Trade Protection and Industry Wage Structure in Poland

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Abstract

This study examines the impact of Poland's trade liberalization 1994-2001 on the industry wage structure. The liberalization was undertaken in preparation for Poland's accession to the European Union and was more pronounced in industries with larger shares of unskilled labor. Our analysis indicates that a decrease in an industry tariff was associated with higher wages being earned by workers employed in the industry, controlling for worker characteristics and geographic variables. The result is robust to including year and industry fixed effects, controlling for industry-level exports, imports, concentration, stock of foreign direct investment and capital accumulation. The finding is consistent with liberalization increasing competitive pressures, forcing firms to restructure and improve their productivity, which in turn translates into higher profits being shared with workers. It could also be potentially attributed to trade liberalization lowering the costs of imported inputs which enhances firm profitability. The result holds when skilled workers are excluded from the sample, thus suggesting that reductions in trade barriers benefited the unskilled in terms of an increase in wages.

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Introduction

Rapid trade liberalizations undertaken by many developing and transition countries during the past decade have inspired heated public discussions. Proponents of trade liberalization posit that for developing countries, many of which are small economies with abundant labor, opening would lead to rising wages. They point to the substantial increases in average real wages taking place in open economies in the developing world over the last several decades as evidence that trade does indeed increase demand for the abundant factor – labor in this case – much like the trade theory would predict. Opponents of trade liberalization, on the other hand, speak about the uneven distribution of gains from openness to trade and resulting increases in wage inequality. They also claim that liberalization will lead to a "race to the bottom" in wages, and as a consequence, to impoverishment of workers.

There exists little conclusive evidence about the effects of trade liberalization on wages. One shortcoming of the early literature has been the use of average industry wage data, which are assumed to be independent of characteristics of workers in the industry, and the focus on outcomes (e.g., exports, imports, prices) instead of policy measures (e.g., tariffs). Only recently researchers have begun to utilize policy variables, such as tariffs, to examine the impact of liberalization on industry wage premiums which measure the portion of wages that cannot be explained by a worker's or a firm's characteristics but can be explained by a worker's industry affiliation. However, the conclusions of such studies have been mixed. On the one hand, Revenga (1997) and Goldberg and Pavcnik (2004) provide evidence suggesting that trade liberalization erodes wages of workers in previously protected sectors. On the other hand, Pavcnik et al. (2004) find no significant relationship between liberalization and industry wage premium and Gaston and Trefler (1994) show that liberalization is associated with a higher industry wage premium.

In this paper, we investigate the relationship between trade liberalization and wages to understand the channel through which trade liberalization affects the wage structure and, indirectly, the linkage between trade and poverty. Unlike the existing studies, which are based on the U.S. or Latin American data, this paper focuses on Poland, a Central European country undergoing transition from planned to market economy. Factor endowments in Poland differ from those in the countries previously examined. The share of population aged 15-75 with college education at 9.2 percent in 1999 is lower than that in the United States, yet unlike many

Latin American countries Poland attained universal literacy among the population due to its socialist legacy.

We are interested in the impact of trade liberalization on wages because it has important implications for income inequality and poverty. Industries differ in the composition of workforce with some having a higher proportion of skilled labor than others. If trade liberalization erodes wages, and if tariff reduction is greater in sectors with disproportionate percentage of unskilled labor, as was the case in Poland, then the unskilled could experience a greater decline in earnings. As in other countries, the educational attainment is a powerful predictor of poverty status in Poland. For instance, while fewer that 0.6 percent of households headed by a person with college education were subject to hard poverty in 2001, the same was true of 12 percent of households headed by an individual with a secondary vocational degree and 18 percent of households whose head had only primary education. As evident from Table 1, the figures for medium poverty were equally striking. Moreover, this pattern persisted throughout the whole period of our study 1994-2001 (Topinska and Kuhl, 2003).

The effect of trade liberalization on income distribution and poverty is likely to be larger in Poland than in other countries due to the rigidity of the Polish labor market and the slow change in the regional distribution of economic activities (see Table A1 in Appendix I). Thus, even a moderate change to wages across industries is likely to exacerbate the existing regional disparities in incomes and poverty incidence illustrated in Figure 1.

The rigidity of Poland's labor regulations is an advantage in our analysis: with the limited labor mobility across sectors in the short- and medium-term, a worker's industry affiliation is the immediate channel through which the effects of trade liberalization will be felt. As illustrated in Figure 2, employers in Poland are more restricted in their hiring and firing decisions relative to their counterparts in the United Kingdom, Turkey, Russia, Brazil, Colombia or Mexico, just to name a few. Figure 2 presents the index of hiring and firing flexibility compiled by the Global *Competitiveness Report* (GCR), published jointly by the Geneva-based World Economic Forum and the Center for International Development at Harvard University in 1996. It is a country specific measure that quantifies the average response to the survey question: "Is hiring and firing of workers flexible enough?" It takes on the value of 6 for a very flexible labor market and 1 in the case of the most rigid ones. Since it is based on the views of "business practitioners" in each country, it captures not only laws on the books but also their enforcement. According to this

index, Singapore and Hong Kong had the most flexible labor markets while Poland ranked 25th out of 49 countries. While for Singapore and Hong Kong the index value was above 5; the United Kingdom, Brazil, the Czech Republic, and Russia (among other countries) had an index above 4; the index for Poland was equal to 3.6. A similar picture emerges from Figure 3, which presents the Index on the Flexibility of Individual Dismissal compiled by Djankov et al. (2001).[1] Unlike the GCR Index in the previous Figure, this index is based on the existing regulations rather than their enforcement. In addition to rigid labor markets which hinder worker reallocation across sectors, labor mobility across regions is limited in Poland due to housing shortage and prohibitive rent costs (for evidence see Deichmann and Henderson, 2004, Przybyla and Rutkowski, 2004).

The second advantage of choosing Poland as the subject of our analysis is the fact that the changes in its tariffs can be treated as exogenous, as they were stipulated by the Association Agreement between the European Community and Poland signed in 1991. This agreement predetermined the schedule of tariff reductions, which took place during the period of interest 1994-2001. Moreover, as the goal of the agreement was free movement of goods between the two entities and Poland's accession to what is now called the European Union, all tariffs on manufactured products (with the exception of processed food) were brought down to zero by 2001. Poland's trade liberalization was rapid and encompassed a drastic reduction in tariffs from over 20 percent in leather manufacturing; and over 15 percent in wood; non-metallic; rubber and plastic products in 1991 to zero within a decade.

We investigate the relationship between trade liberalization and wages in an expanded Mincerian wage equation. We pool together information from Labor Force Surveys conducted during the 1994-2001 period into one regression. Controlling for worker-, firm-, sector- and location-specific characteristics as well as year and industry fixed effects, we expand the wage equation to include tariff variables. The analysis covers 14 manufacturing sectors, including electricity production. Given the nature of the specification used, our attention is restricted to employed individuals, and thus we do not consider the implications of trade liberalization for unemployment.

We find that workers in industries with lower tariffs tend to have higher wages. This result is robust to including year and industry fixed effects, industry exports, imports,

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[1] We are grateful to Simeon Djankov for providing us with the index.

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concentration and capital accumulation, in addition to controlling for detailed worker characteristics. The result is consistent with a reduction in tariff leading to increased competitive pressures in the liberalizing industry which forces companies to restructure and improve their productivity, which in turn results in the gains being shared with employees. This interpretation is in line with the findings of many studies that established a positive association between trade liberalization and productivity.[2] To further support this interpretation we employ firm level data for the period 1996-2000 to demonstrate that trade liberalization indeed resulted in the increased productivity in liberalizing sectors. The robust and significant relationship between a reduction in tariff and an increase in wages is also consistent with the stylized fact that there is much inefficiency in a planned economy; a sector that is exposed to greater foreign competition during the transition becomes more efficient and productive. Another possible explanation for the finding is that trade liberalization makes imported inputs cheaper which enhances profitability of the firms relying on such inputs. Findings of Fernandes (2003) appear to support this hypothesis but because of the aggregated nature of our industry classification, we are not able to investigate this hypothesis in-depth.

Further, our findings do not suggest any erosion of wages of the unskilled (i.e., "race to the bottom" in wages) from trade liberalization as they hold when we exclude skilled workers from the sample. Moreover, our data indicate that industries with a greater reduction in tariffs are also those with higher proportions of the unskilled.

This study is organized as follows. The next section presents some facts on Poland's trade liberalization. It is followed by a description of the empirical strategy and the data employed in the analysis. Then we present the estimation results. The last section concludes.

Trade Liberalization in Poland

In September 1989 Poland's first non-communist government since the end of World II assumed power, taking over the economy with a large budget deficit and a triple-digit inflation. On January 1, 1990 the government implemented a bold reform program ("Balcerowicz plan") aimed at stabilizing the economy, beginning the process of economic liberalization and privatization. During the initial period of transition (1990-91) Poland experienced a deep

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[2] See Harrison (1994) for Cote d'Ivoire, Krishna and Mitra (1998) for India, Kim (2000) for Korea, Pavcnik (2002) for Chile and Fernandes (2003) for Colombia.

recession, followed by a strong recovery with the average annual growth rate of GDP equal to almost 5 percent during the 1992-2000 period.

Transition to a market economy completely revolutionized Poland's international trade. The country moved from a centrally-planned system of exports and imports conducted by state trading agencies under the arrangements of the Council for Mutual Economic Assistance to a free market where local producers suddenly become subject to the forces of competition. In 1991, trading under the Council for Mutual Economic Assistance collapsed and in December of the same year Poland signed an Association Agreement with the European Community, which was a prelude to its future membership in the European Union (EU). In July of 1995 Poland joined the World Trade Organization. Severe recessions in Poland's traditional export markets coupled with lowering of tariffs in Western European countries resulted in massive reorientation of Polish international trade from East to West.

The Association Agreement signed by Poland (and other Central and Eastern European countries) stipulated asymmetric phase-out of import tariffs with the goal of free trade in industrial goods by the end of 1999. As a result, in 1999 the average Polish tariff on imports from the EU, the European Free Trade Association (EFTA) and Central European Free Trade Agreement (CEFTA) countries was brought down to 6.5 percent, as compared to the Most-Favored-Nation (MFN) rate of 15.6 percent and the 34.6 percent rate applied to non-WTO members. The rapid liberalization of trade in manufacturing products was not, however, accompanied by similar changes in agricultural goods. While in 1999, the simple average applied MFN rate on manufacturing products was equal to 11.1 percent, the corresponding figure for agriculture was 34.2 percent. The difference largely reflects the tariffication of variable levies agree by Poland during the Uruguay Round. As Poland was a non-market economy for the base years of 1986-88, selected in the Uruguay Round for estimating tariff equivalents of non-tariff barriers prohibited on agricultural products, Poland applied the generally much higher EU tariff rates as the basis for tariffication, and thus considerably increased its protection of the agricultural sector (WTO 2000).

Figure 4 shows the reduction in sectoral tariffs applied to imports from the European Union and from the world, respectively, between 1994 and 2001. The largest reduction of 23 percentage points was observed in leather and leather products, followed by a 15-percent-point or higher reductions in other non-metallic products; rubber and plastic products; wood and wood

products; and other manufacturing. The smallest change was registered in tariffs on electricity and natural gas, which were low to begin with. By 1999 all industrial products from the EU with the exception of food, beverage and tobacco products; motor vehicles; and petroleum and petroleum products were entering Poland duty free; however, imports from the world were still subject to positive tariffs. As of 1999, about three-quarters of Poland's exports and imports were conducted under preferential trading arrangements and thus subject to preferential tariffs.

As detailed in Appendix II, the Association Agreement predetermined the speed and extent of trade liberalization which allows us to treat tariff changes as exogenous. Since many agricultural products and processed foods, beverages and tobacco were excluded from the liberalization specified in the agreement and/or remained subject to quantitative restrictions, we will not include them in the analysis.

Related Literature

The theoretical context for our analysis is provided by the specific factors model. The model focuses on the short-run and assumes that factors of production are immobile across sectors. Given the rigidities present in Poland's labor market, this model constitutes a suitable basis for thinking about the relationship between trade and wages in the Polish context. The model predicts a positive association between protection and industry wages. Protection reduces imports and reduced imports increase labor demand, which in turn increases wages. This mechanism raises wages in the protected industry relative to the economy-wide average wage.

The second channel through which trade and protection affect wages is imperfectly competitive factor markets. For example, unions may extract part of the rents from protection in the form of more jobs rather than higher wages. Unionization is not a material issue in our analysis because the power of trade unions has been substantially weakened during the transition process. Trade union density in Poland has dropped from 80 percent of the workforce in the 1980s to 14 percent in 2002. The highest trade union density was observed in mining (43.8 percent), and non-tradable sectors such as transport (27.3 percent), and education (27.5 percent) (Boeri and Garibaldi, 2003).

The third channel through which trade and protection affect wages is imperfectly competitive product markets. Trade and protection affect the strategic interaction between firms

which in turn affects firm performance and wages. For example, if trade protection promotes entry into an industry by enhancing the profitability of existing firms, and if new entrants face setup costs, then protection promotes inefficient entry and raises average production costs (Horstmann and Markusen, 1986).

Another strand of literature particularly relevant to a transition economy, like Poland, which until 1990 was heavily protected and not subject to market forces and competition, is the literature on trade liberalization and productivity. Inefficiencies and lower productivity associated with an increase in trade protection have been illustrated in the literature using the computable general equilibrium models (for example, Cox and Harris, 1985; Brown et al. 1992). There is also strong evidence from findings of firm-level studies that reduction in trade protection results in productivity improvement. The competition effect from imports has been documented by many empirical studies (Roberts and Tybout, 1997). For instance, Pavcnik (2002) finds that the productivity of plants in the import-competing sectors grew 3-10 percent more than in the non-traded goods sector during trade liberalization in Chile, suggesting that exposure to international competition forces previously shielded plants to improve their performance. Fernandes (2003) demonstrates that trade liberalization in Colombia has increased plant-level productivity, primarily through gains in within-plant productivity. Other studies reaching similar conclusions include Harrison (1994) for Cote d'Ivoire, Krishna and Mitra (1998) for India, Kim (2000) for Korea, and Hay (2001) for Brazil.

Data and Methodology

Labor Force Survey (LFS)

The analysis is based on the data collected through the Polish Labor Force Survey (LFS). The survey has been conducted four times each year since the fall of 1992, and we have access to selected quarters of the surveys during the period 1992-2001. Unfortunately, it is not possible to employ all eleven years in the analysis as the 1992 and 1993 surveys were based on a different industry classification. Thus, our analysis covers the period of 1994 through 2001. We use the second quarter of years 1993 through 2001, except in years 1999 and 2001, for which only information for the first quarter was available.

The survey sample is representative of the country's population. Sampling for the LFS follows the two-stage household sampling. First, the stratification is based on voivodships (administrative districts) and primary sampling units are sampled from each strata with diversified sampling probability, proportional to the number of households in a primary sampling unit. Second, a determined number of households are selected randomly from each primary sampling unit, depending on the size of primary sampling units. For example, 8 households are sampled from primary sampling units from rural municipalities, and 5 households are sampled from primary sampling units from large cities.

Between 1993 and 1998, the sample was interviewed only in the middle month of the quarter whereas since 1999, a uniform number of randomly selected households was interviewed in every week of the 13 weeks throughout the quarter. In each quarter about 24 thousand households were interviewed, amounting to about 40 thousand individuals sampled. Members of households above aged 15 were asked questions on their employment status, type of employers, sector of employment, monthly earnings, weekly hours worked, and personal characteristics. Unfortunately, wage information on self-employed is not available as questions about earnings were not asked to the self-employed. Employees make up about 70 percent of the sample in the survey, and self-employed, another 25 percent, and the remaining 5 percent are unpaid family workers. Employment sectors are classified according to a variant of the European NACE classification system, which includes 34 sectors, 14 of which pertain to manufacturing activities.

Empirical Framework

We investigate the relationship between trade liberalization and wages by estimating a reduced form model with the logarithm of real hourly wages being the dependent variable. The real hourly wage is calculated by deflating the reported monthly wage to 1992 zlotys using the Consumer Price Index from the IMF's *International Financial Statistics* and dividing it by the number of hours worked in the reporting week multiplied by the number of weeks (4.2). Our sample is restricted to individuals of ages 15-75 inclusive, employed in the manufacturing and electricity sectors. We estimate the following wage equation (1) by pooling all workers from the 1994-2001 Labor Force Surveys

(1) $$\ln w_{it} = \alpha + X_{it}\beta + \delta\, tariff_{jt} + \lambda_j + \delta_t + \varepsilon_{it}$$

where ln w_{it} is the log of real wages of worker i employed in industry j and observed in the LFS in year t. Note that the data set is not a true panel but consists of repeated cross-sections. X_{it} is the vector of worker characteristics that include age, age squared, marital status, gender, a dummy for the educational attainment category, a dummy for the occupation category, a dummy for employment in the private sector, a dummy for the geographic region (voivoidship) and a dummy for the size of the city where the worker lives. $Tariff_{jt}$ represents the average tariff applied to imports of industry j's products in year t. λ_j denotes the fixed effect for the worker's industry affiliation, and δ_t is the year fixed effect. Year fixed effects are included to absorb economy wide shocks that may affect wages while industry dummies control for sector-specific effects, such as for instance, prevalence of labor unions. The standard errors are clustered on industry-year combinations to adjust for the fact that while our variable of interest (tariff) is at the industry level, the regression is performed at the micro level (see Moulton 1990).

$Tariff_{jt}$ is defined as the simple average of tariffs on products of industry j imported at time t. We use tariffs vis-à-vis the European Union as well as tariffs pertaining to imports from the world. We experiment with trade-weighted average tariffs and the results are similar to those for the simple averages, therefore we report only the latter. The tariff data come from the World Bank's WITS database.

We estimate the effects of tariff changes on workers' wages while controlling for the individual worker's characteristics as well as for other potential influences (e.g., geographic and sectoral variables). Later, we also allow returns to schooling to vary by years. To eliminate a potential omitted variable bias, we also include such controls as the Herfindahl Index, measuring concentration in the industry, capital accumulation in the industry, stock of foreign direct investment (FDI) in the sector, sectoral imports and exports. We use lagged values to avoid potential simultaneity bias. The Herfindahl index pertains to four largest firms in the sector and is calculated based on firm level data from the *Amadeus* database covering the period 1994-2001. The information on capital accumulation comes from various issues of the *Polish Statistical Yearbook*. The FDI figures are from the Foreign Trade Research Institute (various issues). Trade data come from the UN COMTRADE database.

Descriptive Statistics

Before proceeding to the empirical results, we briefly discuss the summary statistics. As presented in Table 2, the average age of workers in our sample was 56 in 1994 and increased steadily to 59 years in 2000. However, there was a sharp drop in 2001, with the average age equal to only 39 years. Average hours of work remained quite steady at about 41 hours throughout the period, with the exception of 2001 when a decline to 39 was registered. About three quarters of workers in our sample were married, and females constituted less than half (45-47 percent) of the sample throughout the period. In 1994, only 24 percent of workers were employed in the private sector, but by 2001 this figure increased to 49 percent. Throughout the second half of the 1990s, almost all employed (97 percent) considered their jobs permanent, but in 2001 this figure dropped to 88 percent. The real average hourly wage increased by about 50 percent between 1994 and 2001.

The educational attainments have increased during the period considered. The proportion of workers with primary school education or less fell from 13.7 percent to 10.5 percent. The shares of workers with general secondary education or vocational education have remained constant at 7 percent and 35 percent, respectively. The percentage of workers with tertiary education rose—the share of those with university degrees increased from 12 to 15 percent.

Table 3 presents the distribution of labor across industries in each year during the 1994-2001 period. The figures reflect structural changes taking place in the economy during this period, namely a fall in the agricultural and mining employment and a rise of services sectors which until 1990 had been underdeveloped. As for the latter, a particularly strong expansion was observed in wholesale and retail trade (43 percent growth), hotel services (71 percent growth); financial, banking and real estate services (at 43 percent). Employment in manufacturing industries remained relatively stable with the exception of plastic and rubber products which registered a 89 percent growth whereas machinery has contracted, halving its share.

The changes in the economic structure have also affected the role of unions in the Polish economy. Mining and machinery sectors used to be industries with strong union presence, but the large fall in employment in these industries contributed to erosion of unions in Poland, as was the case in many other European countries where sectors with highest number of union members had contracted (Boeri and Garibaldi, 2003). Unionization has also become weaker because of privatization and the increase in the number of smaller enterprises. Historically, 100

percent of large state-owned enterprises (250+ employees), and 75 percent of medium-sized state-owned enterprises (50-250 employees) had two or more unions. After being privatized, however, only 5 percent of large private companies had unions. Moreover, unions are totally absent in newly created small private companies (Gardawski et al., 1998). Thus, unionization is not a significant force in Poland during the period of our analysis.

Within each industry, we observe changes in the composition of labor force. As illustrated in Table 4, which presents the share of unskilled workers in each industry, with the exception of the paper and pulp manufacturing and social and communal services sector where there have been increases in the shares of unskilled workers, the other industries registered declines of different magnitudes. Sectors such as construction, agriculture, wood product manufacturing and textile manufacturing experienced a limited fall (3-5 percent) in the shares of unskilled workers, whereas industries such as banking and financial services; rubber and plastic product manufacturing observed larger declines (44 percent, and 57 percent, respectively) over time.

As evident from Figure 5, sectors with a higher proportion of unskilled workers experienced a larger reduction in import tariffs between 1994 and 2001. The correlation between the unskilled labor share and the change in tariff is –0.644. The sector with the largest decrease (23 percentage points) in the average tariff vis-à-vis the European Union is the leather manufacturing in which the shares of unskilled labor were 22 percent and 17 percent in 1994 and 2001, respectively. In contrast, machinery and equipment industry had the smallest decrease (8 percent) in tariff and the shares of unskilled labor were 11 percent and 5 percent in 1994 and 2001, respectively.

Empirical Results

Table 5 presents the full set of explanatory variables in our basic wage model which includes year and industry dummies. Our sample encompasses manufacturing (except for the food, beverage and tobacco sector, excluded because of the concerns regarding non-tariff barriers and tariffs not being predetermined), and the electricity sector. The coefficients on the worker characteristics are generally significant, with the exception of a dummy for employment in the private sector. The coefficients also have their expected signs. Older workers tend to earn more.

Female workers with similar characteristics earn on average less than their male counterparts; married workers tend to earn more possibly due to marriage signaling stability; the returns to schooling also have their expected signs with significantly higher returns for a tertiary education. There are also wage premiums enjoyed by workers living in larger cities.

Moving on to the variables of interest, the results suggest that industry tariffs are negatively correlated with workers' hourly wages, controlling for an individual worker's characteristics, geographic variables and employment in the private sector. Both the coefficient on tariffs vis-à-vis the European Union as well as the coefficient on tariffs vis-à-vis the world are negative and statistically significant at the five and the one percent level, respectively. This finding indicates that workers in more liberalized sectors earn more controlling for all observable characteristics of the worker, the job and the industry. This finding is robust to including year and industry fixed effects. In this basic specification, a 10 percentage point decline in the industry tariff vis-à-vis the EU is associated with a 2.6 percent increase in wages of workers employed in the industry. For tariffs on imports from the world the corresponding increase in wages is 3.4 percent.

Next, we add to the basic model controls for industry concentration, sectoral imports and exports to demonstrate that our results are robust to the inclusion of additional controls. In the top panel of Table 6, we present the results for the simple average of import tariffs in a given industry vis-à-vis the European Union. In the bottom panel, we present results employing tariffs vis-à-vis the world. As the coefficients on worker characteristics remain very similar to those in the basic specification, this and the following tables will only present the effects of our variables of interest—tariffs and sector-specific characteristics. The specification in column (1) includes the lagged value of Herfindahl index, which captures industry concentration, in addition to all variables present in the basic specification. Controlling for the industry concentration does not change our earlier conclusion that lower trade protection is associated with higher wages. In column (2), we include lagged Herfindahl index and lagged imports (expressed in logarithmic form). In the top panel with tariffs on imports from the EU we employ figures pertaining to trade with the EU. Similarly, when tariffs vis-à-vis the world are used, trade figures pertain to trade with the world. As before, tariffs are negatively correlated with wages. In column (3), we include lagged exports (expressed in logarithmic form) in addition to the variables listed in the previous column. As before, lower tariffs are associated with higher wages and the effect is

significant at the one percent level. As for other industry-specific variables, only lagged exports appear to be statistically significant. The positive coefficient on exports suggests that export-oriented industries offer a wage premium to workers employed there.

To ensure that our tariff variables do not simply proxy for the increased ability of sectors to export, we conduct two checks. First, we calculate the correlation between the annual changes in industry tariffs vis-à-vis the EU (or the world) and the annual changes in exports to the EU (or the world). The correlations are quite low -.02 (.12). For imports, the corresponding figures are -.04 (.06). Second, we estimate two additional specifications: one with contemporaneous imports and exports but without tariffs and another one with contemporaneous imports, exports and tariffs. If tariffs simply proxy for the sector's ability to export, the tariff variable should lose its significance. This is not the case, though. While contemporaneous exports are positively correlated with industry wages, the coefficient on tariffs remains negative, similar in magnitude to the earlier regressions and statistically significant at the one percent level. As before, industry imports do not appear to have a statistically significant effect on wages.

To address the concern that there may be other sector-specific time-varying factors affecting wages, we experiment with additional controls, such as, capital accumulation, stock of foreign direct investment and the share of unskilled labor. The first two variables are expressed in logarithms. The last variable has been calculated based on the Labor Force Survey. All three controls enter as first lags. Additionally, in all specifications we include the lagged value of industry concentration. Results using tariffs vis-à-vis the European Union are presented in the top panel of Table 7 and those using tariffs vis-à-vis the world are in the bottom panel. In column (1), controlling for capital accumulation and the industry concentration, we still find that lower tariffs are associated with higher wages. Also, there is a mildly positive correlation between capital accumulation and wages. In column (2), we control for industry's concentration and FDI stock in the sector, and similarly we find a negative and significant relationship between tariffs and wages. However, FDI stock does not appear to have any significant effect on wages. In column (3), we control for capital accumulation, foreign direct investment, industry's concentration, and the share of unskilled labor. The effect of tariff on wages is still significantly negative suggesting that workers in sectors with greater extent of liberalization benefit from higher wages, even after controlling for observable individual, sectoral, and geographical characteristics.

As a robustness check, we repeat the above analyses by allowing returns to schooling to change over time. To do so, we combine our seven education categories into three groups: tertiary, secondary and primary or less, and interact each education group with year dummies. The results are very similar. Table 8 presents the basic specification with additional controls such as capital accumulation, stock of foreign direct investment and the share of unskilled labor. Ceteris paribus, workers in more liberalized sectors receive higher wages.

As another robustness check, not reported here, we re-estimate all the specifications correcting standard errors for clustering on industries, rather than industry-year combinations. Doing so does not change the conclusions of the paper.

Finally, we exclude skilled workers (i.e., those with university education) from our sample and present the estimation results of the sub-sample of unskilled workers in Table 9 and Table 10. The findings are very similar to those for the full sample in terms of the magnitudes of the impact from tariff reduction and the significance levels. The findings indicate that a reduction in the tariff is associated with wage increases for unskilled workers, after controlling for sector- and worker-specific characteristics. Thus, reductions in trade barriers appear to have benefited the unskilled in terms of an increase in wages.

In summary, our results suggest that lower trade protection in Poland has been associated with higher wages. These findings are consistent with those of Gaston and Trefler (1994) based on cross-sectional data for the U.S. Below we discuss four potential explanations for our results. The first potential explanation is that output mix has shifted towards the production of labor-intensive goods, raising the return to labor relative to other factors of production. Since trade protection was greatest prior to trade reform in labor-intensive sectors, this could explain why workers in the sectors which had a reduction in protection appear to experience higher wages. If this was the story, we would expect to see a shift in the pattern of production or employment towards labor-intensive industries. The data presented in Tables 3 and A1 demonstrate, however, that this was not the case.

The second potential explanation is that a reduction in tariffs has been associated with an increase in firms' ability to export. However, as demonstrated earlier, there is hardly any correlation between annual changes in industry tariffs and industry exports. Moreover, as illustrated in Table 6, controlling for contemporaneous exports does not lead to a decline in the significance level or the magnitude of the estimated effect of tariffs.

The third possibility is that trade liberalization increases firm productivity and profitability through access to cheaper or better intermediate inputs. While the high level of aggregation in our industry classification prevents us from testing this hypothesis explicitly, empirical support for this hypothesis has been presented by Fernandes (2003). She finds that among Colombian plants that changed their imports, most plants that experienced productivity increases during the period of trade liberalization were also the ones that increased their reliance on imported inputs.

The final possibility is that trade liberalization has led to increased competitive pressures in industries, thus forcing firms to restructure and improve their productivity. This argument is in line with results of many firm-level studies, cited earlier, which find that trade liberalization leads to higher productivity. This channel is even more plausible in the context of a transition economy, like Poland, where local firms were sheltered from any kind of competition until 1990. To provide further evidence on the plausibility of this channel, we use firm level data for the same period to demonstrate that trade liberalization led to a higher total factor productivity in Polish firms. To make this exercise as comparable as possible to the industry premium results we use the same aggregation of industries and a comparable time period (1996-2000). Full details are provided in Appendix III.

Conclusions

In this study, we examine the relationship between changes in tariffs and wages during Poland's trade liberalization 1994-2001. Our results indicate that a worker's wages are higher in industries with a larger reduction in trade protection, after controlling for individual worker's characteristics, such as age, education, gender, marital status, geographic variables and employment in the private sector. Our findings are robust to controlling for industry-level exports and imports, degree of concentration, capital accumulation, FDI stock and the share of unskilled workers employed. Moreover, they are not affected by controlling for unobserved but time-invariant industry characteristics.
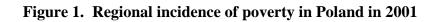
This result is consistent with the argument that reduction in trade protection brings about higher competition from imports, which can enhance worker productivity and industry performance. The robust and significant relationship between a reduction in tariff and an

increase in wages is also consistent with the stylized fact that there is much inefficiency in a planned economy; a sector that is exposed to greater foreign competition during the transition becomes more efficient and productive. Another possible explanation is that trade liberalization improves access to cheaper or better intermediates inputs which could enhance profitability.
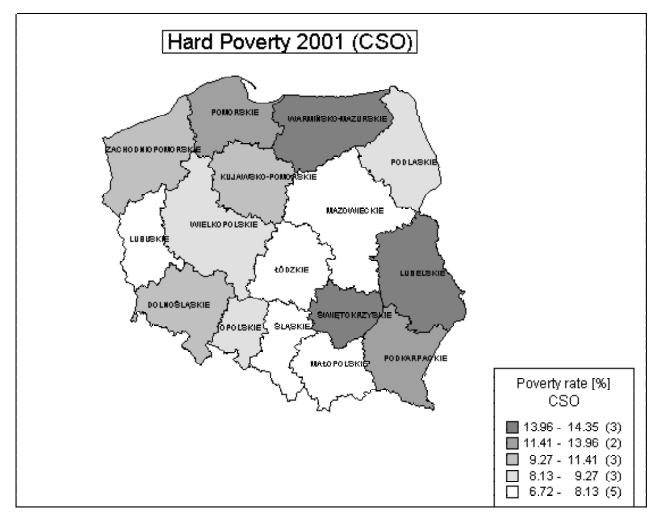
In addition, we find that industries with larger reduction in tariffs are also those with higher shares of unskilled labor. When we exclude skilled labor from our sample, the results still hold. Thus, there is no evidence of trade liberalization leading to an erosion of wages of the unskilled or the so called "race to the bottom"

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Figure 1. Regional incidence of poverty in Poland in 2001

Source: Topinska and Kuhl (2003)

Figure 2. Rigidity of Poland's labor market in international comparison -Index I

Source: World Economic Forum (1996)

Figure 3. Rigidity of Poland's labor market in international comparison -Index II
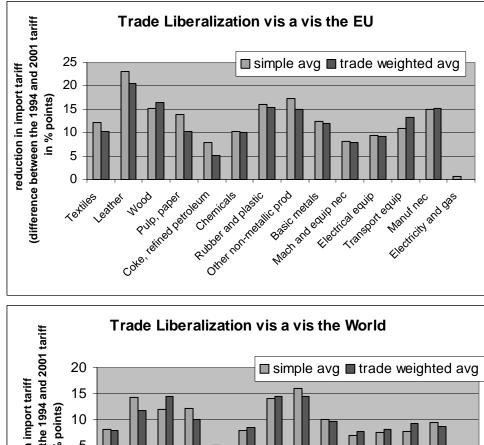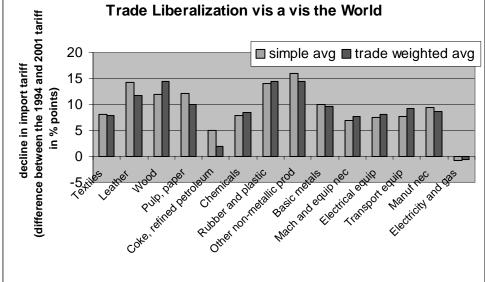

Source: Djankov et al. (2001)

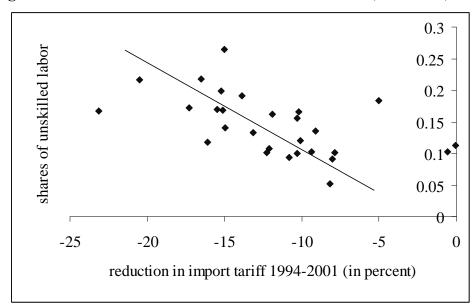**Figure 4. Reduction in Poland's import tariffs between 2001 and 1994**

Trade Liberalization vis a vis the EU

reduction in import tariff (difference between the 1994 and 2001 tariff in % points)

☐ simple avg ■ trade weighted avg

Textiles, Leather, Wood, Pulp, paper, Coke, refined petroleum, Chemicals, Rubber and plastic, Other non-metallic prod, Basic metals, Mach and equip nec, Electrical equip, Transport equip, Manuf nec, Electricity and gas

Trade Liberalization vis a vis the World

decline in import tariff (difference between the 1994 and 2001 tariff in % points)

☐ simple avg ■ trade weighted avg

Textiles, Leather, Wood, Pulp, paper, Coke, refined petroleum, Chemicals, Rubber and plastic, Other non-metallic prod, Basic metals, Mach and equip nec, Electrical equip, Transport equip, Manuf nec, Electricity and gas

Source: World Bank's WITS database

Figure 5. Share of unskilled labor and tariff reduction (1994-2001)

Table 1. Hard and medium poverty in Poland in 2001

Education of the hh head	Poverty Headcount (%)	
	Hard poverty	Medium poverty
Tertiary	0.57	1.29
Secondary general	3.75	6.96
Secondary vocational	12.16	19.01
Primary	**17.72**	**26.76**
TOTAL	9.60	15.17

Source: Topinska and Kuhl (2003).

Table 2. Summary Statistics

	1994	1995	1996	1997	1998	1999	2000	2001
real hourly wage (in PLN)	1.03	1.05	1.14	1.25	1.32	1.35	1.47	1.49
	[.56]	[.57]	[.64]	[.74]	[.72]	[.79]	[1.0]	[1.1]
age	55.9	56.6	57.2	58.1	58.7	58.9	59.5	39.2
	[9.6]	[9.6]	[9.57]	[9.5]	[9.3]	[9.2]	[8.9]	[10.6]
weekly hours worked	41.6	41.9	41.9	41.9	41.6	41.1	40.5	39.4
	[7.8]	[7.6]	[7.4]	[7.3]	[7.3]	[6.9]	[8.2]	[9.3]
married	77%	77%	77%	78%	79%	80%	81%	74%
female	45%	46%	46%	45%	46%	46%	46%	47%
working in private sector	24%	27%	30%	34%	37%	38%	41%	49%
current job is non-temporary	97%	97%	97%	97%	98%	97%	97%	88%
Highest level attained (% by categories)								
primary or less	13.73	13.62	12.94	11.94	11.1	11.24	10.46	10.53
general secondary	7.51	7.34	6.81	6.48	6.45	6.30	6.22	7.18
basic vocational	35.62	35.30	35.37	35.96	35.66	34.94	34.92	35.15
2-yr-college or secondary vocational	30.93	31.41	31.68	32.37	32.67	32.83	32.07	32.28
University	12.22	12.34	13.20	13.25	14.11	14.71	16.33	14.86
Size of City (% by categories)								
100,000 or more people	33.28	32.03	31.4	30.16	29.16	29.04	27.72	28.73
less than 100,000 people	35.78	37.19	38.66	38.96	38.11	38.41	40.14	38.54
village	30.94	30.78	29.95	30.88	32.73	32.56	32.14	32.72
Num of observations	15,509	15,798	15,056	14,623	14,312	12,594	9,206	10,650

Notes:
[..] denotes standard deviations.   The sample is restricted to those between 15-75 year-old, employees only.

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Table 3. Distribution of employment by industries, 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Agriculture, fishery	0.044	0.037	0.033	0.032	0.033	0.032	0.029	0.024
Mining	0.047	0.044	0.039	0.036	0.036	0.032	0.025	0.021
Manufacturing *of which*								
Food, beverage, tobacco	0.053	0.054	0.055	0.053	0.052	0.054	0.051	0.052
Textile	0.041	0.046	0.042	0.042	0.042	0.040	0.039	0.037
Leather	0.008	0.008	0.007	0.008	0.008	0.006	0.006	0.006
Wood	0.019	0.017	0.017	0.020	0.018	0.018	0.018	0.025
Paper products	0.009	0.010	0.010	0.010	0.011	0.010	0.010	0.012
Petroleum	0.004	0.004	0.003	0.003	0.003	0.004	0.002	0.003
Chemical	0.014	0.013	0.017	0.014	0.012	0.013	0.014	0.012
Rubber/plastic	0.007	0.007	0.008	0.009	0.010	0.011	0.011	0.014
Non-metallic	0.016	0.017	0.018	0.018	0.014	0.013	0.016	0.015
Metal	0.038	0.040	0.039	0.035	0.035	0.036	0.034	0.034
Machinery	0.027	0.028	0.024	0.025	0.022	0.023	0.023	0.017
Electrical appliances	0.014	0.012	0.014	0.014	0.013	0.013	0.014	0.017
Transport equipment	0.019	0.018	0.019	0.021	0.020	0.018	0.016	0.016
Other manufacturing	0.018	0.015	0.017	0.017	0.017	0.015	0.014	0.020
Services *of which*								
Utilities	0.025	0.028	0.029	0.027	0.025	0.023	0.027	0.026
Construction	0.077	0.072	0.068	0.074	0.077	0.076	0.079	0.072
Wholesale and retail trade	0.094	0.101	0.101	0.100	0.108	0.109	0.108	0.134
Hotels and restaurants	0.012	0.013	0.013	0.013	0.012	0.012	0.012	0.020
Transport, and communication	0.073	0.078	0.074	0.080	0.080	0.074	0.076	0.072
Financial, real estate and business activities	0.045	0.051	0.057	0.052	0.055	0.062	0.058	0.064
Public administration	0.066	0.066	0.072	0.073	0.072	0.068	0.074	0.070
Education, health and social work	0.188	0.183	0.194	0.194	0.192	0.207	0.209	0.185
Other community, social and personal service activities	0.044	0.038	0.030	0.032	0.032	0.033	0.033	0.032
All sectors	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 4. Share of unskilled labor (workers with primary or less schooling), by industries 1994-2001

	1994	1995	1996	1997	1998	1999	2000	2001
Agriculture, fishery	0.335	0.357	0.346	0.309	0.336	0.323	0.313	0.283
Mining	0.140	0.141	0.121	0.105	0.114	0.094	0.113	0.104
Manufacturing *of which*								
Food, beverage, tobacco	0.191	0.182	0.194	0.169	0.159	0.154	0.130	0.158
Textile	0.166	0.138	0.147	0.143	0.129	0.129	0.161	0.108
Leather	0.217	0.200	0.190	0.179	0.129	0.135	0.180	0.167
Wood	0.218	0.204	0.223	0.174	0.156	0.230	0.211	0.199
Paper products	0.156	0.154	0.142	0.149	0.116	0.096	0.228	0.191
Petroleum	0.183	0.197	0.137	0.128	0.146	0.125	---	0.091
Chemical	0.120	0.162	0.191	0.159	0.124	0.120	0.113	0.100
Rubber/plastic	0.169	0.168	0.258	0.234	0.134	0.183	0.073	0.118
Non-metallic	0.265	0.237	0.199	0.230	0.209	0.199	0.185	0.172
Metal	0.162	0.152	0.150	0.132	0.120	0.132	0.096	0.101
Machinery	0.101	0.107	0.076	0.059	0.060	0.086	0.074	0.052
Electrical appliances	0.135	0.127	0.108	0.081	0.090	0.125	0.114	0.103
Transport equipment	0.133	0.122	0.102	0.098	0.105	0.092	0.083	0.094
Other manufacturing	0.168	0.148	0.174	0.156	0.133	0.104	0.109	0.140
Services *of which*								
Utilities	0.113	0.143	0.125	0.109	0.097	0.086	0.096	0.102
Construction	0.163	0.171	0.153	0.167	0.151	0.153	0.153	0.149
Wholesale and retail trade;	0.088	0.090	0.092	0.075	0.083	0.078	0.068	0.080
Hotels and restaurants	0.147	0.212	0.158	0.119	0.066	0.097	0.125	0.109
Transport, and communication	0.140	0.147	0.135	0.123	0.117	0.122	0.102	0.105
Financial, real estate and business activities	0.086	0.064	0.079	0.075	0.067	0.070	0.048	0.067
Public administration;	0.069	0.054	0.041	0.045	0.042	0.032	0.036	0.036
Education, health and social work	0.106	0.108	0.105	0.100	0.091	0.091	0.079	0.075
Other community, social and personal service activities	0.123	0.139	0.134	0.118	0.116	0.132	0.165	0.173

Table 5. Effects of trade protection on wages: A basic model, 1994-2001

Dependent variable: log hourly real wage	[1]	[2]
Simple Average Tariff vis-à-vis EU	-.263**	
Simple Average Tariff vis-à-vis the world		-.341***
Age	.0182***	.0182***
age squared	-.000192***	-.000192***
married dummy	.0674***	.0675***
female dummy	-.146***	
dummy: employed in private sector	.00767	.00755
Occupation: professionals	-0.224***	-0.224***
Occupation: technicians	-0.252***	-0.253***
Occupation: clerks	-0.360***	-0.360***
Occupation: service workers	-0.422***	-0.422***
Occupation: skilled agricultural workers	-0.469***	-0.469***
Occupation: craft workers	-0.370***	-0.370***
Occupation: plant and machine operators	-0.336***	-0.336***
Occupation: elementary occupations	-0.473***	-0.473***
city size [50K – 1million population]	-0.048***	-0.048***
city [20-50K population]	-0.052***	-0.052***
city [10-20K population]	-0.105***	-0.105***
city [5-10K population]	-0.073***	-0.073**
city [2-5K population]	-0.107***	-0.106***
city (<2K population]	-0.159***	-0.160***
village dummy	-0.095***	-0.095***
dummy: 2 year college	-0.165***	-0.165***
dummy: secondary technical	-0.253***	-0.253***
dummy: secondary general educ	-0.261***	-0.261***
dummy: vocational education	-0.308***	-0.308***
dummy: primary educated	-0.360***	-0.360***
dummy: less than primary	-0.440***	-0.440***
Voivoidship dummies	yes	yes
Year dummies	yes	yes
Industry dummies	yes	yes
No. of observations	27,531	27,531
R-squared	.408	.408

Notes: * denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. Omitted categories of dummies: city—population above one million, education—4- or 5-year college degree, occupation—managers.

Table 6. Effects of trade protection on wages with additional trade-related measures

Dependent variable:	The Basic Model (specified in Table 5) plus additional control variables:				
log hourly real wage	[1]	[2]	[3]	[4]	[5]
Simple Average Tariff vis-à-vis the European Union	-0.315***	-0.271***	-0.267***		-0.332***
	[.112]	[0.114]	[0.109]		[0.0984]
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0681	-0.103	-0.0897	-0.0741	-0.11
	[0.0591]	[0.0794]	[0.0604]	[0.0524]	[0.047]
Lagged imports		0.0132	-0.00598		
		[0.0169]	[0.015]		
Lagged exports			0.0562***		
			[0.0141]		
Contemporaneous imports				-0.00178	-0.000962
				[0.011]	[0.0113]
Contemporaneous exports				0.0581***	0.0601***
				[0.014]	[0.0144]
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	24,213	24,213	24,213	24,598	24,598
R-squared	.412	.413	.413	.41	.41
Simple Average Tariff vis-à-vis the World	-0.360***	-0.304***	-0.261***		-0.333***
	[0.0849]	[0.109]	[0.103]		[0.0958]
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0673	-0.0978	-0.0854	-0.0485	-0.101
	[0.0553]	[0.0876]	[0.0605]	[0.0555]	[0.0567]
Lagged imports		0.0139	0.00364		
		[0.0187]	[0.0151]		
Lagged exports			0.0515***		
			[0.015]		
Contemporaneous imports				0.00931	-0.0171
				[0.0241]	[0.0255]
Contemporaneous exports				0.0682***	0.0643***
				[0.0166]	[0.0169]
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	24,213	24,213	24,213	24,598	24,598
R-squared	.413	.413	.413	.41	.41

Notes: The Table only presents selected variables of interest. All columns include the entire set of variables in the basic model specified in Table 5 with additional control variables specified in respective columns.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. [..] denotes robust standard errors.

Table 7. Effects of trade protection on wages with additional sector-specific variables (labor shares, capital accumulation, and foreign direct investment)

Dependent variable:	The Basic Model (specified in Table 5) plus additional control variables:		
log hourly real wage	[1]	[2]	[3]
Simple Average Tariff vis-à-vis the European Union	**-0.233***	**-0.604***	**-0.666***
	[0.127]	**[0.165]**	**[0.126]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0523	-0.0088	-0.38*
	[0.0495]	[0.108]	[0.207]
Lagged capital accumulation	0.0275*		0.00259
	[0.0145]		[0.00917]
Lagged foreign direct investment		0.00726	-0.0212
		[0.00818]	[0.0193]
Lagged unskilled labor shares			0.674***
			[0.227]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	24,598	12,697	10,580
R-squared	.41	.421	.412
Simple Average Tariff vis-à-vis the World	**-0.294***	**-0.534***	**-0.55***
	[0.103]	**[0.13]**	**[0.107]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0553	0.0121	-0.316
	[0.0466]	[0.102]	[0.212]
Lagged capital accumulation	0.0233		-0.00277
	[0.0144]		[0.00946]
Lagged foreign direct investment		-0.000206	-0.0272
		[0.00895]	[0.0215]
Lagged unskilled labor shares			0.636***
			[0.23]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	24,598	12,697	10,580
R-squared	.41	.421	.412

Notes: The Table only presents selected variables of interest. All columns include the entire set of variables in the basic model specified in Table 5 with additional control variables specified in respective columns.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. [..]denotes robust standard errors.

Table 8. Effects of trade protection on wages allowing for time-varying returns to schooling

Dependent variable:	The Basic Model (specified in Table 5) plus additional control variables:		
log hourly real wage	[1]	[2]	[3]
Simple Average Tariff vis-à-vis the European Union	**-0.247****	**-0.619*****	**-0.682*****
	[0.124]	**[0.161]**	**[0.122]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0526	0.00357	-0.377
	[0.0489]	[0.108]	[0.204]
Lagged capital accumulation	0.0282**		-0.0231
	[0.0142]		[0.0187]
Lagged foreign direct investment		0.00764	0.00263
		[0.0081]	[0.00917]
Lagged unskilled labor shares			0.631***
			[0.226]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	24,598	12,697	10,580
R-squared	.407	.417	.408
Simple Average Tariff vis-à-vis the World	**-0.296*****	**-0.546*****	**-0.564*****
	[0.103]	**[0.126]**	**[0.104]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0542	0.025	-0.311
	[0.0461]	[0.101]	[0.209]
Lagged capital accumulation	0.0244*		-0.0293
	[0.0142]		[0.0209]
Lagged foreign direct investment		0.0000125	-0.00287
		[0.00886]	[0.00941]
Lagged unskilled labor shares			0.591**
			[0.229]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	24,598	12,697	10,580
R-squared	.407	.417	.408

Notes: The Table only presents selected variables of interest. All columns include the entire set of variables in the basic model specified in Table 5 except that returns to schooling are now time-varying.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. [..]denotes robust standard errors.

Table 9. Sub-sample of unskilled workers: Effects of trade protection and various trade measures on wages

Dependent variable:	The Basic Model (specified in Table 5) plus additional control variables:				
log hourly real wage	[1]	[2]	[3]	[4]	[5]
Simple Average Tariff vis-à-vis the European Union	**-0.280*****	**-0.229****	**-0.226****		**-0.296*****
	[0.105]	**[0.106]**	**[0.101]**		**[0.0926]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0497	-0.0892	-0.0756	-0.0453	-0.0782
	[0.0609]	[0.08]	[0.0597]	[0.0529]	[0.0482]
Lagged imports		0.0159	-0.00298		
		[0.0161]	[0.0146]		
Lagged exports			0.0546***		
			[0.0145]		
Contemporaneous imports				0.00665	0.00676
				[0.0103]	[0.0108]
Contemporaneous exports				0.0525***	0.0544***
				[0.0141]	[0.0143]
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	23,177	22,819	22,819	23,177	23,177
R-squared	0.349	0.351	0.351	0.349	0.349
Simple Average Tariff vis-à-vis the World	**-0.317*****	**-0.248****	**-0.207****		**-0.274*****
	[0.0811]	**[0.103]**	**[0.0986]**		**[0.0929]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0484	-0.0798	-0.0681	-0.0171	-0.0606
	[0.0575]	[0.0888]	[0.0598]	[0.0522]	[0.0542]
Lagged imports		0.0182	0.00791		
		[0.0177]	[0.0147]		
Lagged exports			0.0499***		
			[0.0155]		
Contemporaneous imports				0.0227	0.000564
				[0.0232]	[0.0247]
Contemporaneous exports				0.0547***	0.0515***
				[0.0159]	[0.0162]
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	23,177	22,819	22,819	23,177	23,177
R-squared	0.349	0.351	0.351	0.349	0.349

Notes: The Table only presents selected variables of interest. All columns include the entire set of variables in the basic model specified in Table 5 with additional control variables specified in respective columns.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. [..] denotes robust standard errors.

Table 10. Sub-sample of unskilled workers: Effects of trade protection and sector-specific characteristics on wages

Dependent variable:	The Basic Model (specified in Table 5) plus additional control variables:		
log hourly real wage	[1]	[2]	[3]
Simple Average Tariff vis-à-vis the European Union	**-0.194***	**-0.523***	**-0.589***
	[0.115]	**[0.15]**	**[0.116]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0326	0.0227	-0.256
	[0.0491]	[0.102]	[0.206]
Lagged capital accumulation	0.0296**		-0.0253
	[0.0143]		[0.0183]
Lagged foreign direct investment		0.00595	0.00242
		[0.0075]	[0.00915]
Lagged unskilled labor shares			0.530*
			[0.267]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	23,177	12,039	10,023
R-squared	0.349	0.365	0.354
Simple Average Tariff vis-à-vis the World	**-0.244***	**-0.463***	**-0.489***
	[0.0946]	**[0.119]**	**[0.0996]**
Lagged Herfindahl Index (i.e., concentration within an industry)	-0.0349	0.0414	-0.198
	[0.0466]	[0.0965]	[0.21]
Lagged capital accumulation	0.0259*		-0.0306
	[0.0143]		[0.0201]
Lagged foreign direct investment		-0.000568	-0.00239
		[0.00841]	[0.0094]
Lagged unskilled labor shares			0.495*
			[0.269]
Year dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
No. of observations	23,177	12,039	10,023
R-squared	0.349	0.365	0.354

Notes: The Table only presents selected variables of interest. All columns include the entire set of variables in the basic model specified in Table 5 with additional control variables specified in respective columns.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level. The sample is restricted to those between 15-75 year-old, employees only, in the manufacturing and electricity sectors. [..]denotes robust standard errors.

Appendix I

Table A1. Distribution of male employment by industries and by broad regions, 1994-2001

1994	Poland	Districts along the western border	Interior/center districts	Capital city (ie., Warsaw)	Districts along the eastern border	Northern coastal districts
Agriculture,mining,fishery	31.39	28.87	33.05	4.6	44.15	20.49
services sector	45.86	45.63	42.44	77.89	38.12	57.94
manufacturing	22.75	25.5	24.51	17.51	17.73	21.57
of which						
food, beverage, tobacco	17	10	20	13	23	18
textile	7	5	11	1	3	4
leather	2	2	2	1	3	2
wood	11	10	10	6	12	12
paper products	3	2	4	11	2	4
petroleum	2	3	1	0	1	1
chemical	5	7	4	8	4	3
rubber/plastic	3	2	3	2	4	1
non-metallic	6	6	6	6	9	3
metal	16	21	15	9	10	8
machinery	11	14	9	9	9	11
electrical appliances	5	5	5	12	3	4
transport equipment	8	5	4	10	12	19
Other manufacturing	7	7	6	11	6	7

2001	Poland	Districts along the western border	Interior/center districts	Capital city (ie., Warsaw)	Districts along the eastern border	Northern coastal districts
Agriculture,mining,fishery	24.92	20.61	27.28	4.02	37.52	13.31
services sector	51.98	54.52	48.12	76.84	44.39	60.92
manufacturing	23.1	24.87	24.6	19.14	18.09	25.77
of which						
food, beverage, tobacco	19	13	22	13	27	20
textile	5	4	9	4	3	1
leather	2	1	2	0	2	1
wood	10	11	8	5	11	12
paper products	4	3	5	9	3	6
petroleum	1	2	1	1	1	1
chemical	5	6	4	6	3	5
rubber/plastic	4	4	5	6	6	3
non-metallic	6	6	6	2	6	2
metal	16	23	14	15	11	12
machinery	9	12	8	12	9	7
electrical appliances	5	5	4	12	3	4
transport equipment	7	6	4	9	9	19
Other manufacturing	7	4	10	7	6	7

Source: Labor Force Surveys

Appendix II[3]

Association Agreement between the European Communities and the Republic of Poland

Article 10 of the Europe Agreement signed in 1991 between Poland and the European Community stipulated the schedule of liberalization with respect to manufacturing products (HS Chapters 25-97). This schedule **did not cover** HS Chapters 1 –24, which encompass **agricultural products**, **processed foods, beverages and tobacco products.** The provisions of Article 10 were as follows:

1. Customs duties on imports applicable in Poland to products originating in the Community listed in Annex IVa shall be abolished **on the date of entry into force** of this Agreement.

Annex IVa covered selected non-agricultural products from the following headings of the Harmonized System: 25, 26, 27, 28, 29, 30, 38, 40, 44, 45, 47, 48, 49, 50, 51, 52, 53, 68, 71, 72, 74, 75, 78, 79, 80, 81, 84, 85, 86, 87, 88, 90, 97.

2. Customs duties on imports applicable in Poland to products originating in the Community which are listed in Annex IVb shall be **progressively** reduced as specified in that Annex.

Annex IVb covered selected tariff lines pertaining to motor vehicles (HS8703, 8704, 8706 and 8707). It specified that customs duties on imports applicable in Poland to these products originating in the Community shall be eliminated according to the following schedule:
   - on 1 January 1994 they will be reduced to six-seventh of the basic duty,
   - on 1 January 1996 they will be reduced to five-seventh,
   - on 1 January 1998 they will be reduced to four-seventh,
   - on 1 January 1999 they will be reduced to three-seventh,
   - on 1 January 2000 they will be reduced to two-seventh,
   - on 1 January 2001 they will be reduced to one-seventh,
   - on 1 January 2002 they will be reduced to zero,

It also specified a suspension of customs duties within the limit of an annual preferential tariff quota for a certain number of cars starting from 1 January 1993.

3. Customs duties on imports applicable in Poland to products originating in the Community other than those listed in Annexes IVa and IVb shall be **progressively reduced**, and abolished by the end of the seventh year at the latest from the entry into force of this Agreement according to the following timetable:
   - **three years after** the date of entry into force of this Agreement each duty shall be **reduced to 80%** of the basic duty,

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[3] The authors would like to thank Federica Saliola for preparing the information for this appendix.

- **four years after** the date of entry into force of this Agreement each duty shall be **reduced to 60%** of the basic duty,
- **five years after** the date of entry into force of this Agreement each duty shall be **reduced to 40%** of the basic duty,
- **six years after** the date of entry into force of this Agreement each duty shall be **reduced to 20%** of the basic duty,
- **seven years after** the date of entry into force of this Agreement the remaining duties **shall be eliminated**.

Provisions of the Europe Agreement with respect to **agricultural products** (HS Chapters 1 to 24) were coved in Chapter II which specified that

- Customs duties on imports applicable in Poland to products originating in the Community listed in the annex XI shall be reduced on the date of entry into force of the Agreement by 10 percentage points.

  Annex XI pertained to selected products from HS Chapters: **01** Live Animals, **04** Dairy Produce, Birds' Eggs, Natural Honey, Edible Products of Animal Origin, not Elsewhere Specified or Included, **06** Live Trees and Other Plants, Bulbs, Roots and the Like, cut Flowers and Ornamental Foliage, **07** Edible Vegetables and Certain Roots and Tubers, **08** Edible Fruit and Nuts, Peel of Citrus Fruits or Melons, **10** Cereals, **12** Oil Seeds and Oleaginous Fruits, Miscellaneous Grains, Seeds and Fruit, Industrial or Medicinal Plants, Straw and Fodder **15** Animal or Vegetable Fats and Oils and Their Cleavage Products, Prepared Edible Fats, Animal or Vegetable Waxes, **18** Cocoa and Cocoa Preparations, **19** Preparations of Cereals, Flour, Starch or Milk, Pastrycooks' Products, **20** Preparations of Vegetables, Fruit, Nuts or Other Parts of Plants, **22** Beverages, Spirits and Vinegar, **23** Residues and Waste From the Food Industries, Prepared Animal Fodder

- The Community and Poland shall grant each other the concessions referred to in Annexes Xa (imports of bovine animal), Xb (some products of chapters 01, 02 - Meat and Edible Meat Offal, 04), Xc (some products of chapters 07, 08, 20) and XI on a harmonious and reciprocal basis, in accordance with the conditions laid down therein.

  Annex Xa specified that "In case the number of animals fixed in the framework of the balance sheet arrangements foreseen in Regulation (EEC) No 805/68 are lower than a reference quantity, a **global tariff quota** equal to the difference between that reference quantity and the number of animals fixed under the balance sheet arrangements will be opened to imports from Hungary, Poland and Czechoslovakia."

- Trade in agricultural goods was to remain subject to **quantitative restrictions**, which according to Article 20 were to be gradually abolished.

Poland shall abolish at the latest by the end of the fifth year from the entry into force of the Agreement the quantitative restrictions on imports originating in the Community listed in Annex IX in accordance with the conditions established in that Annex. Annex IX covered: Beverages, Spirits and Vinegar (HS Chapter 22).

Appendix III

Evidence of Trade Liberalization and Changes in Firm Productivity

In order to shed some light on the channel through which trade liberalization may influence industry premiums, we examine the impact of tariff reductions on the productivity of Polish firms. This exercise is based on an unbalanced panel dataset of 5,090 firms operating in Poland during the period 1996-2000. The information comes from a commercial database Amadeus, compiled by Bureau van Dijk, which contains comprehensive information on companies operating in thirty-five European countries, including Poland.[4]

The analysis proceeds in two stages. First, we estimate a production function separately for each sector to get measures of the total factor productivity (TFP):[5]
$$ln\ Y_{it} = \alpha + \beta_1\ ln\ L_{it} + \beta_2\ ln\ K_{it} + \beta_2\ ln\ M_{it} + \mu_t + \varepsilon_{it}$$
where Y_{it} represents sales of firm i in year t, deflated by the sectoral deflator taken from the Poland's *Statistical Yearbooks*, L_{it} is the number of employees, K_{it} the value of fixed assets and M_{it} the value of materials used. K_{it} and M_{it} are deflated by the GDP deflator. The equation also contains year dummies.

Then we relate the annual changes in TFP to the changes in industry import tariffs:
$$\Delta\ ln\ TFP_{ijt} = \phi\ \Delta\ tariff_{jt} + \mu_j + u_{it}$$
where TFP_{ijt} is the total factor productivity estimated in the first stage for firm i operating in sector j in year t and $tariff_{jt}$ is the tariff on imports of industry j's products in year t. In addition to the 14 manufacturing sectors considered in the paper, we also experiment with including all sectors and setting tariffs on services sectors to zero. Estimating the equation in first differences allows us to eliminate unobserved time-invariant characteristics of industry j. Since some industries may be experiencing faster TFP growth due to, for instance, faster technological progress we also include industry fixed effects in the estimation. To take into account the fact that while the variable of interest (tariffs) is industry-specific, a firm is the unit of observation, we report robust standard errors corrected for clustering by industry. To make the analysis as comparable as possible to the industry premium exercise, we employ exactly the same industry classification and use the same tariff figures (with the exception of the sample encompassing also services industries).

The estimation results, presented below, give support to our hypothesis that trade liberalization is associated with higher productivity at the firm level. We find a negative and statistically significant coefficient on the tariff variable both in the sample encompassing all sectors as well as in the manufacturing subsample. The results hold for both trade liberalization vis-à-vis the

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[4] Unfortunately, the version of Amadeus to which we have access does not include the 2001 figures and is missing employment data from before 1996, which restricts our analysis to the 1996-2001 period.

[5] Due to a small number of observations we combine textiles and leather products into one sector when estimating the production function. We also combine coke and petroleum manufacturing with chemicals.

European Union as well as for tariffs vis-à-vis the world. The results are also robust to including in the regression a lagged measure of industry concentration (Hefindahl index).

Table A2. Total factor productivity and trade liberalization: estimation on first differences

Dependent variable: Total factor productivity	All sectors		Manufacturing only	
Simple Average Tariff vis-à-vis the European Union	**-2.073**** **[0.989]**	**-1.7611*** **[1.0075]**	**-2.0733*** **[1.0026]**	**-2.0987*** **[0.9898]**
Lagged Herfindahl Index (i.e., concentration within an industry)		-1.1178 [0.7906]		0.0908 [1.2733]
Industry dummies	Yes	Yes	Yes	Yes
Simple Average Tariff vis-à-vis the World	**-1.9361**** **[0.8329]**	**-1.7026*** **[0.8448]**	**-1.8098**** **[0.8307]**	**-1.7552**** **[0.8065]**
Lagged Herfindahl Index (i.e., concentration within an industry)		-1.24 [0.7724]		-0.2852 [1.1204]
Industry dummies	Yes	Yes	Yes	Yes

Notes: The number of observations is equal to 6,039 in columns (1) and (2) and 2,420 in columns (3) and (4). The observations pertain to the period 1996-2000.
* denotes significance at the 10-percent level; ** denotes significance at the 5-percent level; and *** denotes significance at the 1-percent level.
[..] denotes robust standard errors clustered by industry.