing the process of rapid financial deepening and the associated vulnerabilities and risks. At the end of section 2, the three main scenarios discussed in the literature with regard to the sustainability of the process are summarized: the “Asian crisis” scenario of a sudden stop in capital flows, the “Portugal” scenario, where rapid credit growth does not lead to a financial and exchange rate crisis, but is followed by a protracted low-growth adjustment process, and the benign scenario of a smooth catching-up (Sirtaine and Skamnelos, 2007). Section 3 focuses on a prominent argument that had been used to predict a more benign outcome, namely the fact that financial deepening has been based on banking sectors dominated by subsidiaries of (mainly) euro area banks. Why should parent banks endanger the profitability of their investments and their reputations by suddenly withdrawing funds lent to the region? As outlined in some detail in section 4, key insights of the modern finance theory did indeed suggest that a sudden stop of capital flows was unlikely. The collapse of Lehman Brothers and its impact on the major euro area banks active in the region changed all this (section 5), as it almost wiped out the macrofinancial stability advantages linked to foreign ownership. Moreover, it laid the ground for a new emerging market crisis scenario, namely contagion from mature economies, as the global liquidity shock hit the very institutions that were supposed to

¹ Frankfurt School of Finance & Management, a.winkler@frankfurt-school.de. This paper is based on a presentation given at the 63rd East Jour Fixe of the Oesterreichische Nationalbank on October 13, 2008. I would like to thank Julia Wörz, Markus Eller and Thomas Reiningger (all OeNB) for helpful comments and suggestions. The views expressed are those of the author and not necessarily those of the Oesterreichische Nationalbank.

² The region is defined as including the following countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the FYR Macedonia, Montenegro, Serbia, Romania and Turkey. Cutoff date for data: December 10, 2008.

provide insurance against a sudden stop. Thus, section 6 concludes by acknowledging the familiar saying that every financial crisis is indeed different.

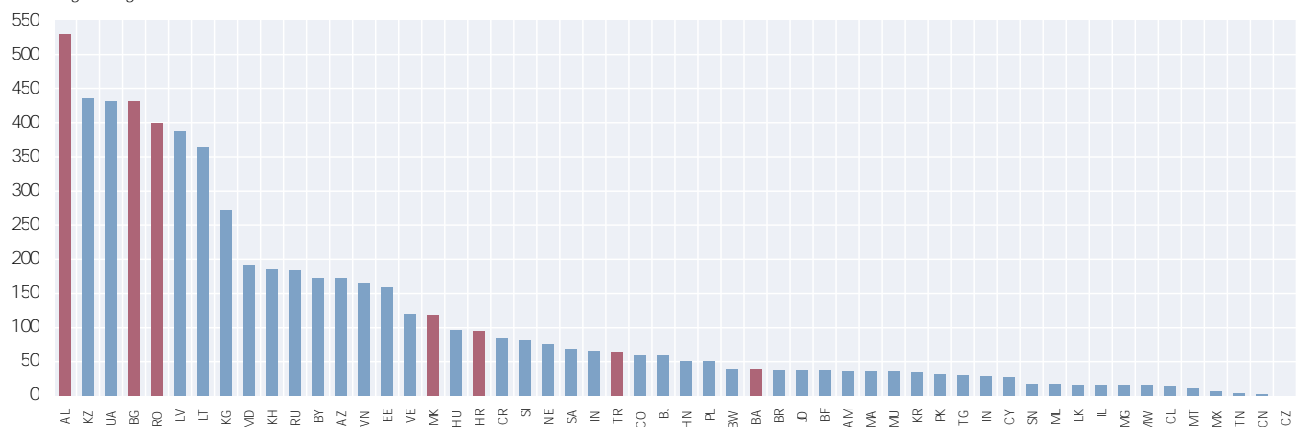
2 Vulnerabilities and Macrofinancial Risk Scenarios

Since the beginning of the decade, Southeastern Europe, like Eastern Europe as a whole, has seen rapid financial development.³ Chart 1 summarizes the evidence, pointing out that the pace of deepening has been extraordinary, even in an emerging market context. Moreover, a comparison of the most widely used indicators of financial development, the broad-money-to-GDP ratio and the private-sector-credit-to-GDP ratio, indicates that credit growth has been particularly strong. By contrast, monetization has been advancing more or less at a pace similar to that of other emerging markets and developing countries.

Chart 1

Private-Sector-Credit-to-GDP Ratio

Percentage change 2007/2006 versus 2000.



Sources: IMF; author's compilations.

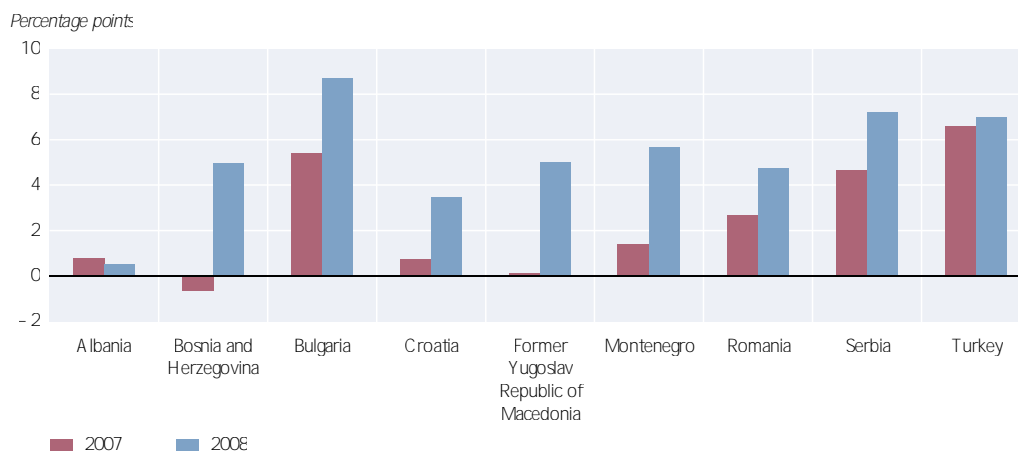
Note: Countries of Southeastern Europe are marked in red. The ranking and the respective percentage changes are sensitive to the choice of the base year. For example, the percentage change of close to zero in the Czech Republic reflects the substantial restructuring and consolidation efforts in the banking sector undertaken by the authorities in the first years of this decade. Over recent years, however, private sector credit as a percentage of GDP has been rising at a pace similar to that observed in other Central and Eastern European countries. Country names in the order of the chart, from left to right: AL = Albania, KZ = Kazakhstan, UA = Ukraine, BG = Bulgaria, RO = Romania, LV = Latvia, LT = Lithuania, KG = Kyrgyzstan, MD = Moldova, KH = Cambodia, RU = Russia, BY = Belarus, AZ = Azerbaijan, VN = Vietnam, EE = Estonia, VE = Venezuela, MK = FYR Macedonia, HU = Hungary, HR = Croatia, CR = Costa Rica, SI = Slovenia, NE = Niger, SA = Saudi Arabia, IN = India, TR = Turkey, CO = Colombia, BJ = Benin, HN = Honduras, PL = Poland, BW = Botswana, EA = Bosnia and Herzegovina, BR = Brazil, J = Jordan, BF = Burkina Faso, AM = Armenia, MA = Morocco, MU = Mauritius, KR = South Korea, PK = Pakistan, TG = Togo, ID = Indonesia, CY = Cyprus, SN = Senegal, ML = Mali, LK = Sri Lanka, IL = Israel, MG = Madagascar, MW = Malawi, CL = Chile, MT = Malta, MX = Mexico, TN = Tunisia, CN = People's Republic of China (Mainland), CZ = Czech Republic.

In the early 2000s, financial deepening was accompanied by strong growth, low inflation – with the exception of countries with a more flexible exchange rate, i.e. Turkey, Romania and Serbia – and current account deficits, which were still modest, given their average range of 5% of GDP. However, until the summer of 2008, inflationary pressures had been intensifying, limiting progress in disinflation or leading to higher inflation rates in countries with comparatively low levels of inflation in the years before. Moreover, rapidly rising current account deficits signaled that domestic demand dynamics had become excessive (charts 2 and 3).

³ There is an extensive literature that closely analyzes the process of financial deepening in the region. See for example the contributions in Liebscher et al. (2006) as well as Enoch and Ötker-Robe (2007).

Chart 2

Inflation Differential to the Euro Area

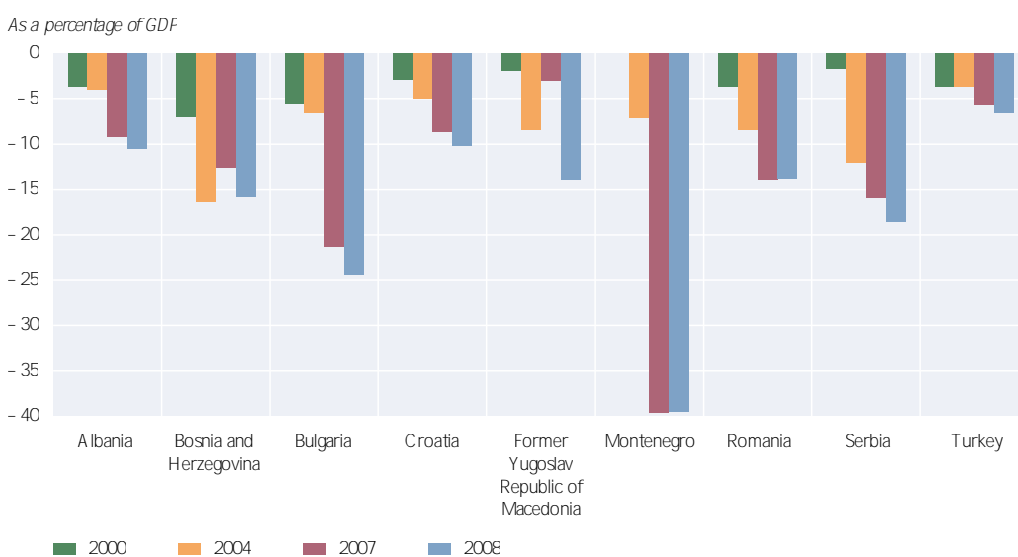


Sources: IMF; authors' calculations.

Note: 2008 figures are estimates.

Chart 3

Current Account Balance



Source: IMF.

Note: 2007 (Albania and Montenegro) as well as 2008 figures (all countries) are estimates.

Macroeconomic vulnerabilities were compounded by rising financial vulnerabilities. In particular, the increasing dominance of foreign exchange-denominated loans became a cause for concern,⁴ also because overall credit was boosted by soaring household consumer and mortgage credit. Unlike enterprises, which might have earnings in foreign currency via exports, households are barely hedged against foreign exchange risk. The main financial vulnerability, however, was seen

⁴ The extent of euro-based asset substitution in the region has been documented in ECB (2007).

in the speed of credit growth itself (Kraft and Jankov, 2005), as this speed suggested that banks underestimated the level of risk associated with rapid credit expansion. For example, the debt burden of borrowers had been rising significantly in several countries, even though debt ratios in most countries are still low compared to those recorded in mature economies. At the same time, many borrowers had engaged in borrowing for the first time, raising doubts about credit quality, given the lack of a track record and debt management experience. These doubts were not dispelled by relatively low or declining ratios of nonperforming loans to total loans, as the usefulness of this variable as an indicator of credit risk was impaired by the speed of credit expansion itself, considering that loan performance problems usually materialize only with a significant lag. Finally, it is a well-established stylized fact that credit booms have preceded many financial and exchange rate crises.⁵

Against this background, several observers have been warning that the countries in the region run the risk of facing an Asian-style financial and exchange rate crisis.⁶ The trigger could be a sudden stop or a reversal of capital flows that reflects a reassessment by international investors of the macroeconomic outlook in the region. In addition to rising inflation and high current account deficits, fiscal policy slippages have been observed, even though government deficits (surpluses) have been stable or even declining (rising) and most countries have been meeting the Maastricht criterion of a deficit below 3% of GDP. However, given strong domestic demand pressures evidenced by rising inflation and high current account deficits, many countries' fiscal policy stance should have been much more restrictive to contain aggregate demand.⁷

With interest rates on the rise in the United States until August 2007 and in the euro area until July 2008, the profitability outlook of investment projects financed in the period of low interest rates became more and more clouded, increasing the probability that capital flows would dry up. A slowdown or reversal of capital flows would be associated with depreciation pressures, raising the debt burden for borrowers with foreign exchange loans. If the exchange rate were to be defended by the monetary authorities, the associated rise in interest rates would be likely to reduce the quality of loan portfolios. Finally, like in Asia, once one country was affected by capital outflows and depreciation pressures, contagion could transmit the pressure to other countries in the region, given that the economies are fairly open and show a high degree of similarity of macroeconomic and financial sector developments.

The second risk scenario made reference to the pre-EMU experience of Portugal, where the credit boom of the mid- to late 1990s was also associated with a strong increase in the current account deficit. However, in contrast to Asia, the

⁵ *At the same time, it has to be acknowledged that most lending booms do not end in a crisis. Much rather, they gradually decelerate, providing for a "soft landing" (Caprio and Klingebiel, 1996 a,b; Gourinchas, Valdés and Landerretche, 2001; Tornell and Westermann, 2002).*

⁶ *One of the first papers that explicitly compares developments in the region with those in precrisis Asia is that of Eichengreen and Choudhry (2005). For a more recent example, see Sorsa et al. (2007).*

⁷ *This holds in particular for countries with a fixed exchange rate regime. However, even in countries with a more flexible exchange rate regime, fiscal policy should have played a much greater role in macroeconomic stabilization, given the limited effectiveness of monetary policy in an environment characterized by a high degree of financial integration and euro-based asset substitution. For details see Winkler (2008).*

boom did not end in a financial and currency crisis, as the adoption of the euro ruled out external adjustment via the exchange rate. Instead, rapid credit and output growth was followed by a protracted period of slow growth (Sirtaine and Skamnelos, 2007). While most Southeastern European countries still have some way to go to become EU members, much less join the euro area, it could be argued that the high degree of real and financial integration with the euro area would act as a strong incentive for the authorities to avoid the “external adjustment path” and to opt for a course of “internal adjustment” (Martin, Schuknecht and Vansteenkiste, 2007) with imbalances and financial excesses unwinding more slowly.

Finally, there was the most benign scenario, which – while acknowledging the similarities with the Asian and Portuguese examples – stressed a unique feature of the process of financial deepening in the region, namely the dominance of subsidiaries of euro area parent banks in the region’s banking sectors. With financial development largely based on fit and proper foreign banks, the catching-up process in the region seemed to have been placed on a sound financial footing, allowing for a crisis-proof process of finance and growth.

3 Foreign, Euro Area Bank-Based Financial Deepening

It is useful to recall that the process of financial deepening of the last decade was preceded by financial crises in many countries of the region. The turbulences marked the end of an approach of financial sector development based on state and domestic private banks with poor governance. Authorities reacted by opening up their financial sectors to foreign investors. With the prospects of EU accession becoming more concrete, foreign banks, mainly from the euro area, seized the opportunity and established subsidiaries or branches in almost all countries of the region. Very quickly, they emerged as the dominant players in the respective banking sectors. At the end of 2007, their share in total banking sector assets exceeded the 70% level in all countries with the exception of Turkey.

Many emerging markets and developing countries have seen an increasing presence of foreign banks in their domestic banking sectors over recent years (Mihaljek, 2006; Claessens et al., 2008). However, the impact of foreign banks on financial sector development has been far from uniform.⁸ Thus, the Southeastern European experience⁹ of rapid financial development largely based on foreign banks from the euro area seems to reflect the favorable conditions for financial integration in Europe (Herrmann and Winkler, 2008). Subsidiaries and branches of parent banks with headquarters in the euro area entered the region because they perceived the host countries as an extension of the single domestic European market (Wiedner, 2005; Wimmer, 2005; Profumo, 2006). Moreover, this approach explains the strong focus on retail activities, an area in which foreign banks have been in the comfortable position of exploiting their comparative advantages, namely their “reputational capital” (Hellman and Murdock, 1998)¹⁰ in expanding

⁸ See for example the evidence provided by Detragiache, Tressel and Gupta (2006), which suggests that in poor countries a stronger foreign bank presence has been associated with slower credit growth and less access to credit.

⁹ The same applies to the Central and Eastern European countries that joined the EU in May 2004.

¹⁰ Grigorian and Manole (2002) compared the reputation bonus of Western banks to a kind of implicit deposit insurance.

the deposit business, and their superior credit technology, governance structure and capitalization in expanding loans to businesses and households.

4 Sudden Stops in a Highly Integrated Financial Market with Interlinked Ownership Structures

Emerging Europe stands out in representing a foreign bank-based development of domestic financial sectors. This holds when comparing the region with other emerging markets, and it holds when analyzing processes of financial deepening from a historical perspective. Thus, it is not surprising that proponents of the benign scenario, predicting a smooth process of financial deepening and catching-up, based their arguments to a considerable extent on alleged advantages of foreign banks as drivers of financial development from a macrofinancial perspective.

The most widely used argument suggesting that the increasing presence of foreign banks in the region should have strengthened financial stability in the region is based on the view that weak and poorly governed state-owned and private banks were a major cause of the financial and currency crises of the 1990s (Llewellyn, 2002). Against this background, the very fact that reputable and experienced foreign banks entered the market was interpreted as an improvement in financial sector quality and solvency (Mehl, Vespro and Winkler, 2005). The quality of financial intermediation was further enhanced by substantial efforts to upgrade the regulatory and supervisory frameworks. Again, the drive toward better regulation and supervision was at least partly motivated by the European integration process and the need to adopt EU standards. Thus, many of the banking sector weaknesses traditionally characterizing emerging markets and developing countries (Caprio, 1997) seemed to have been eliminated.

Opponents of the benign view did not challenge the general validity of these arguments, but pointed to other, less favorable implications of the strong presence of euro area banks in region. Topping the list was the increasing aggressiveness with which foreign banks were engaging in a fight for market shares in the credit market. Moreover, subsidiaries were strongly supported by external funding from parent banks, given low interest rates in mature economies. This indicates that the expansion of credit in the region was another form of the “search for yield” characterizing mature financial markets until summer 2007 (Hardy and Tiemann, 2008). Indeed, the absence of signs of a market-driven slowdown of credit growth raised doubts about the view that foreign ownership as such will mitigate the risk of financial turmoil. This holds in particular as episodes of financial crises following rapid credit growth have not been confined to emerging markets and developing countries, but have been observed in mature economies as well. Finally, even if the presence of foreign banks may have a positive bearing on financial stability, i.e. on indicators measuring credit quality as well as banking sector capitalization, profitability and liquidity, it does not compensate for weak macroeconomic fundamentals, such as rising inflation, high current account deficits and rising external debt. Thus, foreign ownership by itself does not seem to alleviate major risks of financial and exchange rate crises considered in almost any early warning system model (Berg, Borenzstein and Pattilo, 2005).

The example of the Asian crisis showed, however, that it has become difficult to identify the severe macroeconomic imbalances suggested by the currency crisis

literature. Thus, financial and currency crises in emerging markets have been increasingly interpreted as the familiar bank run problem facing any banking system engaged in maturity transformation (Diamond and Dybvig, 1983). In such an environment, foreign-based financial deepening, in particular with subsidiaries and branches of parent banks operating in mature economies, may have financial stability advantages that go beyond the already mentioned solvency aspects.

At the core of the Diamond-Dybvig model is a bank engaging in maturity transformation. The bank issues short-term deposits to finance long-term loans, as the profitability of long-term loans exceeds the return on short-term loans. The model predicts a bank run if depositors fear that other depositors may choose an early withdrawal of their deposits. In such a scenario, it is rational to join the herd, regardless of the profitability of long-term loans, given the short-term illiquidity of the bank. Thus, the model sees the trigger for a bank run in a self-fulfilling prophecy unrelated to economic fundamentals. However, the empirical evidence on banking panics in mature economies suggests that runs are often caused by reasonable doubts about the long-term solvency of a bank or the banking system, for example reflecting the impact of a macroeconomic shock (Calomiris and Gorton, 1991).¹¹

The Diamond-Dybvig model has been designed for a closed economy. However, it can be transferred into an “international setting” defined by one (or both) of the following features (Chang and Velasco, 2000):

- Fixed exchange rates. Under a system of fixed exchange rates, any demand for liquidity in domestic currency can be transformed into demand for liquidity in the anchor currency. Thus, banks engaging in maturity transformation in domestic currency are de facto also engaging in maturity transformation in foreign currency.
- Asset substitution (unofficial dollarization or euroization). Banks engage in maturity transformation on the basis of foreign currencies, by granting foreign currency loans to domestic residents on the basis of either foreign currency deposits or foreign currency short-term debt issuance on international capital markets.

In principle, banks engaging in maturity transformation based on foreign currencies face the same risk of illiquidity as banks providing asset transformation services in domestic currency. Thus, the key difference between a closed economy and an international setting is not the fragility of the banking system as such. Instead, it is the absence of a lender of last resort with unlimited resources in the international setting, which raises the incentive for any depositor to withdraw funds when doubts about the banks’ solvency arise, thus making the system as a whole more crisis-prone (Winkler, 2001).

Southeastern Europe has been featuring both types of “international setting,” as several countries have been operating fixed or quasi-fixed exchange rate regimes. Moreover, banking sectors of basically all countries have engaged to a significant extent in maturity transformation on the basis of foreign currencies, not only, but most importantly, in euro, inter alia reflecting the strong presence of

¹¹ For example, in the current financial crisis, holders of short-term commercial paper refused to fund “banks,” i.e. special purpose vehicles, because they had a rational fear of loss, given the decline in U.S. house prices (Gorton, 2008).

foreign banks in the region (Basso, Calvo-Gonzalez and Jurgilas, 2007). However, the risk of “international illiquidity”, i.e. facing a sudden stop of capital flows, was apparently mitigated by two features:

- First, parent banks have been the main foreign currency “depositors” of their subsidiaries in the region, as they have been funding a large part of the foreign liabilities that banking systems in the region have accumulated over the last years to finance rapid credit growth.
- Second, parent banks have enjoyed an information advantage with regard to the solvency of their subsidiaries compared to external creditors.¹²

The first factor deals with the liquidity risk caused by a self-fulfilling prophecy, as this risk is linked to the existence of a sufficiently large number of investors that form expectations on the behavior of other investors. In the region, however, the subsidiaries were relying to a large extent on only one major investor, namely their respective parent banks. With the herd basically consisting of one (big) sheep, it was difficult to imagine herding behavior on a large scale. The second factor has to do with concerns on early withdrawals caused by fears of losses. The risk of early withdrawals seems to have been mitigated, as parent banks should have been aware of the credit risks subsidiaries have been underwriting over recent years.¹³ With the parent bank as the main depositor not being exposed to an asymmetric information problem, the risk of a run by small retail depositors could be considered very small, as a massive withdrawal by many agents would have been required to trigger herding behavior, given the size of the well-informed depositor. Thus, liquidity risks seem to have been contained not only because parent banks may engage in support lending in times of crisis (De Haas and van Lelyveld, 2008), but also due to the overall large-scale equity and debt investment of the parent bank.

In precrisis Asia, by contrast, domestic banks had engaged in maturity transformation financed by short-term loans from many western banks on the basis of an arm’s length relationship. Thus, “depositors” did not have excellent information about the long-term solvency of the borrowers – the Asian banks – nor were they particularly interested in acquiring such knowledge, given the short-term maturity of their engagement.¹⁴ When facing the risk that other depositors would withdraw their funds, all of them had the incentive to withdraw, triggering the panic.

The relevance of financial structure arguments for macrofinancial stability in emerging markets became visible in August 2007, when the current financial crisis started. As is well known, until fall 2008 spillovers to emerging markets, including the countries in the Southeastern European region (Bracke et al., 2008), were contained. However, there were some exceptions. For example, contagion

¹² See also the discussion in De Haas and van Lelyveld (2008).

¹³ Parent banks should have been able to assess the financial performance of their subsidiaries in Southeastern Europe because the process of rapid financial deepening in the region was based on the “buy and hold” model of retail banking. Following Diamond (1984), banks engaged in financial intermediation by monitoring loans, building up relatively diversified loan portfolios and keeping loans on their books. Thus, the “originate and distribute” model, i.e. the decoupling of loan “production” from holding assets and their associated risks, was basically absent in the region.

¹⁴ As shown in Diamond (1984), short-term deposits and loans under which the borrower incurs substantial nonpecuniary costs in case of failure serve as a substitute for loans that are heavily monitored by the lenders.

effects were recorded in Kazakhstan (De Haas and van Lelyveld, 2008) and – to a lesser extent – in Russia. In both countries, domestic banks had engaged in significant maturity transformation in foreign currency based on traditional short-term capital market borrowing. When risk aversion rose, international investors started to withdraw their funds, requiring massive interventions by the monetary authorities. These interventions were possible because both oil-rich countries had been accumulating substantial foreign exchange reserves in the past. Thus, authorities could make extensive use of reserves to avoid “international illiquidity” of their banking systems and to calm the markets (IMF, 2008a).

Summing up, foreign euro area banks have been the major driver of financial deepening in Southeastern Europe, as parent banks have been providing a substantial share of the funds for the ongoing credit expansion over recent years. Strong capital flows and credit growth engineered a growth process based on domestic demand, investment and consumption that increasingly showed signs of overheating, as evidenced by rising inflation and large current account deficits. At the same time, however, the risk of a sudden stop of capital flows seemed to be low, as it was assumed that foreign banks had done reasonably well in analyzing and managing credit risk. Moreover, risks of international illiquidity were contained due to the interlinked ownership structures. Against this background, the region seemed to be heading for a soft landing, as the impact of the turbulence in the financial markets of mature economies was noticeable, but limited. Indeed, there was some reason to believe that the increase in risk aversion following the events of August 2007 would lead to a decline in credit growth, mitigate overheating pressures and push growth and current account deficits to more sustainable levels.

5 Contagion from Mature Economies The Return of International Liquidity Risk

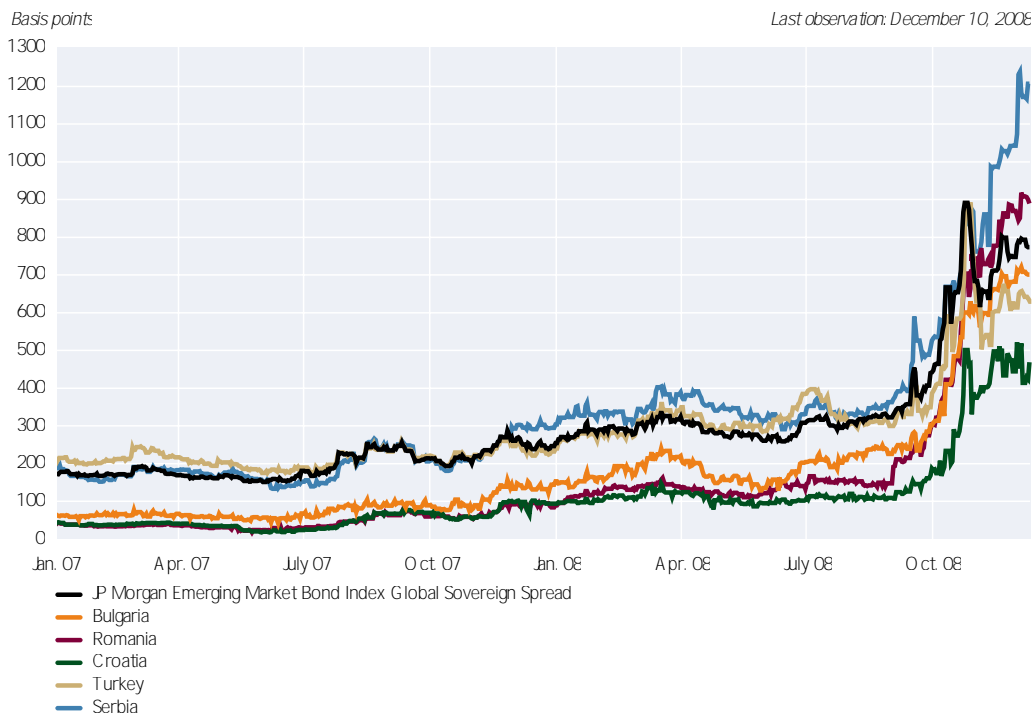
The collapse of Lehman Brothers and its impact on mature economies’ money markets and financial institutions radically changed the environment for financial deepening in the region, as it caused a severe U.S. dollar and euro liquidity shock to hit the global financial system. The shock was so large that huge rescue packages of the U.S. and EU governments (comprising enhanced deposit insurance, inter-bank lending guarantees and recapitalization measures) as well as strong money market interventions and monetary policy reactions by the Federal Reserve and the ECB were needed to contain doubts about further bank failures and to prevent bank run-like phenomena in mature economies.

Under these circumstances, the risk of a sudden stop returned to the region in a new disguise, as parent banks scrambled for liquidity.¹⁵ Several indicators provide evidence of the sudden stop of capital flows, like the substantial rise in interest rates and risk spreads (chart 4), the strong decline in stock prices, depreciation pressures on currencies as well as sales of foreign exchange reserves by central banks (Coricelli and Revoltella, 2008). While these phenomena have been characterizing the emerging market universe as a whole (Canuto, 2008), in Southeastern Europe they turn the question whether parent banks will support

¹⁵ The risk has been emphasized in the IMF’s *Global Financial Stability Report of April 2008*.

Chart 4

Sovereign Bond Spreads of Selected Southeastern European Countries and JP Morgan Emerging Market Bond Index Global Sovereign Spread



Source: Bloomberg

their subsidiaries in case of a financial crisis in the host country (De Haas and van Lelyveld, 2008) on its head: Will parent banks be able to support their subsidiaries, given the significant deterioration of financial conditions in the home country (Aydin, 2008)?

It is almost self-evident that in this situation the beneficial effects of interlinked ownership structures between banks in mature and emerging markets are put to the test. This is because uncertainties may emerge among the other investors of parent banks' subsidiaries, including retail depositors, on whether the "main depositor," i.e. the parent bank, will indeed choose not to withdraw. While this uncertainty may reflect concerns about the quality of the subsidiaries' lending activities in the host country or concerns about the sustainability of current account deficits, "rational fears" about the liquidity situation of the parent bank in its home market may become a large enough incentive for small-scale depositors to withdraw funds. Thus, they might trigger a run on the subsidiary, thereby further aggravating the liquidity shortage for the multinational bank as a whole. In a financially integrated world, international liquidity risks can hardly be avoided when the global financial system is facing a liquidity crisis.

However, even in such a global crisis, there is – from a macrofinancial stability point of view – one final advantage of having financial development based on subsidiaries of parent banks headquartered in a mature economy, here the euro area: the access to the lender of last resort in the very foreign currency in which deposits and short-term debt of the banking sector are denominated. In this

respect, the actions taken by the ECB and by the EU governments to stabilize the euro area financial system have been good news for macrofinancial stability in Southeastern Europe, as they should reduce uncertainties about the stability of the parent banks' subsidiaries and the above-mentioned risks. By contrast, liquidity challenges are likely to be most severe for banks in Southeastern Europe, but also in other emerging markets, that have engaged in substantial maturity transformation in foreign currency but cannot rely on such a support.¹⁶

6 Summary and Conclusions

The financial crisis reached Southeastern Europe in a way predicted by many observers: by provoking a sudden stop of capital flows into the region. However, the mechanism triggering the crisis was somewhat different from the one expected, given the process of rapid financial deepening and the associated macrofinancial vulnerabilities. Neither has there been a financial crisis in the region caused by a rise in nonperforming loans that would have revealed reckless lending by banks, nor has there been a currency crisis in the form of a speculative attack challenging exchange rate regimes in countries with extraordinary high deficits. Instead, the crisis reached the region when the financial turmoil that started in mature economies in the summer of 2007 turned global after the collapse of Lehman Brothers. In this respect, the saying that every financial crisis is different has again been validated.

With the crisis having become global, it is also difficult to assess whether the unique financial structure characterizing the region, namely the dominance of foreign euro area-based banks in domestic banking sectors, would have really made a difference in containing the macrofinancial vulnerabilities and risks associated with the rapid process of financial deepening over recent years. The current crisis reveals, however, that a strategy of financial development based on foreign entry from the anchor currency area is no guarantee for a smooth process of finance and growth. Moreover, given that growth in the region had been fostered by capital inflows, rapid credit growth and domestic demand, the fallout from the crisis may be more severe than in other emerging countries that had been pursuing an export-led growth strategy. The reason is that rising interest rates and slower growth might lead to a significant deterioration in loan portfolio quality in the region, compounding the credit crunch triggered by the turbulences in mature economies.

Against this background, some form of fiscal expansion would be helpful to counteract the expected decline in demand, like in mature economies. However, many countries in the region have missed the opportunity of the "boom years" to build up a fiscal reserve that can be used in times of need. Thus, it may turn out that an insufficient degree of fiscal tightening was the most severe policy failure that occurred in the period of rapid financial deepening.

¹⁶ Since September 2008, the ECB has concluded agreements with several non-euro area EU central banks to support the provision of euro liquidity, thereby mitigating tensions arising from such liquidity challenges.

References

- Aydin, B. 2008.** Banking Structure and Credit Growth in Central and Eastern European Countries. IMF Working Paper 08/215. Washington, D.C.: IMF.
- Bank for International Settlements. 2008.** Annual Report. Basel: BIS.
- Basso, H. S., O. Calvo-Gonzalez and M. Jurgilas. 2007.** Financial Dollarization: The Role of Banks and Interest Rates, ECB Working Paper No. 748. Frankfurt a.M.: ECB.
- Berglöf, E. and P. Bolton. 2002.** The great divide and beyond. Financial architecture in transition, *Journal of Economic Perspectives*, 16(1). 77–100.
- Berg, A., E. Borenstein and C. Pattillo. 2005.** Assessing Early Warning Systems: How Have They Worked in Practice? IMF Staff Papers. 52(3). 462–502.
- Bracke, T. et. al. 2008.** Financial stability challenges in candidate countries – managing the transition to deeper and more market-oriented financial systems. ECB Occasional Paper No. 95. Frankfurt a.M.: ECB.
- Calomiris, C.W. and G. Gorton. 1991.** The Origin of Banking Panics. In: Hubbard, R.G. (ed.), *Financial Markets and Financial Crises*. University of Chicago Press. 109–173.
- Canuto, O. 2008.** Emerging markets and the systemic sudden stop. *Boletim Informações FINEP* (Fundação Instituto de Pesquisas Econômicas) No. 338. November. 14–19.
- Caprio, G. 1997.** Safe and Sound Banking in Developing Countries – We're Not in Kansas Anymore. World Bank Policy Research Paper No. 1739. Washington, D.C.: World Bank.
- Caprio, G. and D. Klingebiel. 1996a.** Bank Insolvency: Bad Luck, Bad Policy, or Bad Banking? Paper prepared for the World Bank's Annual Bank Conference on Development Economics. Washington, D.C.: World Bank.
- Caprio, G. and D. Klingebiel. 1996b.** Bank Insolvencies – Cross Country Experience. World Bank Policy Research Paper No. 1620. Washington, D.C.: World Bank.
- Chang, R. and A. Velasco. 2000.** Exchange-Rate Policy for Developing Countries. *American Economic Review*. 90(2). 71–75.
- Claessens, S., N. Van Horen, T. Gurcanlar and J. Mercado. 2008.** Foreign Bank Presence in Developing Countries 1995–2006: Data and Trends. Mimeo.
- Coricelli, F. and D. Revoltella. 2008.** Comment: Emerging Europe under examination. *Business New Europe*. November 13.
- De Haas, R. and I. van Lelyveld. 2008.** Internal Capital Markets and Lending by Multinational Bank Subsidiaries. EBRD Working Paper No. 105. London: EBRD.
- Detragiache, E., T. Tressel and P. Gupta. 2006.** Foreign Banks in Poor Countries: Theory and Evidence. IMF Working Paper 06/18. Washington D.C.: IMF.
- Diamond, D. W. 1984.** Financial Intermediation as Delegated Monitoring. *Review of Economic Studies* 51. 393–414.
- Diamond, D. W. and P. H. Dybvig. 1983.** Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy* 91(3). 401–419.
- Eichengreen, B. and O. Choudhry. 2005.** Managing Capital Flows: Eastern Europe in an Asian Mirror, University of California, Berkeley. Mimeo.
- Enoch, C. and I. Ötker-Robe. 2007.** Rapid Credit Growth in Central and Eastern Europe, Endless Boom or Early Warning? Palgrave Macmillan.
- European Central Bank. 2007.** Review of the international role of the euro. Frankfurt a.M.: ECB.
- Grigorian, D. A. and V. Manole. 2002.** Determinants of Commercial Bank Performance in Transition: An Application of Data Envelopment Analysis. IMF Working Paper 02/146. Washington, D.C.: IMF.

- Gorton, G. 2008.** The Panic of 2007. NBER Working Paper No. 14358. Cambridge, Mass.: NBER.
- Gourinchas, P.-O., R. Valdés and O. Landerretche. 2001.** Lending Booms: Latin America and the World. NBER Working Paper No. 8249. Cambridge, Mass.: NBER.
- Hardy, D. C. and A. F. Tiemann. 2008.** Innovation in Banking and Excessive Loan Growth. IMF Working Paper 08/188. Washington, D.C.: IMF.
- Hellmann, T. and K. Murdock. 1998.** Financial sector development policy: The importance of reputational capital and governance. In: R. Sabot and I. P. Székely (eds). *Development Strategy and Management of the Market Economy 2*. Oxford: Clarendon Press.
- Herrmann, S. and A. Winkler. 2008.** Real convergence, financial markets, and the current account – emerging Europe versus emerging Asia. ECB Occasional Paper No. 88. Frankfurt a.M.: ECB.
- International Monetary Fund. 2008a.** Republic of Kazakhstan Country Report 08/228. Washington, D.C.: IMF.
- International Monetary Fund. 2008b.** Global Financial Stability Report. April. Washington, D.C.: IMF.
- Kraft, E. and L. Jankov. 2005.** Does speed kill? Lending booms and their consequences in Croatia. *Journal of Banking and Finance* 29: 105–121.
- Liebscher, K., J. Christl, P. Mooslechner and D. Ritzberger-Grünwald. 2006.** Financial Development, Integration and Stability. Evidence from Central, Eastern and South-Eastern Europe. Edward Elgar.
- Llewellyn, D.T. 2002.** An analysis of the causes of recent banking crises. *European Journal of Finance* 8(2): 152–175.
- Martin, R., L. Schuknecht and I. Vansteenkiste. 2007.** The role of the exchange rate for adjustment in boom and bust episodes. ECB Working Paper No. 813. Frankfurt a.M.: ECB.
- Mehl, A., C. Vespro and A. Winkler. 2006.** Financial sector development in South-Eastern Europe: Quality Matters. In: Liebscher, K., J. Christl, P. Mooslechner and D. Ritzberger-Grünwald (eds). *Financial Development, Integration and Stability. Evidence from Central, Eastern and South-Eastern Europe*. Edward Elgar: 186–203.
- Mihaljek, D. 2006.** Privatisation, consolidation and the increased role of foreign banks. In: *The banking system in emerging economies: how much progress has been made?* BIS Papers No. 28. Basel: BIS.
- Profumo, A. 2006.** UniCredit's strategy in Central and Eastern Europe. In: Liebscher, K., J. Christl, P. Mooslechner and D. Ritzberger-Grünwald (eds). *Financial Development, Integration and Stability. Evidence from Central, Eastern and South-Eastern Europe*. Edward Elgar: 519–530.
- Sirtaine, S. and I. Skamnelos. 2007.** Credit Growth in Emerging Europe. A Cause for Stability Concerns? World Bank Policy Research Working Paper No. 4281. Washington, D.C.: World Bank.
- Sorsa, P., B. B. Bakker, C. Duenwald, A. M. Mäecler and A. Triffin. 2007.** Vulnerabilities in Emerging Southeastern Europe – How Much Cause for Concern? IMF Working Paper 07/236. Washington, D.C.: IMF.
- Tornell, A. and F. Westermann. 2002.** Boom-Bust Cycles in Middle Income Countries: Facts and Explanation. NBER Working Paper 9219. Cambridge, Mass.: NBER.
- Wiedner, H. 2005.** Banking in South-East Europe: the case of the Raiffeisen Group. In: Liebscher, K., J. Christl, P. Mooslechner and D. Ritzberger-Grünwald (eds). *European Economic Integration and South-East Europe. Challenges and Prospects*. Edward Elgar: 382–385.

- Wimmer, M. 2005.** Banking in South-East Europe: the case of Erste Bank. In: Liebscher, K., J. Christl, P. Mooslechner and D. Ritzberger-Grünwald (eds.). *European Economic Integration and South-East Europe. Challenges and Prospects*. Edward Elgar. 386- 390.
- Winkler, A. 2001.** On the need for an international lender of last resort: Lessons from domestic financial markets. *Würzburg Economic Papers* No. 28. University of Würzburg.
- Winkler, A. 2008.** Policy mix challenges in South-East Europe. Paper prepared for the Workshop "Introduction to Central Banking" Center of Excellence in Finance. Ljubljana. November 10- 14.

