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Impact of Trade on Productivity of Skilled and Unskilled Intensive Industries: A Cross-Country Investigation

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Abstract

This paper examines the effect of trade openness on the productivity of skilled labor intensive and unskilled labor intensive industries in the group of 20 OECD countries. Using panel data and fixed effects approach, we find that skilled workers' relative gains in productivity exceed those of their unskilled counterpart. Given this differential impact of trade openness on the relative productivity of the skilled and unskilled intensive industries, our findings lend support to the conclusions of past studies that skilled labor is likely to be more pro trade than unskilled labor.

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I. Introduction

Trade theory maintains that increase in trade results in a positive and sustained effect on economic growth due to increased efficiencies in the allocation of resources and economies of scale (Grossman and Helpman, 1991; Obstfeld and Rogoff, 1996). In the past empirical debate and subsequent research has centered around the effect of trade openness on overall economic growth and development.[3] Sachs and Warner (1995), in defense of a positive effect of trade on economic growth, assert that during the 1970s and 1980s, open economies enjoyed a 4.5 percent rate of growth per year while this rate was a mere 0.7 percent for the relatively closed economies. Meanwhile, there are those researchers who maintain that trade openness may not systematically contribute to economic growth. For example, Rodríguez and Rodrik (2000) argue that there exists a fair amount of skepticism about this relationship, both on theoretical and empirical grounds.[4]

When it comes to the effect of trade openness on productivity, a number of past studies have analyzed the relationship between trade openness and total factor productivity (TFP) for the overall economy. Alcala and Ciccone (2004), after looking at the effect of trade openness on labor productivity, conclude that trade has a significant and robust effect on labor productivity. Meanwhile, Miller and Upadhyay (2000) contend that although no consensus has emerged, most past studies conclude that opening the economy to more trade enhances TFP.

While past empirical studies analyzing the impact of trade openness on various economic variables have been performed almost exclusively with aggregate cross-country data, in this paper we investigate the impact of trade openness on labor productivity of skilled intensive and unskilled intensive industries. Our rationale for studying this impact on the two groups of industries is that, when

[3] See Yanikkaya (2003) for a comprehensive review of literature on trade and economic growth.
[4] In fact, according to Yanikkaya's (2003) findings, the relationship between trade and economic growth is not a simple and straightforward matter. This relationship is influenced by certain characteristics such as size of the country and whether or not trade restrictions are applied to the products that the countries have comparative advantage in their production.

countries have a comparative advantage in skilled intensive industries or unskilled intensive industries, we expect increased trade to potentially have a differential impact on productivity of labor in skilled intensive and/or unskilled intensive industries.[5] Given that the findings of previous studies addressing this issue have used data for a particular country and hence are specific to the experiences of that country (see Thurow, 1992; Leamer, 1996 among others), using panel data would allow for a more comprehensive examination of the relationship between trade openness and productivity. This would provide results that could be readily generalized across countries. In addition, since labor productivity is considered an important determinant of wages, investigating the impact of openness on productivity would provide a way of assessing whether trade openness has a differential impact on the benefits accruing to workers in skilled intensive and unskilled intensive industries.

Based on the above, we decompose aggregate labor productivity into productivity of skilled intensive and unskilled intensive industries and analyze the impact of trade openness on labor productivity for each group.[6] The two groups of industries are constructed by classifying each 2-digit level industry as skilled intensive or unskilled intensive industries using an index of skill intensity we develop based on data for the U.S. Utilizing data available from the Structural Analysis (STAN) database for 20 OECD countries for the 1981-2000 period, we consider labor productivity for each group relative to that for the economy and ask whether changes in trade openness has a differential impact on relative productivities of the two groups of industries over the time period.[7, 8] This approach,

[5] Furthermore, considering skilled intensive and unskilled intensive industries allows us to distinguish between industries that are more likely to have experienced skill biased technical change (skill intensive industries) from those that would not (unskilled intensive industries).

[6] There is no general agreement on the definition of skilled and unskilled labor in past empirical studies. Some define skilled as workers with college education while unskilled as workers with no-college education (see for example Anteweiler and Trefler, 2002). Others use production and non-production workers as proxy for skilled and unskilled labor (see for example Zhu and Trefler, 2005). In light of this, and lack of cross-country data on characteristics of workers at the industry level, for the purpose of this study we classify industries as skilled labor or unskilled labor intensive and analyze the impact of trade on labor productivity of the two groups of industries.

[7] Using relative and not absolute productivities for the two groups of industries overcomes the problem of converting labor productivities of countries to a common currency.

by allowing us to specifically test for the impact of trade openness on relative productivity, will provide substantially more information than past studies on the effect that trade openness has on labor productivity. Specifically, our approach would determine whether workers in skilled intensive industries or unskilled intensive industries benefit more from trade openness.

In this paper we develop an empirical model and use it to investigate whether increase in trade openness has had a differential impact on productivity of the two groups of industries relative to the overall economy. We do so by controlling for the effects of spending on public education, spending on research and development, and allowing for exogenous technical change. In addition, using panel data for OECD countries will allow us to control for country-specific fixed effect.

Our empirical analysis reveals that, relative to the overall economy, skilled labor intensive industries benefit more in terms of labor productivity from trade openness than unskilled intensive industries. Given that labor productivity is a good proxy for wages, we can speculate that this differential impact of trade openness on productivity would translate into a differential impact of trade on wages. Thus our findings lend support to past country specific studies which find trade openness to be the main source of increase in wages of skilled workers relative to unskilled workers (for example see Thurow, 1992; Leamer, 1996).

The empirical results could also provide an explanation for people's opinion on trade openness. Mayda and Rodrik (2005) using data on trade opinion from the International Social Survey Programme (ISSP) conclude that "Education and skill are very strongly correlated with support of free trade in countries that are well endowed with human capital" (p. 1490).[9] Our results indicate that workers in

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[8] Data were available for years 1981 through 2000 and for 20 OECD countries. Ideally, one would want to use data for not only developed but also developing countries to address the issue at hand. However, lack of data at the industry level for developing countries constrains us to using data only for developed OECD countries. See Appendix for more details on the source and nature of the data used as well as for the list of countries for which data was available.

[9] Also see O'Rourke and Sinnott (2001), Beaulieu et al. (2004) and Baker (2005) who find that skilled workers are more likely to support free trade than unskilled workers.

skilled intensive industries would support trade more so than workers in unskilled intensive industries. Given our definition of the two groups of industries, we expect that skilled intensive industries hire relatively more skilled and educated workers. It follows that if higher relative productivity translates into higher relative wages then it is conceivable that the group of workers who benefit more from trade openness, in terms of productivity, would be more pro-trade than others.

The remainder of this paper is organized as follows. Section II develops the empirical model to be used as a base for our analysis. Section III reports and interprets the empirical results of our investigation using a fixed effects procedure. Section IV gives the summary and conclusion to this work.

II. Empirical Specification

Given the goal of this paper, we classify industries as skilled labor intensive or unskilled labor intensive by creating an index (measure) of skill intensity for each 2 digit level industry based on data obtained for the U.S. from the Bureau of Labor Statistics (BLS) on the share of production workers in employment for each sector.[10] Using this index we classify all 2-digit industries (excepting industries under the heading "Community Social and Personal Services") in the OECD STAN database with less than 75% share of production workers as skilled intensive industries while the rest are classified as unskilled intensive industries.[11]

To develop our empirical specification, we assume that the aggregate production function (APF) in per worker terms for economy *i,* at time *t* is given by

$$
\begin{aligned}
y_{i,t} &= A_{i,t} F(k_{i,t}) \\
A_{i,t} &= A_{i,0} \exp(\lambda t + \omega' X_{i,t} + \eta_i + \varepsilon_{i,t})
\end{aligned}
\qquad (1)
$$

[10] A similar methodology is used by Zhu and Trefler (2005) to measure the skill intensity of 4-digit industries in the US.

[11] See Appendix (Tables A1 and A2) for more details. We checked for the sensitivity of the results obtained to this definition of skilled intensive and unskilled intensive industries and found that qualitatively the results were similar for alternate definitions where we used 70% or 65% as the cutoff for classifying the industries.

where A represented total factor productivity (TFP), y is value added per worker and k is capital per worker. Growth in TFP has four components: a time trend coefficient λ that represents the average growth of TFP considered a measure of exogenous technological change, X represents a vector of variables that effect TFP growth, η represents country specific fixed effect and ε is an exogenous iid shock. Trade theory implies that increase in trade results in increased efficiencies in the allocation of resources and economies of scale thus resulting in higher TFP. Accordingly, this specification of the aggregate production function implies that the impact of trade on productivity is through TFP.

We assume that the production functions for both groups of industries are similar to the APF given by (1). These functions, in per worker terms, are specified as:

$$\begin{aligned} y_{i,k,t} &= A_{i,k,t} F(k_{i,k,t}) \\ A_{i,k,t} &= A_{i,k,0} \exp(\lambda_k t + \omega'_k X_{i,t} + \eta_{i,k} + \varepsilon_{i,k,t}) \end{aligned} \qquad (2)$$

where k represents either skilled or unskilled intensive group of industries.[12] Dividing (2) by (1) and taking logarithms yields the following relationship:

$$\ln \frac{y_{i,k,t}}{y_{i,t}} = \ln \frac{F(k_{i,k,t})}{F(k_{i,t})} + \ln \frac{A_{i,k,0}}{A_{i,0}} + (\lambda_k - \lambda)t + (\omega_k - \omega)' X_{i,t} + \eta_{i,k} - \eta_i + \varepsilon_{i,k,t} - \varepsilon_{i,t} \qquad (3)$$

Using equation (3) we get the empirical specification for our analysis as:

$$\ln RP_{i,k,t} = const + \alpha \ln RI_{i,k,t} + \Lambda t + \Omega' X_{i,t} + \phi_i + \upsilon_{i,k,t}, \qquad (4)$$

where for industry group *k, RP* is labor productivity of industry k relative to the overall economy and *RI* is one-period lagged relative investment per worker and is used as a proxy for capital per worker for industry k relative to the overall economy. The coefficients Λ and Ω represent the difference between the impact of exogenous technological change and policy variables on the productivity of sector k and that for the whole economy, respectively. When estimating regression (4) for industry group k, a

[12] We assume that all the policy variables that effect TFP growth are the same for the overall economy and for the two groups of industries.

positive estimate for Λ would imply that trend TFP growth for the group is greater than that for the overall economy. Likewise, if the estimated coefficient for one of the elements of Ω is positive we would conclude that the impact of the policy variable on productivity of the sector is greater than that for the overall economy. We include country-specific fixed effects through ϕ and the regression includes an iid error term represented by υ.[13]

Using the classification of industries as skilled or unskilled intensive we compute labor productivity for the two groups of industries by dividing the sum of value added by the sum of labor for each group. Relative labor productivity (*RP*) is then computed by dividing labor productivity of a group by the labor productivity for the overall economy. Relative investment per worker (*RI*) for each group is computed in a similar fashion.

For the policy variable vector *X* we include three variables that potentially would affect TFP: 1) expenditure on research and development as a fraction of GDP (RnD); 2) logarithm of public education expenditure per capita (lnPubed); 3) trade openness measured using the methodology described below.

The choice of our policy variables is based on sound theoretical and empirical arguments. Following Romer (1990), a number of studies have shown that research and development expenditures lead to improved total factor productivity and subsequent economic growth.[14] As a result, we expect a positive sign for this variable in our empirical models. Barro (1997) and, recently, Bilbao-Osorio and Rodriguez-Pose (2004) have shown the importance of expenditures on education in the promotion of economic growth.[15] Accordingly, it is hypothesized that per capita expenditures on education would

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[13] We conducted Hausman (1978) specification test to evaluate whether it was appropriate to use the fixed effects model rather than the random effects model to estimate the coefficients in our model. We found conclusive evidence in favor of the fixed effects specification.

[14] See Bilbao-Osorio and Rodriguez-Pose (2004) for recent evidence on the impact of R&D on economic growth. For theoretical arguments on relationship between growth and research and development expenditures see Romer (1990).

[15] See Poot (2000) for a survey of the literature on the impact of public education expenditure on economic growth.

have a positive impact on TFP. We expect a positive sign for this variable in the empirical models to be estimated.

For the third and our critical policy variable, trade openness, there are two distinct definitions that researchers have used in the past. First is the *traditional* definition of openness which is expressed as follows:

$$TOP = (X + M) / Y,$$

where *TOP* is the *traditional* measure of openness, *X* is total exports, *M* is total imports and *Y* is GDP, all measured in constant US dollars.[16]

The second definition of openness is given by Alcala and Ciccone (2004) and is called *real* openness. These authors argue that "… an increase in the degree of specialization affects openness in two opposite ways. Holding the price of nontradable goods constant, a higher degree of specialization raises openness as more specialization necessarily implies a larger volume of imports." (p. 617). However, they show that, at the same time a higher degree of specialization will raise the price of non-tradeables leading to lower openness. (p. 617). Accordingly, based on "sound theoretical reasons", they conclude that the traditional openness "…may result in misleading picture of the productivity gains due to trade." (p. 613). Alcala and Ciccone's definition of *real* openness is given by:

$$ROP = (X + M) / Y_{PPP},$$

where *ROP* is *real* openness, *X* and *M* are in constant US dollars and Y_{PPP} is a measure of GDP in purchasing power parity US dollars. In what follows, we present results from estimating regression (4) using both definitions of trade openness.

[16] Recent studies by Andersson (2001) and Dar and Amirkhalkhali (2003), among others, have used this definition.

III. The Results

Before proceeding with the task of estimating our empirical model of equation (4), we provide summary statistics using the data for 20 OECD countries over the 1981-2000 period for the key variables used in our empirical model (Table 1). The information provided helps us understand some important issues pertaining to the relationship between openness and relative labor productivity. Based on this summary table we observe that: 1) Skilled labor intensive industries have a higher productivity relative to the overall economy (*RP*) than unskilled labor intensive industries; 2) Relative investment per worker (*RI*) in skilled labor intensive industries is higher than that for unskilled labor intensive industries. A higher relative investment could explain the higher relative productivity of skilled intensive industries. This confirms that when analyzing the impact of trade openness on relative productivities we need to control for relative investment per worker.

Our empirical results, based on the estimation of equation (4), are reported in Tables 2 and 3. All estimated coefficients are relative to the overall economy and all models include country-specific fixed effects. We have used different lags for trade openness variables to verify the impact of such lags on the results for our models. The numbers of lags are clearly identified in each column of the Tables. Based on Rodrik's (1995) claim that the effect of trade openness on other economic variables occurs with a rather long lag, we base our analysis on the results for openness variables with three year lags. The empirical results are robust to the use of different lags of trade openness since the value of the coefficients and their signs and levels of significance for most of our variables do not vary by much across columns in Tables 2 and 3.

Considering the reported results, we find a positive sign and statistically significant coefficient for relative investment (*RI*) variable in all the models reported. That is, this variable does positively and significantly affect the relative productivity of labor for both skilled intensive and unskilled intensive industries. These results are in line with economic theory and are reasonable since they confirm that investment and subsequent capital formation promote productivity of both groups of industries.

Intuitively and theoretically one would expect that the higher the proportion of research and development expenditure to GDP the higher labor productivity would be. Our results, when using three period lags for traditional and real openness, indicate that research and development expenditures have contributed relatively more to the productivity of the group of unskilled intensive industries than that of the skilled intensive industries.[17]

The estimated coefficient for per capita expenditure on public education (*Pubed*) shows that this variable has had a positive and significant impact on the relative productivity of the unskilled intensive industries. This is true whether we use real or traditional openness in the model. For the skilled intensive group of industries, although positive, the coefficient for *Pubed* is not statistically significant in any of the models. As with research and development expenditure, our results show that relative to the overall economy, per capita expenditure on public education has benefited the unskilled intensive sector relatively more than the skilled intensive sector in terms of productivity.

The estimated coefficient for traditional openness (TOP) for unskilled intensive industries is negative and statistically significant while that for skilled intensive industries is insignificant for all lagged values of this variable (Table 2). This suggests that, relative to the overall economy, increase in trade has had a negative effect on the productivity of the former group while the impact for the latter group has been the same as that for the overall economy. Similar results are obtained when using the real (ROP) definition of trade openness (Table 3). Accordingly, it is concluded that, relative to the overall economy, after controlling for the effects of spending on public education and research and

[17] It should be noted that this finding is not robust to use of different lags of TOP and ROP.

development as well as allowing for exogenous technological change, skilled labor intensive industries benefit relatively more from trade than unskilled intensive industries in terms of productivity. Furthermore, given that labor productivity is a good proxy for wages, we can speculate that this differential impact of trade openness on productivity would translate into a differential impact of trade on wages. Thus our findings support the conclusion that increased trade is an important source of increase in wages of skilled labor relative to unskilled labor (see Thurow (1992); Leamer (1996) among others).

Our findings clearly indicate that trade openness has had a differential impact on productivity of the two groups of industries. For the OECD countries that we have considered the benefits in terms of productivity relative to the overall economy from trade for unskilled intensive industries has been lower than that for skilled intensive industries. These results corroborate the conclusions reported by Mayda and Rodrik (2005), O'Rourke and Sinnott (2001), Beaulieu et al. (2004) and Baker (2005) among others. Our results show that since workers in skilled intensive industries benefit more, in terms of productivity gains (and thus perhaps in terms of wages), from trade expansion than their unskilled counterpart, it would seem logical that workers working in skilled intensive industries (relatively higher number of skilled workers) are more likely to oppose protectionism than workers working in unskilled intensive industries (relatively higher number of unskilled workers).

To confirm the above we follow Mayda and Rodrik (2005) and use data obtained from the International Social Survey Programme (ISSP).[18] We construct a *pro-trade dummy*=1 if expressed trade opinion was 4 or 5 otherwise *pro-trade dummy*=0. That is, *pro-trade dummy*=1 if the respondent disagreed (opinion 4) or strongly disagreed (opinion 5) with the statement that "(Respondent's country) should limit the import of foreign products in order to protect its national economy." The

[18] We use data for the ISSP 1995 National Identity I survey.

anti-trade dummy=1 if trade opinion was 1 or 2 otherwise *anti-trade dummy*=0, that is if the respondent strongly agreed (opinion 1) or agreed (opinion 2) with the above statement.

We plot the mean for the two dummy variables for different years of education of respondents to illustrate how the opinion on trade varies by education. As is evident from Figure 1, plotted for all 24 countries in the ISSP dataset, and Figure 2, plotted for the 13 countries common to our dataset and the ISSP dataset, opinion on trade systematically varies with years on education. Specifically, the Figures suggest that people with more years of schooling are more likely to be pro-trade than anti-trade.[19] As discussed earlier, considering education to be a good proxy for skills, this suggests that for the countries in our dataset (relatively rich OECD countries with a high endowment of skilled labor) skilled labor is more likely to be pro-trade than unskilled labor. In all, our conclusion that trade openness has a differential impact on labor productivity of skilled intensive and unskilled intensive industries lends support to the observed relationship between trade opinion and years of education.

IV. Summary and Conclusion

In this paper, we set out to study the effect of trade openness on labor productivity of skilled intensive and unskilled intensive industries. Based on the usage of production and non-production workers, we created an index of skill intensity for each of the 2 digit industries in an economy and used it to classify them as skilled intensive or unskilled intensive. Our quest for testing the hypothesis that trade openness improves the productivity began by defining labor productivity for each industry relative to the overall economy and relating them to investment per worker, research and development expenditure as a fraction of GDP, per capita expenditure on education and trade openness. We

[19] The same pattern emerges if we include only people that are currently employed in the dataset. Furthermore, subjective social class has a bearing on pro-trade views of people. Specifically, respondents who attribute themselves to a higher social class are likely to be more pro-trade at every level of education relative to respondents who attribute themselves to a lower social class.

developed an empirical model that allows us to investigate the relationship between trade openness and labor productivity of skilled and unskilled intensive industries relative to the overall economy.

Using panel data for 20 OECD countries from 1981 to 2000 we estimated our empirical models utilizing the fixed effects procedure. Our results show that investment has led to increased productivity for both skilled labor intensive and unskilled labor intensive industries. We find that, increased investment and innovation have played a pivotal role in promoting productivity and efficiency in OECD countries. Meanwhile expenditure on research and development has contributed relatively more to the labor productivity of unskilled intensive industries than that of skilled intensive industries. We observe a similar impact of expenditure on public education per capita on relative productivity.

With regards to trade openness, our results indicate that, relative to the overall economy, after controlling for the effects of spending on public education and research and development as well as allowing for exogenous technological change, skilled labor intensive industries benefit relatively more from trade than unskilled intensive industries in terms of productivity. Given that labor productivity is a good proxy for wages; our findings support the conclusion that increased trade is an important source of increase in wages of skilled labor relative to unskilled labor.

Since workers in skilled intensive industries benefit more, in terms of productivity gains (and thus perhaps in terms of wages), from trade expansion than their unskilled counterpart, it would seem logical that workers working in skilled intensive industries (relatively higher number of skilled workers) are more likely to be pro trade than workers working in unskilled intensive industries (relatively higher number of unskilled workers). These results corroborate the conclusions reported by

Mayda and Rodrik (2005), O'Rourke and Sinnott (2001), Beaulieu et al. (2004) and Baker (2005) among others.[20]

Distinguishing between skilled and unskilled intensive industries, when analyzing the impact of trade openness on labor productivity, allows us to infer that ongoing discussions on trade policies need to take into account the fact that trade can have a differential impact on different segments of industries. In light of our findings and the current round of the WTO negotiations regarding the inclusion of services and other non-tradable goods into new trade agreements, it becomes imperative that further research consider the impact of expanded trade in such areas on productivity of different sectors and industries.

[20] It must be noted that the group of countries included in our sample are mostly developed and as such we cannot extend our conclusion to the case of developing countries. See Abizadeh and Tosun (2007) on the impact of trade openness on labor productivity in developing countries.

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Table 1: Statistical Summary Table

		N	mean	standard deviation
Skilled	RP	2081	1.909	1.321
	RI	2081	2.063	2.738
Unskilled	RP	4109	1.243	0.947
	RI	4109	1.534	2.858
All	ROP	6190	0.627	0.380
	TOP	6190	0.588	0.314
	RnD	313	1.725	0.732
	lnPubed	332	6.769	0.652

Table 2: Effect of Traditional Openness (TOP) (lagged as indicated) on Relative Productivity of Skilled and Unskilled Intensive Industries

	One period lag		Two period lags		Three period lags		Five period lags	
	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled
LnRI	0.162	0.451	0.164	0.463	0.150	0.427	0.142	0.439
	(0.027)*	(0.082)*	(0.027)*	(0.080)*	(0.027)*	(0.079)*	(0.027)*	(0.083)*
RnD	-0.011	-0.095	-0.015	-0.093	-0.018	-0.107	-0.018	-0.099
	(0.015)	(0.058)	(0.015)	(0.058)	(0.015)	(0.058)***	(0.015)	(0.057)***
lnPubed	0.058	0.104	0.068	0.111	0.059	0.089	0.039	0.035
	(0.028)	(0.104)	(0.029)	(0.103)	(0.028)	(0.103)	(0.028)	(0.102)
TOP	-0.346	-0.186	-0.353	-0.145	-0.392	-0.245	-0.450	-0.432
	(0.051)*	(0.213)	(0.055)*	(0.220)	(0.067)*	(0.262)	(0.079)*	(0.294)
year	0.000	0.004	-0.001	0.003	-0.001	0.005	-0.001	0.008
	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)
constant	-0.222	-10.23	0.788	-8.390	0.542	-11.60	1.103	-15.47
	(2.544)	(9.828)	(2.507)	(9.519)	(2.596)	(9.770)	(2.474)	(9.044)
N	228	216	228	216	227	215	224	212
Countries	20	20	20	20	20	20	20	20
R-sq	0.488	0.248	0.479	0.247	0.455	0.229	0.445	0.230

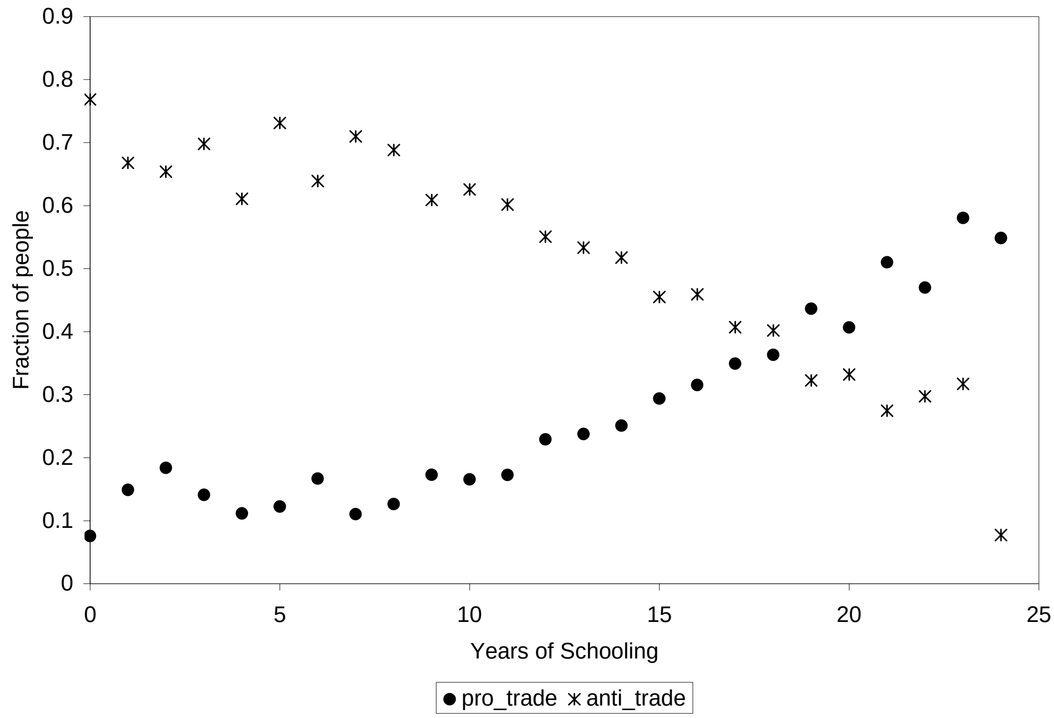
Note: Standard errors in parenthesis. *, **, *** signify 1%, 5% and 10% level of significance, respectively. All models include country-specific fixed effects.

Table 3: Effect of Real Openness (ROP) (lagged as indicated) on Relative Productivity of Skilled and Unskilled Intensive Industries

	One period lag		Two period lags		Three period lags		Five period lags	
	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled
LnRI	0.188	0.469	0.189	0.481	0.176	0.449	0.163	0.453
	(0.028)*	(0.071)*	(0.028)*	(0.071)*	(0.028)*	(0.073)*	(0.028)*	(0.082)*
RnD	-0.014	-0.095	-0.014	-0.091	-0.012	-0.101	-0.009	-0.090
	(0.016)	(0.058)***	(0.016)	(0.058)	(0.016)	(0.058)***	(0.016)	(0.057)
lnPubed	0.061	0.097	0.076	0.115	0.067	0.094	0.052	0.040
	(0.030)*	(0.104)	(0.030)*	(0.103)	(0.030)**	(0.103)	(0.030)***	(0.102)
ROP	-0.137	-0.151	-0.115	-0.068	-0.079	-0.081	-0.054	-0.122
	(0.033)*	(0.121)	(0.033)*	(0.122)	(0.031)*	(0.114)	(0.031)***	(0.110)
year	-0.003	0.005	-0.004	0.003	-0.005	0.003	-0.006	0.004
	(0.001)*	(0.005)	(0.001)*	(0.005)	(0.001)*	(0.004)	(0.001)*	(0.004)
constant	5.388	-11.228	7.296	-6.862	8.695	-8.196	10.187	-9.081
	(2.506)*	(8.833)*	(2.384)*	(8.512)	(2.239)*	(8.102)	(1.943)*	(6.963)
N	228	216	228	216	227	215	224	212
Countries	20	20	20	20	20	20	20	20
R-sq	0.421	0.251	0.407	0.247	0.382	0.228	0.364	0.227

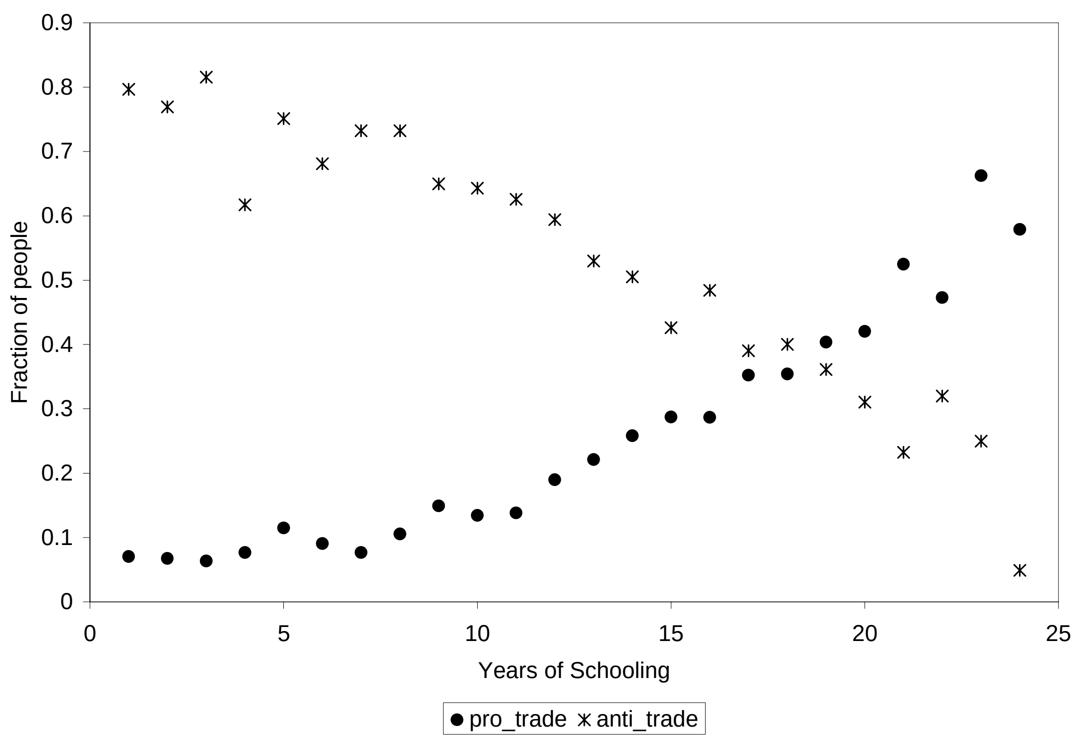
Note: Standard errors in parenthesis. *, **, *** signify 1%, 5% and 10% level of significance, respectively. All models include country-specific fixed effects.

Figure 1: Trade opinion by Years of Education for all Countries in the ISSP dataset



Data Source: ISSP 1995 - "National Identity I" survey.

Figure 2: Trade opinion by Years of Education for Countries Common to the ISSP dataset and our dataset



Data Source: ISSP 1995 - "National Identity I" survey.

APPENDIX

DATA

The industry level data used for our analysis is from the OECD STAN Industrial database provided at www.sourceoecd.org. This database provides information for all ISIC Rev.3 2-digit industries for most OECD group of countries for the 1970-2000 time period (20 countries had the minimum data required for the analysis). In addition we used the national income data in current dollars on exports, imports and GDP from the OECD to construct our openness measures for the same time period.

For classifying industries as skilled and unskilled, we constructed a skill intensity measure using data from the Bureau of Labor Statistics (BLS) for the U.S. (Table A1). Industries with a higher fraction of production workers (more than 75%) were classified as unskilled intensive industries while others were classified as skilled intensive industries (Table A2).

Data for exchange rates and purchasing power parities was obtained from the Penn World Tables Mark 6.1.

Data for research and development expenditures as a fraction of GDP (*RnD*) was obtained from the national income accounts published by the OECD.

Data for total public education expenditure per capita (*Pubed*) was constructed using data from the World Bank EDSTAT database.

The list of countries for which data was used for the analysis is as follows:

Australia	Finland	Italy	Portugal
Austria	France	Korea	Spain
Belgium	Hungary	Netherlands	Sweden
Canada	Iceland	Norway	United Kingdom
Denmark	Ireland	Poland	United States

Table A1: Fraction of Production Workers by Industry for the U.S. using BLS data

Industry (Skilled)	Fraction Production Workers	Industry (Unskilled)	Fraction Production Workers
Computer and electronic products	0.57	Natural resources and mining	0.76
Chemicals	0.59	Paper and paper products	0.76
Beverages and tobacco products	0.59	Nonmetallic mineral products	0.77
Petroleum and coal products	0.65	Construction	0.77
Machinery	0.65	Plastics and rubber products	0.77
Miscellaneous manufacturing	0.66	Furniture and related products	0.78
Electrical equipment and appliances	0.7	Leather and allied products	0.78
Printing and related support activities	0.7	Apparel	0.78
Durable goods	0.71	Primary metals	0.78
Manufacturing	0.71	Information	0.79
Nondurable goods	0.73	Food manufacturing	0.79
Goods-producing	0.73	Wholesale trade	0.8
Transportation equipment	0.74	Textile mills	0.8
Fabricated metal products	0.75	Utilities	0.81
Financial activities	0.75	Wood products	0.81
		Textile product mills	0.81
		Motor vehicles and parts	0.82
		Total private	0.82
		Professional and business services	0.82
		Other services	0.82
		Private service-providing	0.84
		Trade, transportation, and utilities	0.84
		Retail trade	0.85
		Transportation and warehousing	0.87
		Education and health services	0.87
		Leisure and hospitality	0.88

Data Source: Bureau of Labor Statistics (BLS).

Table A2: Classification of STAN Industries as Skilled or Unskilled

Industry	Skilled/Unskilled
Food products and beverages	unskilled
Tobacco products	skilled
Textiles and textile products	unskilled
Leather, leather products and footwear	unskilled
Wood and products of wood and cork	unskilled
Paper and paper products	unskilled
Publishing, printing and reproduction of recorded media	skilled
Coke, refined petroleum products and nuclear fuel	skilled
Chemicals and chemical products	skilled
Rubber and plastics products	unskilled
Other nonmetallic mineral products	unskilled
Basic metals	unskilled
Fabricated metal products, except machinery and equipment	unskilled
Machinery and equipment, n.e.c.	skilled
Electrical and optical equipment	skilled
Motor vehicles, trailers and semitrailers	unskilled
Other transport equipment	skilled
Furniture; manufacturing n.e.c.	unskilled
Recycling	Not classified
Electricity, gas, steam and hot water supply	unskilled
Collection, purification and distribution of water	unskilled
Construction	unskilled
Sale, maintenace and repair of motor vehicles; retail sale of automotive fuel	unskilled
Wholesale Trade	unskilled
Retail trade; repair of personal and household goods	unskilled
Hotels and restaurants	unskilled
Transport and storage	unskilled
Post and telecommunications	Not classified
Financial intermediation	skilled
Real estate, renting and business activities	skilled
COMMUNITY SOCIAL AND PERSONAL SERVICES	
Public admin. and defence; compulsory social security	Not classified
Education	Not classified
Health and social work	Not classified
Other community, social and personal services	Not classified
Private households with employed persons	Not classified
Extraterritorial organisations and bodies	Not classified

Note: Not classified industries have not been included in the analysis. The BLS data did not allow for classification of Recycling, Post and Telecommunications and industries under the heading community social and personal services were not classified since they were considered to be industries fully or partly controlled by the government.