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Effects on Trade and Technical Change on the Labor Market

by

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Abstract

The purpose of this paper is to analyze the impact of trade liberalization and technical change on the labor market, looking at the experiences of Poland, Bulgaria and Romania. Evidence suggests that both explanations receive some support. In Bulgaria and Romania, firms in industries with a high import penetration ratio destroy disproportionately more jobs than firms in industries with a low import penetration ratio do. In Poland, trade seems to have a positive effect on employment creation for firms located in industries with a high export intensity share.

The effect of skilled biased technological change seems to be present in Polish manufacturing firms. Firms with high R&D intensity create more jobs on average than firms characterized by a lower R&D intensity. For the sample of Bulgarian and Romanian firms, it is difficult to identify a clear pattern.

In this paper we also link job flow measures to a dynamic labor demand equation. Estimation results confirm the negative effect of trade and the positive impact of firm R&D intensity on job flow measures for the sample of Bulgarian firms. The results for Poland and Romania are less conclusive.

1. Introduction

Disentangling the impact of trade liberalization on the labor market from other effects is not an easy task (see, for a discussion, Harrison and Leamer, 1997 and Levinsohn, 1999). In general, research has focused on industrialized countries, where changes in trade policy typically involve marginal reductions in tariffs and other trade barriers. Marginal changes cannot account for large effects on labor market outcomes. As suggested by Krugman (1995) and Levinsohn (1999), industrializing countries might provide a better subject for the analysis. Major trade reforms in the last three decades have occurred in developing countries. Using micro-economic data, the experiences of Mexico, Morocco and Chile have been recently analyzed by Feliciano (1994), Revenga (1997), Currie and Harrison (1997) and Levinsohn (1999). The “threat of trade” argument is usually presented in the following terms. An increase in import competition implies shifts in industry product demand away from domestic production and, hence, shifts in employment in the same direction. However, there is also a positive effect of trade that may counteract the negative impact. While firms in industries with high import penetration ratios reduce production and dismiss their workers, firms in industries characterized by high export intensity ratios increase production and employment in the same direction.

A competing explanation refers to skilled biased technical change as the factor responsible for changes in labor market outcomes. In the literature, skilled-biased technical change has received some support as the most likely explanation for the strong employment shift in favor of skilled workers registered in industrialized countries (see, e.g., Berman *et al*., 1998; Machin and Van Reenen, 1998). Skilled biased technical change implies a strong reduction of low skilled workers in low R&D intensive industries associated with a strong degree of job creation for highly skilled workers in high R&D intensive industries.

The present paper investigates the effects of trade and technology on job reallocation, looking at the experiences of Poland, Bulgaria and Romania. The data used for the analysis are firm-level data and they cover a panel of manufacturing enterprises over the years 1993-1997. These data were combined with trade flows, production and producer price index data collected at the 3-digit industry level.

Understanding whether and how adjustment has occurred could provide essential insights as to the functioning of the Polish, Bulgarian and Romanian labor markets. This seems particularly relevant in the prospect of the EU enlargement, as further labor reallocation is expected. Moreover, the opening of CEECs to the world economy and its consequences in terms of increased foreign competition and pressure for technical up grading can be relevant to other transition countries embarking on a similar process. Finally, because of the magnitude of the changes implemented in

Central and Eastern Europe, these countries might provide a natural experiment for measuring the labor market effects of trade reforms. However, since trade liberalization in CEECs has been implemented simultaneously with other major reforms, it might be difficult to disentangle trade effects from those of other measures.

The structure of the paper is as follows. Section 2 discusses trade flows data. Section 3 describes patterns of job creation and destruction according to different measures of trade exposure, R&D intensity and wages. Since descriptive statistics at relatively high aggregation will hide the heterogeneity across firms, which has been documented in the previous chapters, we specify dynamic firm level demand functions for jobs in section 4. Results of dynamic functions augmented by indices of trade and technological change are shown in section 5. Section 6 concludes.

2. Data

The evolution of export and import shares in gross domestic product is shown in figure 1, where trade flows are defined as total flows in goods and services. From Figure 1 Bulgaria emerges as a very open economy with trade shares that range between 40 and 60 percent in gross domestic product. Poland and Romania are larger economies and report more modest shares of trade flows[1].

The evolution of manufacturing export and import shares over the sample period for the three economies is shown in figure 2. These shares are constructed using data on exports, imports and production flows provided by national statistical offices at the 3-digit NACE industry level. These data will be used in the following analysis. Unfortunately, there is a caveat. We do not have total manufacturing exports for Bulgaria at the 3-digit industry level. In order to overcome this limitation, we use manufacturing export flows from Bulgaria to the EU, which were recorded by EUROSTAT, trade statistics, at the 3-digit NACE-CLIO industry level. The share resulting from this series is reported as BG-exp in Figure 2. As expected, the export share is lower than the import share for Bulgaria; however, the two shares seem to have a common trend. In addition, from other trade sources, e.g. the United Nation trade statistics, the share of manufacturing export flows to the EU in total manufacturing exports is about 50 percent for Bulgaria in 1996 and 1997. We think these flows might represent a good approximation of the actual export pattern.

Trade and production data were then combined with firm level data retrieved from the Amadeus data set. In addition, variables were deflated using an appropriate producer price index at the 3-digit industry level.

Comparing Amadeus data and national statistics by country, it is evident that the former covers mainly the upper part of firm distribution (see table 1). Average industry sales across firms in Amadeus are much larger than national averages. Moreover, sales coverage ratios, computed as total industry sales in Amadeus as total industry sales at the country level, are on average greater than 50%. Given that very large and inefficient firms historically characterize transition countries and that these firms are probably the ones subjected to more intense job reallocation, Amadeus data are probably suited for the analysis.

(Figures 1 and 2 about here)

(Table 1 about here)

[1] A detailed description of the liberalization measures adopted by these economies over the 90s is provided in appendix B.

3. Job flows according to trade exposure, R&D intensity and wage level

In this section, we analyze patterns of job dynamics according to several measures of trade exposure, R&D intensity and firm average wage.

We first present the relationship between job flows and trade exposure. Following Davis *et al*. (1996), we sort 3-digit manufacturing industries by two measures of foreign trade exposure: the import penetration ratio, defined as the share of imports in domestic sales, and export intensity ratio, defined as the share of exports in domestic sales (see appendix A for details). After this sorting, we compute quintiles of the shipments-weighted distributions and we examine how net and gross job flows vary by these two measures. The results are reported in table 2.

Looking at the relationship between net job growth and import penetration ratio, there is evidence of a disproportionate destruction of jobs in industries with high import penetration ratio in Bulgaria and Romania. In Poland, industries with high, but not very high, import penetration ratio are net creators of jobs. Looking at gross job measures, lower job creation but not higher job destruction rates explain the disproportionate loss of jobs in highly penetrated industries in Bulgaria and, at less extent, in Romania. Hence, the threat of trade, i.e. higher foreign competition leading to higher job displacement, seems to occur in both countries in the form of fewer job opportunities in the sectors exposed.

Considering the lower panel of table 2, job creation is higher in Polish industries with high export intensity ratio, suggesting that Polish industries that enter foreign markets are creating more jobs than firms in other sectors are. Trade exposure seems to have a positive effect for Polish firms. Looking at the results for Bulgaria and Romania, it is more difficult to identify a clear pattern in the data. Perhaps, firms in highly export intensity industries seem to destroy disproportionately more jobs in Bulgaria.

If the results reported in table 2 suggest that a greater exposure to international trade has opposite effects on the three countries analyzed, i.e. a positive effect on Poland through exports and a negative on Bulgaria and Romania through imports, it might be relevant to consider the alternative explanation. Perhaps, skilled-biased technical change has also a different effect across countries.

(Table 2 about here)

Table 3 reports annual job flows for two measures of R&D intensity: industry R&D intensity according to the OECD classification and firm level R&D intensity, the latter being defined as the ratio of intangible fixed assets to total firm sales (see appendix A for details). In the case of firm R&D intensity, we construct five categories computing quintiles of the distribution of the firm R&D measure for each year and then averaging over the years.

Considering first the lower panel of table 3, job destruction is higher in high R&D intensive industries across all countries. Job creation is instead higher in low R&D intensive industries. These results are surprising: we would expect firms in high R&D sectors perform better, at least in terms of job creation, than firms in low R&D sectors. However, evidence suggests that there is a disproportionate loss of jobs in high R&D intensive industries across all countries. Perhaps the industry classification we use is too broad and, thus, does not take into account the high heterogeneity of firms within sectors, documented in chapters 2 and 3. In fact, when considering the magnitude of job flows according to firm R&D intensity (the upper panel of table 3), there is evidence of higher job creation in Polish firms with high R&D intensity and, at less extent, in Bulgarian and Romanian firms. Since job destruction is also higher in high R&D intensive firms, the results indicate that firms with high R&D intensity are characterized by more turbulence than firms with lower R&D intensity.

Looking at net employment growth, low R&D intensive firms in Poland destroy disproportionately more jobs than high R&D intensive firms, which are almost in equilibrium, i.e. job destruction equal to job creation. This finding seems to reflect the effect of skilled biased technological change on Polish manufacturing firms during the second part of the 90s. The effect is less evident for Bulgaria and Romania.

In table 4, we consider how job flow behavior varies with a firm's position in the firm wage distribution. Across all countries, job creation and destruction rates are higher in low wage firms. However, while low wage firms destroy most jobs in Bulgaria, low wage firms are net creators of jobs in Poland and Romania. If we accept that wages reflect the skills and abilities of workers, we can interpret differences in mean wages across firms as differences in average worker levels of human capital, thus suggesting that less skilled workers in our sample suffer less job stability than high skilled workers. This is a regularity found also for industrialized countries (see Davis *et al*., 1996).

(Table 3 and 4 about here)

4. The relationship between gross job flows and a dynamic labor demand equation

It has been suggested (see, among others, Klein *et al*., 1999; Salvanes and Førre, 2001) that the model of job flows can be embedded in the standard dynamic labor demand equation.

From section 1.2.1, recall the definition of net employment growth:

$$\Delta N_{i,s,t} = JC_{i,s,t} - JD_{i,s,t} \tag{1}$$

The net employment change for firm i in sector s at time t is the resultant of gross flows of workers, i.e. the difference between gross job creation and gross destruction. The net employment change is also the focus of a dynamic labor demand equation. Therefore, there exists a relationship between studying gross job flows and analyzing a dynamic labor demand equation. Focussing on the gross flows of jobs allows us to distinguish between firms that are expanding, contracting or being stable over the period $t-1$ and t. As expressed in equation (1), this is equivalent to analyze a labor demand equation distinguishing between firms that expand their size, i.e. firms for which $\Delta N_{i,s,t} > 0$, and firms that contract their size, i.e. $\Delta N_{i,s,t} < 0$, and firms that do not change their workforce, $\Delta N_{i,s,t} = 0$.

To be rigorous (see, for details, Salvanes and Førre, 2001), the exact decomposition of the net employment change for a firm i in sector s at time t is:

$$\Delta N_{i,s,t} = H_{i,s,t} - S_{i,s,t} = JC_{i,s,t} + R_{i,s,t} - (JD_{i,s,t} + S^{R}_{i,s,t}) \tag{2}$$

where total hires $H_{i,s,t}$ are the sum of job creation and rehires, $R_{i,s,t}$, of workers due to quits or layoffs. Total separations $S_{i,s,t}$ may be decomposed into job destruction and separations of workers which are being replaced $S^{R}_{i,s,t}$. The sum of hires and separations due to replacement, $R_{i,s,t} + S^{R}_{i,s,t}$ in our notation, is called churning or replacement flow in the literature. Under the conventional assumption that there are no vacancies, $R_{i,s,t}$ and $S^{R}_{i,s,t}$ are equal in equilibrium. In order to compute total hires and separations at the firm level, we would require information on worker flows, which is not available for the sample of firms we study. Thus, we concentrate on job destruction and creation.

4.1 Dynamic labor demand specification

In this subsection we specify a firm level dynamic labor demand equation for gross and net flows of jobs. Consider the cost function for the i^{th} firm in sector s at time t as expressed by the following function:

$$C_{i,s,t}(W_{i,s,t}, G_{i,s,t}; Q_{i,s,t}) = A_{i,s,t} W_{i,s,t}^{\alpha} G_{i,s,t}^{(1-\alpha)} Q_{i,s,t} \tag{3}$$

A firm i minimizes its costs, $C_{i,s,t}$, in order to produce a target amount of output, $Q_{i,s,t}$. The firm uses labor paid at wage $W_{i,s,t}$ and non-labor inputs paid at cost $G_{i,s,t}$. Non-labor inputs can include capital and material inputs. $A_{i,s,t}$ is a parameter, specific to the firm, which indicates the Hicks neutral technological progress.

By applying the Shephard's lemma, we can express the conditional demand for labor as the partial derivative of the cost function with respect to $W_{i,s,t}$. In symbols:

$$N_{i,s,t} = \delta C_{i,s,t}(W_{i,s,t}, G_{i,s,t}; Q_{i,s,t}) / \delta W_{i,s,t} = \alpha A_{i,s,t} W_{i,s,t}^{\alpha-1} G_{i,s,t}^{(1-\alpha)} Q_{i,s,t} \tag{4}$$

The conditional labor demand for labor depends on wages, average unit cost of non-labor inputs and firm desired level of output. In order to have a dynamic labor demand for labor, we have to transform equation (4) in period changes. After taking logs and total differentiating equation (4), we obtain:

$$dln(N_{i,s,t}) = dln(A_{i,s,t}) - (1-\alpha)dln(W_{i,s,t}) + (1-\alpha)dln(G_{i,s,t}) + dln(Q_{i,s,t}) \tag{5}$$

Our purpose is to study the impact of trade and technological change on the reallocation of jobs across and within sectors. The term $A_{i,s,t}$ in the labor demand equation accounts for the impact of technological change on the demand for labor of firm i. In order to consider the impact of trade on labor, we augment equation (5) by a parameter $H_{i,s,t}$, which captures the heterogeneity of firms within a sector with respect to foreign competition.

Equation (5) becomes:

$$dln(N_{i,s,t}) = dln(A_{i,s,t}) - (1-\alpha)dln(W_{i,s,t}) + (1-\alpha)dln(G_{i,s,t}) + dln(Q_{i,s,t}) + dln(H_{i,s,t}) \tag{6}$$

4.2 Econometric specification

Following Hamermesh (1995) and Salvanes and Førre (2001), we consider gross as well as net changes in jobs. Since a firm i at any time t can either creates or destroys jobs, we derive firm level econometric specifications for gross creation, gross destruction and net employment growth as follows:

$$JC_{i,t} = \beta_0 + \beta_1 \Delta w_{i,t} + \beta_2 \Delta q_{i,t} + \beta_3 \Delta a_{i,t} + \beta_4 \Delta h_{s,t} + \Delta\varepsilon_{i,t} \tag{7}$$

$$JD_{i,t} = \beta_0 + \beta_1 \Delta w_{i,t} + \beta_2 \Delta q_{i,t} + \beta_3 \Delta a_{i,t} + \beta_4 \Delta h_{s,t} + \Delta\varepsilon_{i,t} \quad (8)$$

$$NET_{i,t} = \beta_0 + \beta_1 \Delta w_{i,t} + \beta_2 \Delta q_{i,t} + \beta_3 \Delta a_{i,t} + \beta_4 \Delta h_{s,t} + \Delta\varepsilon_{i,t} \quad (9)$$

where the dependent variables are, alternatively, job creation, job destruction and net employment growth at the firm level between time *t-1* and *t*; $\Delta w_{i,t}$ is the change in firm average wage deflated by an appropriate 3-digit producer price index; $\Delta q_{i,t}$ denotes the change in firm real sales, i.e. sales deflated by the 3-digit producer price index; $\Delta a_{i,t}$ denotes technical change, which is measured by either firm or industry R&D intensity. Industry R&D intensity refers to three categories: low, medium and high R&D, with high R&D being the base group. $\Delta h_{s,t}$ denotes the changes in industry import competition and export intensity ratios. In all specifications, we include year dummies in order to control for macroeconomic effects.

Even if we have assumed that firm sales are exogenous, in reality endogeneity may arise for the presence of current firm sales in the specifications. We try to instrument the variable with industry average sales, but it did not give good results. We proceed, being aware of this potential source of endogeneity.

5. Results

In this section we present the results of a tobit estimation for the job creation and destruction specifications described in equation (7) and (8), as well as the results of a OLS estimation for net changes of jobs, i.e. equation (9), adjusted for repeated observations on firms. We report two sets of estimations, measuring technological change either at the firm or at the industry level. In all specifications, wage and sales variables have the expected signs. An increase in average firm wage has a negative impact on the three measures (gross and net) of labor costs. An increase in sales has a positive impact (see tables 5- 7).

Since our focus is on trade and technology effects, in this section we concentrate the discussion on import, export and technology parameters. In Bulgaria, changes in import penetration ratio have a negative and significant impact on gross and net employment changes in the first set of equations. However, its significance disappears when we include a firm level measure of R&D. In this case, firm R&D appears to have a positive and significant effect on job creation and net job reallocation, perhaps indicating the positive effect of technological change at the firm level.

(Table 5 about here)

Although the effect of technological change was not evident for Bulgaria when analyzing patterns of job dynamics (see table 3), the empirical analysis at the firm level shows a positive impact. As suggested in table 2, firms in low and medium R&D intensive industries relative to high R&D intensive industries are characterized by high turbulence in terms of all job flow measures.

Looking at the results for Polish firms (see table 6), information on wages is available for a limited number of firms, so that the sample size in the estimation is largely reduced. This feature of the data might contribute to explain the lack of significance of many variables in the estimations. Apart from the significance of wages and sales variables, the only significant effect is the industry effect of low and medium R&D industries. It is worth noting that firms in low and medium R&D industries have higher job destruction and net job growth rates than firms in high R&D intensive industries. However, the effect in job creation is not significant. Firms in high R&D intensive sectors do not perform worse than their counterparts in lower R&D sectors in terms of job creation.

(Table 6 about here)

Finally, the results for Romania are reported in table 7. While import penetration ratio has a negative impact on job destruction, export penetration ratio has a positive effect on net job growth. Firms in low, but not in medium, R&D industries are characterized by higher turbulence relative to those in high R&D sectors. Firm R&D intensive measure is available only for a third of the sample. When using it in the estimation, no effect of trade or technological change emerges.

(Table 7 about here)

6. Conclusions

In this paper we explore the impact of trade and technical change on the manufacturing sector of three countries of Central and Eastern Europe. Looking at patterns of job dynamics, evidence suggests that both trade and skilled biased technological change have affected these economies. However, there are differences across countries. The threat of trade, i.e. job displacement due to import competition, seems to have destroyed manufacturing jobs in Bulgaria and Romania, but not in Poland. The positive employment effect of increased export intensity seems to characterize Polish manufacturing firms. In addition, when the impact of technological change on the labor market is measured at the firm level, high R&D intensity is associated with higher job creation across Polish firms, but less evident across Bulgarian and Romanian enterprises. Estimations of a dynamic labor demand equation confirm the negative effect of trade on job flow measures only in the case of Bulgaria. The results also shows that Bulgarian firms, characterized by high R&D intensity, are performing better in terms of job creation and net employment growth. For the other two countries, the estimation results are less conclusive.

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Appendix A

Table 1A: Classification in high-, medium- and low-R&D intensive industries

Sector type	*ISIC Rev.2*	*NACE Rev.1*	*Description*
High-R&D intensive			
	383	311-316	Manufacture of electrical machinery and apparatus
	3832	321-323	Manufacture of radio, television and communication equipment
Medium-R&D intensive			
	351-352	241-247	Manufacture of industrial chemicals
	382	291-297	Manufacture of machinery
	3825	300	Manufacture of office machinery and computers
	385	331-335	Manufacture of medical, precision and optical instruments
	384	341-355	Manufacture of transport equipment
Low-R&D intensive			
	311-313	151-159	Manufacture of food products and beverages
	314	160	Manufacture of tobacco products
	321-322	171-183	Manufacture of textiles and textile products
	323-324	191-193	Manufacture of leather and footwear
	331-332	201-205	Manufacture of wood and wood products
	341-342	211-223	Manufacture of paper; publishing and printing
	353-354	231-233	Manufacture of coke and refined petroleum products
	355-356	251-252	Manufacture of rubber and plastic products
	361-369	261-268	Manufacture of non-metallic mineral products
	371-372	271-275	Manufacture of basic metals
	381	281-287	Manufacture of fabricated metal products
	390	361-366	Other manufacturing

Source: OECD, Paris.

Import penetration ratio and export intensity ratios

Import penetration ratio by 3-digit NACE Rev.1 sectors is defined as imports/ (production+ imports - exports). Export intensity ratio by 3-digit NACE Rev. 1 sectors is defined as: exports / (production + imports - exports). Data on exports, imports and industry production were collected by National Statistical offices.

International trade exposure

We use data collected from the National Statistical Offices in Poland, Bulgaria and Romania to construct measures of exposure to international trade. The data provided are 3-digit NACE Rev.1 industry level data on exports, imports and production in manufacturing.

One measure of trade exposure is the import penetration ratio defined as:

$$IMP_{j,t} = imports_{j,t}/(output_{j,t} + imports_{j,t} - exports_{j,t}) \quad (A.1)$$

where the subscripts j and t refer to a 3-digit industry sector and time, respectevely. The values for $imports_{j,t}$, $exports_{j,t}$ and $output_{j,t}$ are computed at current prices. The denominator in equation (A.1) approximates domestic industry sales. Following Davis *et al*. (1996), we indentify five import penetration categories, which are based on the quintiles of the imports-weighted distribution of the pooled 1994-1997 industry-level data.

A second measure of trade exposure is the export intensity ratio that is given by:

$$EXI_{j,t} = exports_{j,t} /(output_{j,t} + imports_{j,t} - exports_{j,t}) \quad (A.2)$$

We define five export intensity categories that are chosen based on quintiles of the exports-weighted distribution of the pooled industry data.

Real firm average wage

Data on annual wages and employment at the firm level for the years 1993-1997 are retrieved from the Amadeus CD-ROM. We deflate the series by the corresponding producer price index provided by National country statistics. We define five wage categories computing quintiles of the employment-weighted distribution of real average wages for each year and then averaging over the years.

Firm R&D intensity

Data on annual firm intangible fixed assets and sales are retrieved firm the Amadeus CD-ROM. We define five R&D intensity categories computing quintiles of the distribution of the ratio of intangible assets to firm sales for each year and then averaging over the years.

Appendix B: Institutional background

Under central planning, the two historical factors that have mostly shaped Central and Eastern European trade were the state monopoly over foreign trade and the involvement in the Council of Mutual Economic Assistance (CMEA). The state, operating through foreign trade organizations, retained monopoly power over foreign trade activity. Shortages, administrative rationing and foreign trade price equalization schemes insulated producers from international markets, although international links were not completely cut (Rodrik, 1994; Kaminski *et al*., 1996; Hoekman and Djankov, 1996; and Repkine and Walsh, 1999). Under the CMEA, the dominance of the Soviet Union gave rise to bilateral ties between the Soviet Union and the other CMEA members, who were required to adjust their production structures to the needs of the bloc. The applied foreign trade regime was explicitly biased against exports and implicitly biased against imports regardless of tariff and non-tariff barriers. On the export side, multiple exchange rates distorted prices and foreign exchange surrender requirements reducing the incentives for firms to engage in foreign trade, while, on the import side, the centralized control of foreign exchange transactions and the centralized allocation of foreign exchange served as a non-tariff barrier.

The reorientation of trade to the European Union (EU) started in the mid-80s. Between 1986 and 1991, the share of CEECs exports to the CMEA markets decreased from 52 percent to 27 percent, while the share of CEECs exports to the EU and other OECD markets doubled, rising from 30 percent to 62 percent (Kaminski *et al*., 1996; Hoekman and Djankov, 1996). The extent to which international markets absorbed the fall in intra-CMEA trade varied among countries. In Poland, significant steps to dismantle the state monopoly over foreign trade were undertaken in the early 80s, when the authorities liberalized conditions to obtain foreign trade licenses. Therefore, the country benefited early from the trade concessions offered by OECD governments. Given different initial conditions and delays in reform, the Balkan countries, i.e. Bulgaria and Romania, suffered a large decline in total exports between 1988-1991 and since then experienced a recovery. In 1997, the share of trade in GDP was 46.6 percent and 27.1 percent in Bulgaria and Romania, respectively.

Trade liberalization between CEECs and the EU has been characterized by significant increases in IIT (Landesmann, 1995; Hoekman and Djankov, 1996; Brenton and Gross, 1997; Thom, 1999) as well as by CEECs' trade specialization in traditional (labor intensive) goods clustered in few sub-sectors of the economy (Rodrik, 1994; Repkine and Walsh, 1999).

Liberalization in CEECs consists of mainly four components: trade and price liberalization, privatization, labor market liberalization and financial market reforms. Given the emphasis of this paper on studying the impact and consequences of trade reforms, in the remainder of this section we focus on describing the trade liberalization measures and we briefly mention the other reforms.

For Poland, all spheres of foreign trade were rapidly liberalized after the collapse of central planning and the CMEA. The country quickly adopted a unified exchange rate, made their currency convertible for current account transactions, gave firms full autonomy to operate in international markets, removed most price controls, and abolished export controls and reduced tariffs. Although Bulgaria attempted to liberalize early in the transition[2], the country was unable to maintain these reforms in face of mounting domestic and external imbalances (the CA was -9.3 percent and -12.8 percent of GDP in 1992 and 1993, respectively – EBRD, 1999). Thus, Bulgaria reversed partially liberalization between 1994-1996 and a temporary import surcharge was introduced during the crisis of 1996. It has only recently restored the level of liberalization that once prevailed (EBRD, 1999). Romania followed a more gradual approach to trade liberalization. The country unified the exchange rate in 1997 and it reduced tariffs and price controls achieving full current account liberalization only in 1998 (see table 1B).

As countries removed the mechanisms that shielded firms from international competition and as their initial real currency undervaluation was eroded, strong pressures for protectionism grew up from domestic industries. Using the IMF calculation of an index of the real effective exchange rate[3], the Polish zloty was 61.25 in 1989. It depreciated to 51.57 in 1990 and since it started appreciating. It was 111.12 in 1997. The Bulgarian leva arose (appreciated) steadily from 62.98 in 1992 to 100 in 1995. It dropped to 86.09 during the 1996 crisis while in 1997 it appreciated again (105.10). As a consequence of this appreciation, strong pressures for protectionism rose, which led most CEECs to increase their tariffs and, sometimes, non-tariff barriers. Poland raised temporary import restrictions during the years 1992-1995 while Bulgaria introduced new tariffs in 1994-1995 and during the crisis of 1996.

Privatization laws were adopted in all countries on the onset of transition (Poland in 1990, Bulgaria in 1992 and Romania in 1991). While privatization of small-scale enterprises advanced rapidly, privatization of medium-sized and large enterprises has been much more difficult, shaped by multiple objectives and political constraints[4].

Poland entered transition with an already initiated private sector, which consisted of small-scale enterprises. An EBRD index of cumulative progress in small-scale privatization (see table 2B) reports the highest ratings of 0.9 for Poland. While Romania achieved a relative rapid progress in

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[2] In 1991 Bulgaria liberalised most prices, removed import controls and adopted a unified exchange rate (EBRD, 1997). However, the country maintained export controls on essential inputs as well as restrictions on access to convertible currency markets.

[3] Using the IMF index, appreciations are measured as increases, while depreciations are measured as reductions in the value of the index.

[4] See, Roland (2000), chapter 10, for an exstensive discription of the privatization process in CEECs.

small-scale privatization, Bulgaria lagged behind. The countries report ratings of 0.77 and 0.43, respectively.

Table 1B: Liberalization measures

	Price liberalization	*Full current account convertibility*	*Capital account convertibility 1997*	*Tariff revenue (% of imports) 1996*	*Small-scale privatization index 1997*	*Private sector share in GDP 1997*
Poland	1990	1995	partial*	10.7	0.90	65
Bulgaria	1991	1997	partial	6	0.43	50
Romania	1995	1998	partial	5.1	0.77	60

Note: (*): Since January 2000, only restrictions on short-term capital remain.
Source: EBRD, Transition Report (1998 and 1999); EUROSTAT trade statistics (1993-1996); Buch and Hanschel (1999).

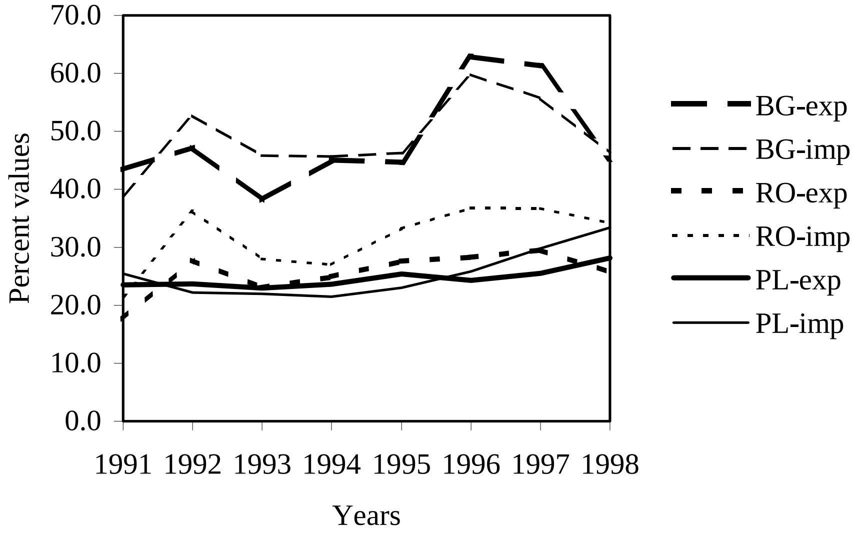
For Romania, privatization of medium-sized and large enterprises has significantly benefited insiders through management-employee buy-outs (MEBOs) as primary privatization method. This resulted in roughly 60 percent of state-owned enterprise assets being privatized in Romania by 1997. Poland and Bulgaria sold directly shares to investors as their primary method. Polish and Bulgarian state-owned firms' assets accounted for 35 percent and 50 percent of GDP, respectively (table 1B).

Regarding labor market liberalization, Romania is characterized by decentralized wage setting procedures while wages are still regulated in Bulgaria and Poland. Financial market reforms involve letting the market sets interest rates and removing quantitative restrictions to external borrowing. While interest rates are fully liberalized in all countries, full capital account convertibility has still to be implemented (Buch and Hanschel, 1999).

To summarize, the picture given is the one in which liberalization measures have been applied in the three countries at very different speeds. Poland appears more advanced in the liberalization process and, in fact, the country is among the "first wave" candidates for the EU accession[5]. Conversely, Bulgaria and Romania lag behind, even if they have recently shown signs of enhancement.

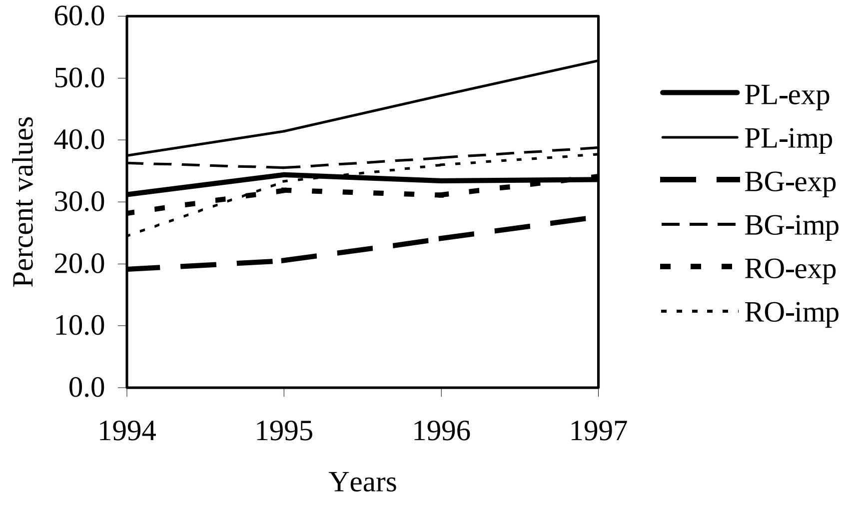
[5] While Poland signed the EU Association Agreements in March 1992, Bulgaria and Romania signed the Agreements only in 1995.

Figure 1: Shares of exports and imports in GDP



Note: Trade flows include goods and services.
Source: IMF Financial statistics, (2000).

Figure 2: Shares of exports and imports in total manufacturing output



Note: All trade flows are total manufacturing flows, except Bulgarian exports flows, which refer to manufacturing export flows to the European Union only.
Source: National statistical offices and EUROSTAT, trade statistics.

Table 1: Comparison between Amadeus data and country national statistics

	N. of firms in Amadeus	*Avg. Sales in Amadeus*	*N. of firms in National sts.*	*Avg. Sales in National sts.*	*Sales coverage ratio*
Bulgaria					
1994	999	28.9	4418	8.6	0.80
1995	1275	25.4	7454	9.7	0.78
1996	1167	18.7	8292	9.2	0.70
1997	1196	17.3	8954	7.7	0.72
Poland					
1994	924	18.6	18686	17.5	0.35
1995	2308	29.0	24932	12.1	0.66
1996	2267	44.6	29293	10.9	0.75
1997	2157	41.9	32723	11.1	0.72
Romania					
1994	1737	16.9	32257	9.8	0.59
1995	1850	19.7	34404	11.2	0.64
1996	1927	21.7	32065	12.0	0.63
1997	1984	24.2	35962	12.7	0.63

Note: Coverage ratio = Total sales in Amadeus over total sales in the national statistics by 2-digit NACE industry classification. Sales variables are expressed in millions of US dollars.

Table 2: Annual average job flows according to foreign trade exposure, 1995-1997

Country/quintiles	*pos*	*neg*	*gross*	*net*	*exc*
Import penetration ratio at the 3-digit industry level					
Poland					
Very Low	4.1	6.5	10.6	-2.4	7.9
Moderately Low	5.1	5.5	10.6	-0.4	9.8
Average	3.4	6.3	9.7	-2.8	6.9
Moderately High	6.4	4.8	11.2	1.6	8.3
Very High	3.7	6.6	10.3	-2.9	7.4
Bulgaria					
Very Low	3.3	6.5	9.8	-3.2	5.8
Moderately Low	3.1	5.3	8.4	-2.3	5.7
Average	3.3	4.8	8.1	-1.4	5.1
Moderately High	2.1	5.9	8.0	-3.7	4.3
Very High	2.1	4.8	6.9	-2.7	4.2
Romania					
Very Low	3.1	7.9	11.0	-4.8	6.2
Moderately Low	4.2	8.7	13.0	-4.5	8.5
Average	2.6	8.7	11.4	-6.2	5.3
Moderately High	2.0	8.0	10.0	-5.9	4.1
Very High	3.4	8.7	12.1	-5.3	6.7
Export intensity ratio at the 3-digit industry level					
Poland					
Very Low	3.5	5.8	9.3	-2.2	7.1
Moderately Low	3.5	7.3	10.8	-3.8	6.9
Average	3.1	5.8	8.9	-2.6	6.3
Moderately High	6.0	5.5	11.5	0.5	8.8
Very High	5.3	5.5	10.8	-0.2	9.5
Bulgaria					
Very Low	3.7	5.0	8.7	-1.3	6.3
Moderately Low	2.7	5.0	7.7	-2.4	4.7
Average	3.8	4.3	8.1	-0.4	6.3
Moderately High	2.1	7.1	9.1	-5.0	4.1
Very High	2.4	5.2	7.6	-2.8	3.9
Romania					
Very Low	3.6	8.5	12.2	-4.9	7.0
Moderately Low	2.5	10.4	12.8	-7.9	5.0
Average	2.6	10.3	12.9	-7.8	5.1
Moderately High	2.2	8.5	10.7	-6.3	4.4
Very High	3.3	7.2	10.6	-3.9	6.7

Note: Import penetration ratio is the ratio of imports to total industry sales, defined as imports plus output minus exports; export intensity ratio is the ratio of exports to total industry sales. The two series of quintiles are computed on the pooled industry-year trade data using the shipments-weighted distributions of the import penetration and the export intensity ratios. Industries are allocated to classes on an annual basis (see appendix A for details). For details on job flow definitions, see appendix A.

Table 3: Annual average job flows according to firm and industry R&D intensity, 1994-1997

Country/quintiles	*pos*	*neg*	*gross*	*net*	*exc*
		R&D intensity at the firm level			
Poland					
Very Low	3.7	4.7	8.5	-1.0	6.3
Moderately Low	2.6	6.0	8.7	-3.4	5.3
Average	3.5	5.6	9.1	-2.1	6.7
Moderately High	4.0	5.2	9.3	-1.2	7.2
Very High	5.4	5.6	11.0	-0.1	9.5
Bulgaria					
Very Low	2.6	4.6	7.2	-2.0	4.3
Moderately Low	2.4	5.4	7.7	-3.0	4.2
Average	2.1	6.9	9.1	-4.8	3.9
Moderately High	3.5	6.1	9.6	-2.5	6.0
Very High	2.0	8.4	10.4	-6.3	4.1
Romania					
Very Low	1.9	6.6	8.5	-4.6	3.9
Moderately Low	2.7	7.5	10.3	-4.8	5.5
Average	3.8	8.3	12.1	-4.5	7.5
Moderately High	2.8	8.0	10.8	-5.1	5.6
Very High	1.9	8.0	10.0	-6.1	3.9
		Industry R&D intensity			
Poland					
High R&D	3.4	8.1	11.6	-4.7	6.9
Medium R&D	3.8	5.7	9.5	-1.8	7.7
Low R&D	3.9	5.6	9.5	-1.6	7.9
Bulgaria					
High R&D	1.6	7.0	8.6	-5.4	3.2
Medium R&D	2.1	6.1	8.3	-4.0	4.1
Low R&D	2.6	5.6	8.2	-3.0	4.7
Romania					
High R&D	2.0	9.8	11.8	-7.8	3.9
Medium R&D	1.4	8.0	9.4	-6.6	2.8
Low R&D	3.6	8.4	12.1	-4.8	7.3

Note: R&D intensity at the firm level is defined as the ratio of intangible fixed assets to sales. Quintiles are computed from the R&D intensity distribution for each year and then averaged over the years (see Appendix A). Industry R&D intensity classification has been provided by the OECD (see table A.1).

Table 4: Annual average job flows according to firm average wage level, 1994-1997

Country/quintiles	*pos*	*neg*	*gross*	*net*	*exc*
Poland					
Very Low	8.1	6.8	14.9	1.3	12.9
Moderately Low	6.7	9.8	16.5	-3.1	10.0
Average	2.4	8.8	11.2	-6.5	4.7
Moderately High	4.2	5.8	10.0	-1.5	6.7
Very High	4.4	5.1	9.5	-0.1	5.4
Bulgaria					
Very Low	3.0	8.5	11.5	-5.5	6.0
Moderately Low	2.1	7.8	9.9	-5.7	4.2
Average	2.0	6.9	8.9	-4.9	4.0
Moderately High	2.5	6.9	9.4	-4.4	5.0
Very High	2.4	4.9	7.3	-2.5	4.0
Romania					
Very Low	18.7	13.9	32.6	4.7	27.3
Moderately Low	8.2	15.6	23.8	-7.4	16.4
Average	3.7	10.5	14.2	-6.8	7.4
Moderately High	2.3	9.8	12.0	-7.3	4.7
Very High	1.8	6.9	8.8	-5.1	3.7

Note: Following Davis *et al*. (1996), we first expressed all wages in real terms using a 3-digit sectoral level producer price index (base year 1995). Second, we computed quintiles of the employment-weighted distribution of firms' real average wages by year, and we averaged them over the years in order to identify five wage classes. Third, we computed job flow rates by years and wage class. Finally, to obtain the reported figures, we computed average job flows rates across years by wage groups (see appendix A for details).

Table 5: Job creation, destruction and net growth estimations, Bulgaria

	JC	*JD*	*NET*	*JC*	*JD*	*NET*
$\Delta w_{i,t}$	-.344*	-.190*	-.272*	-.323*	-.226*	-.295*
	(.014)	(.012)	(.048)	(.018)	(.015)	(.067)
$\Delta q_{i,t}$	.281*	.188*	.237*	.267*	.215*	.253*
	(.013)	(.010)	(.028)	(.017)	(.014)	(.038)
$\Delta imp_{i,t}$	-.032**	-.026**	-.020***	-.017	-.017	.001
	(.014)	(.012)	(.012)	(.017)	(.015)	(.014)
$\Delta exi_{i,t}$	-.002	.001	.002	.005	.004	.008
	(006)	(.001)	(.006)	(.007)	(.006)	(.008)
$\Delta a_{i,t}$				.011**	.006	.009*
				(.004)	(.004)	(.004)
Medium R&D	.042**	.034**	.012			
	(.021)	(.017)	(.011)			
Low R&D	.074*	.046*	.036*			
	(.019)	(.015)	(.010)			
Pseudo R2	.37	.37	.26	.33	.39	.28
N of obs.	2789	2789	2789	1711	1711	1711
Uncensored	1310	1423		795	895	

Note: *JC* and *JD* are tobit estimations; *NET* is a OLS estimation with heteroskedasticity consistent standard errors. Standard errors are reported in brackets. When using industry R&D intensity, high R&D is the base category. (*) significant at 1% level; (**) significant at 5% level; (***) significant at 10% level. All specifications include year dummies.

Table 6: Job creation, destruction and net growth estimations, Poland

	JC	*JD*	*NET*	*JC*	*JD*	*NET*
$\Delta w_{i,t}$	-.549*	-.366*	-.494*	-.537*	-.247*	-.448*
	(.034)	(.033)	(.102)	(.036)	(.034)	(.114)
$\Delta q_{i,t}$	.497*	.404*	.412*	.476*	.331*	.378*
	(.042)	(.036)	(.059)	(.046)	(.036)	(.061)
$\Delta imp_{i,t}$	.056	.045	.057	.037	-.001	.015
	(.062)	(.060)	(.042)	(.064)	(.057)	(.042)
$\Delta exi_{i,t}$	.017	.005	.008	.018	-.004	.006
	(025)	(.026)	(.015)	(.028)	(.025)	(.017)
$\Delta a_{i,t}$				.007	.001	.001
				(.009)	(.008)	(.007)
Medium R&D	.053	.116**	.051			
	(.055)	(.046)	(.059)			
Low R&D	.076	.144*	.093*			
	(.053)	(.043)	(.058)			
Pseudo R2	.47	.42	.44	.43	.35	.38
N of obs.	581	581	581	508	508	508
Uncensored	284	287		244	256	

Note: *JC* and *JD* are tobit estimations; *NET* is a OLS estimation with heteroskedasticity consistent standard errors. Standard errors are reported in brackets. When using industry R&D intensity, high R&D is the base category. (*) significant at 1% level; (**) significant at 5% level; (***) significant at 10% level. All specifications include year dummies.

Table 7: Job creation, destruction and net growth estimations, Romania

	JC	*JD*	*NET*	*JC*	*JD*	*NET*
$\Delta w_{i,t}$	-.816*	-.558*	-.715*	-.713*	.-593*	-.676*
	(.019)	(.011)	(.033)	(.037)	(.022)	(.058)
$\Delta q_{i,t}$	.794*	.494*	.629*	.590*	.531*	.516*
	(.015)	(.009)	(.027)	(.025)	(.020)	(.038)
$\Delta imp_{i,t}$	-.007	-.016**	-.015	.044	.016	.008
	(.019)	(.008)	(.010)	(.039)	(.017)	(.019)
$\Delta exi_{i,t}$	.008	.007	.010***	.007	.002	.009
	(012)	(.005)	(.005)	(.023)	(.010)	(.011)
$\Delta a_{i,t}$				-.004	-.002	.003
				(.009)	(.004)	(.005)
Medium R&D	.012	.024	.004			
	(.052)	(.017)	(.017)			
Low R&D	.151*	.035**	.042*			
	(.049)	(.016)	(.016)			
Pseudo R2	.37	.94	.62	.35	.97	.63
N of obs.	4891	4891	4891	1149	1149	1149
Uncensored	1661	3151		378	758	

Note: *JC* and *JD* are tobit estimations; *NET* is a OLS estimation with heteroskedasticity consistent standard errors. Standard errors are reported in brackets. When using industry R&D intensity, high R&D is the base category. (*) significant at 1% level; (**) significant at 5% level; (***) significant at 10% level. All specifications include year dummies.