Openness and growth in Central-Eastern European Countries

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Abstract

We present evidence of the relationship between trade-openness and growth in the sample of former communist countries before and after the transition from a central planned economy (CPE) to a market economy by applying standard OLS and panel estimation techniques. The main finding is that during the transition the importance of openness on growth per capita has increased sharply by changing the coefficient from a negative sign to a positive and significant one. The result seems to be robust to (i) estimation methods , (ii) different measures of openness adopted and (iii)consistent with the integration view, which states that a higher degree of trade openness spurred by market incentives and comparative advantages enhances the per capita growth rate of economies.

Commercio internazionale e crescita nei paesi dell'Europa centro-orientale (CEECs)

Abstract

Nel lavoro presentiamo i risultati empirici del nesso tra *openness* reale e tasso di crescita del reddito procapite per il gruppo di economie pianificate nel periodo che precede (1960-1989) e segue la transizione verso un'economia di mercato (1990-2000) applicando sia metodologie econometriche standard della crescita sia metodologie panel. Il principale risultato dell'analisi è che durante il processo di transizione l'importanza del coefficiente di openness è mutato repentinamente mostrando il giusto segno e significatività statistica. Il risultato sembra robusto ai metodi di stima, a diverse misure del grado di integrazione commerciale e coerente con la visione secondo la quale un maggior grado di aperture di un'economia, quando è indotto da incentivi di mercato e dal vantaggio comparato, può avere *effetti di crescita* sul reddito pro capite.

Keywords: economic growth, transition economies, trade openness

JEL: O47, O42, G30

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1. Introduction

The economic instability of the transition countries and their recent accession to the EU has brought to the forefront the interest of economists for the growth process of these economies as a laboratory to test the role of many factors as potentially responsible for growth per capita for these economies. Among the many factors, specifically FDI, finance, R&D spillovers and technology transfers, that have been studied in recent literature (Damijan et al [2003], Djankov and Hoeckman [2000] Bevan e Estrin [2000], Blomstrom and Sjoholm [1999], Meyer [1998]) we investigate in this paper the role of trade openness providing empirical evidence of the impact of this variable on the growth rate in two periods 1960-1989 and 1990-2000. Indeed, we wish to compare the role of openness played in former communist countries and in the subsequent period after the collapse of the communist regime. The channel of trade as a growth determinant has been less studied for these countries, but it is one of the main channels of potential international technology transfers. The opening up of the CEECs with the advanced countries of the European Union began in 1989 and since then former communist countries have fully participated in the modern multilateral world trading system. In the previous period trade in Central planned economies (CPEs) was substantially bilateral and this, together with all the many problems of foreign trade in these countries, reinforced the tendency to foster trade diversion rather than trade creation (see Ethier [1995], Lavigne [1995] for a discussion). If this is true, we must find evidence of a negative role of openness in CPEs and the opposite for the Central-Eastern European Countries (CEECs). The access through international trade to a wide variety of intermediate goods and new final products would have favoured productivity growth. The object of this paper is to provide an assessment of the changing role of international trade on growth after the beginning of the integration process in the early ‘90s.

In the remainder of the paper we present in section 2 some motivations for the subject from the literature. In section 3 we illustrate the methodology used to evaluate the nexus

between trade and growth. In section 4 we illustrate the main empirical findings by using annual and five-year averages data. In section 5 we investigate the degree of economic integration between the CEECs and EU member states by calculating some indices of inter and intra industry trade which will be included in standard regressions. Some concluding remarks are reported in section 6.

2. Motivation for this paper from literature

Since endogenous growth theories do not predict that trade will unambiguously enhance the growth rate of economies, we believe that the comparison between trade and growth in CPEs and the same relationship in the CEECs may help further understanding of the role of trade and other variables on growth. A fairly extensive literature offers arguments for and against the role of trade-openness on growth. It is argued that when a country has a comparative advantage in non dynamic sectors or is behind in technological development, trade can be detrimental for growth pushing the country to specialise in traditional goods and this leads, in innovation-based-models, to a lower growth rate (Matsuyama [1991]). Unlike this theoretical result a different channel between trade and growth is analysed in the paper by Rivera-Batiz and Romer (1991), as well as in Grossman & Helpman (1991, chs. 7 and 8). They show that when innovation is the main source of growth, integrating two identical economies into a single market leads to an increase in the growth rate. However, if integration involves only trade without the diffusion of technologies and ideas, then the growth rate is not affected.

The main theoretical predictions that can be drawn from endogenous growth studies is that higher trade can foster output growth in the world economy as a whole, but a subset of countries may experience lower growth depending on their initial conditions and levels of technological progress. Therefore, the effects of international trade on growth are still an open area for further theoretical research. If we want to verify the main predictions of these models empirically, we would expect integration between similar countries to enhance the growth rate. This occurred

for the EU countries until 1970 but since then it seems that the possibility of catching up through international trade has decreased abruptly for this group of countries. Obviously catching up should work for backward CEECs. We test if the increase in growth rates in former CPEs after the'90s has been driven from trade with EU economies or by other mechanisms. The above mentioned theoretical arguments can have a partial response if we look at the changing process in Central-Eastern Europe and at the role of trade in these countries even if the time period is too short to come to conclusions for long run growth effects.

From an empirical point of view, many papers have recently begun to cast doubt on the key results on openness and growth, thus making this area of empirical research a highly controversial subject. To demonstrate how controversial the subject is we select for reviewing just few empirical studies based on the degree of openness and commercial oriented innovation efforts as engines of growth (i.e. Harrison (1996) Sachs and Warner (1995), Edwards (1998), Frankel and Romer (1999) Rodriguez and Rodrick (2000), Miller and Upadhyay (2000), Alcalà e Ciccone (2004) Greenway *et al.* (1998, 2002), Rodrick *et al.* (2002), Dollar and Kraay (2001, 2003), Yanikkaya (2003), *inter alia*).

Harrison [1996] uses a variety of openness measures to test the association between openness and growth. She found that each type of measure should have different statistical significance. The association found is generally positive. However, the strength of the link depends on whether the specification uses cross-section or panel data. The author shows that for industrialising countries, which have recorded significant fluctuations in trade regimes over time, long run averages may not serve to distinguish policy changes occurring from free trade to protectionism.

A recent interesting paper is the one by Rodriguez and Rodrick (2000). Even though the focus of their paper is primarily on *trade policy,* it is possible to infer that the empirical literature reviewed by the authors has many shortcomings. They argue that results are not convincing and may depend on indicators of openness used by researchers as well as on the

methodology adopted. If the measure of openness used is trade barriers, there is little evidence that lower barriers, in the sense of lower tariffs to trade, are significantly associated with growth. However, also in their paper, when the authors apply two measures of trade restrictions (tariff and non-tariff barriers to trade) over the period from 1975 to 1994 the finding is an inverse relationship between trade barriers and economic growth. Indeed, tariffs and other types of protection may have contradictory effects since they imply efficiency losses.

There are papers that address the question of causality as the one by Frankel and Romer (1999). They rightly posed the question of endogeneity of trade share with GDP and growth rate of income. The novelty in this paper is an attempt to deal with endogeneity by using geographic variables as instruments of the relationship bearing out the positive effect of trade. Also this paper is criticised by Rodriguez and Rodrick on the basis that their geographic variables are not valid instruments. Geography may affect income and productivity along many channels and not only trade.

Another study that controls for geographic factors and institutional quality and finds a significant and robust correlation between openness and trade is the paper by Alcalà and Ciccone (2004). The two authors use a measure of *real openness* and a proxy for tradable GDP openness. They find that the effects of international trade on labour productivity and on income per capita at a country level are highly significant and robust (a 1 percent increase in real openness raises average labour productivity by 1.45 percent). The same robust effect is found when a measure of *tradable* openness is used.

The regression analysis in the paper by Dollar and Kraay (2001) focuses on changes in growth rates and in the volume of trade by controlling for common shocks. Their results show a significant and positive nexus between the two variables. Also these authors observe that it is extremely difficult to isolate the effect of trade from other variables for the lack of adequate instruments in the regressions. In Dollar and Kraay (2003) the joint role of both institutions and trade has been recognized in the very long run but also a relatively larger role of trade over a

shorter horizon is shown. In their work they further document three stylised facts: (i) countries with better institutions grow faster, (ii) countries that trade more grow faster, (iii) countries with better institutions also tend to trade more.

Other recent papers, such as the ones by Miller and Upadhyay (2000) Greenaway *et al.* (2002), Yanikkaya (2003), show mixed results. The impact of trade on growth depends crucially, as in the paper by Harrison, on the specific measure of openness used.

These few but representative studies reviewed are sufficient to draw attention to the strong implications that empirical results have not only for academic research but also for an economic policy perspective. Hence, the link between growth and its determinants must be clear and unambiguous.

3. Data and methodological issues.

In our analysis we use time series data taken mainly from the Penn World Tables. A detailed description of these data can be found in the Appendix as well as in Summers-Heston (1991) and Heston, Summers and Bettina Aten (HS&A, 2002). Among many variables we use the series (at constant international dollars of 1995) of GDP per capita, the share of total gross investment on GDP, the share of government expenditure, the measure of *real openness*, all as a percentage of GDP, and population growth rates. Other data for different measures of human capital accumulation are taken from Barro and Lee (BL 1993 and 2000). Our data set includes the countries of the former communist regime (CPEs), the same countries which are generally indicated as transition economies (TEs) and all the CEECs. The data set for CPEs covers the period from 1960 to 1989 and the data for CEECs the period from 1990 to 2001.

The variables chosen respond to the standard empirical modelling of growth used in recent literature. Generally, the most commonly used econometric method has been cross section estimation of the Mankiw-Romer -Weil (1992) style. This approach uses a single regression and average-values of the variables and growth rates for each country for the entire period. It also

assumes that the production function parameters and levels of technologies are the same across countries. The emerging of a widespread dissatisfaction with this standard empirical method of growth analysis and mistrust of growth regressions has brought many researchers to partly overcome the criticisms by adopting a methodology that accounts for individual country effects. In this work we employ standard OLS and OLS with instrumental variables as well as panel estimation with country specific effect (fixed effects). We apply panel estimations by using pooled data at an annual frequency. The possibility of using pooled annual data for the panel of countries under study has been suggested by Pesaran and Smith (1995), Lee, Pesaran and Smith (1997) and has been recently adopted by Bond, Leblebicioglu and Schiantarelli (2004) to measure the growth effect of capital accumulation. However, assuming there are some limits in using annual data since it does not allow controlling for cyclical fluctuations, five-year averages are used in panel estimation.

Our empirical modelling is a standard cross-country growth regression that can cover much of the existing literature on the empirics of growth:

$$y_{it} = \beta_0 + \beta_1 y_{i,t-1} + \beta'_2 X_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

where y_{it} denotes the logarithm of per capita GDP in country i at time t , y_{it-s} is a lagged income per capita, X_{it} is a vector of proximate determinants of economic growth in which we include the measure of trade volumes, the logarithm of the share of investment on GDP, measures of human capital accumulation and the population growth rate. The country specific intercept η_i allows for country specific effects such as unobserved factors that influence the country growth rate and the disturbance term reflects shocks to the level of output per capita. The error term $\varepsilon_{i,t}$ and η_i are assumed to be uncorrelated and independently distributed across countries ($E(\eta_{i,}) = 0$, $E(\varepsilon_{i,t}\eta_i) = 0$. Subtracting lagged income from both sides of equation (1) we get :

$$y_{it} - y_{i,t-s} = \beta_0 + \hat{\beta}_1 y_{i,t-1} + \beta'_2 X_{it} + \eta_i + \varepsilon_{it}$$

(2)

where on the LHS we have the growth rates (logarithm differences) and on the RHS the determinants of growth.

4. Results

Following the methodological discussion presented above we give the results of our analysis of real openness, investment, human capital and growth. We start by reporting results for the CPEs, then for the CEECs

Among the determinants of growth we will test different specifications of the basic regression equation by including the Heston, Summers and Aten (2002) Penn World Table (PWT 6.1) measure of real trade openness (OPEN), given by the ratio of export plus import to GDP, the natural log of real investment ratio I/Y as a proxy for capital accumulation, the natural log of real consumption government spending in GDP (G) as a proxy for macroeconomic policy, human capital, which will be denoted in specific regression with PRIM, to indicate the percentage of population with primary education and SECON for secondary education. The variable AVER will also be used as the stock measure in Barro and Lee (2000) denoting the average years of schooling of the population. In some regressions interaction of human capital with investment and Openness have been used. We restrict the number of countries and the period of observations from 1960-1990 for the CPEs. Time periods, country-samples and methodology adopted will be indicated for each regression.

The coefficient estimates of the first regression are listed in column 1 of Table 1. The basic regression estimated is:

$$\Delta \ln y_{it} = \beta_0 + \beta_1 \ln\left(\frac{INV}{RGDP}\right)_{i,t}$$
$$+ \beta_2 \ln OPEN_{i,t} + \beta_3 \ln G_{i,t} + \Delta \ln POP_{i,t} + \Delta \varepsilon_{i,t}$$

The other regressions estimated will differ from the one above simply because of the number of regressors, and because we will alternatively include both level of openness and logarithm change of Openness as independent variables (Δln OPEN), as indicated in Table 1. We find a significant negative effect of trade on growth and a positive relationship for the investment share. The estimated coefficient (of ln) of real investment on GDP is positive and statistically significant at a 1% level. The openness variable has a negative sign and the coefficient is significant at a 5% level.

Then, we add data for human capital (HC) (BL, 2000) to run regression 2. The coefficients, except for primary education which is positive and significant, are negatively correlated with growth, even when we interact measures of secondary education with openness and the investment ratio or when the stock of human capital proxied by average years of schooling in the population above 25 years is used. This is a striking result since we know that the average years of schooling for these countries is high. The explanations given for this common result in the literature is that the rate of accumulation of human capital is very slow and since most of the variation is cross sectional, it should be absorbed by the fixed effects in panel estimations[1]. In the econometric literature positive coefficients (at a 10% confidence level) for human capital are obtained with the exclusion of the constant term from the regression (see Benhabib and Spiegel [2002]). We tried to interact human capital with openness and investment to estimate the effect of these interactions on the growth rate. The idea is that larger openness encourages the introduction of new technologies, increases the demand for skilled workers with a positive impact on *learning by doing* and productivity. This suggested including the interaction term plus the level of human capital as separate regressors (see Harrison [1996]). Disappointingly, the coefficients of these interaction terms turned out to be negative (not shown). Only the interaction term between investment and primary education exhibited a positive and

[1] When we introduce the rate of growth of human capital the coefficient turns out to be positive. However, even though in endogenous growth models the growth rates depend on the level of human capital (not its growth rate),

significant coefficient and it remained positive in all the specifications. Therefore, without the interaction term, the regression estimated is:

$$\ln RGDP_{i,t} - \ln RGDP_{i,t-1} = \beta_0 + \beta_1 \ln\left(\frac{INV}{RGDP}\right)_{i,t}$$
$$+ \beta_2 \Delta \ln OPEN + \beta_3 \Delta \ln POP_{i,t} + \beta_4 \ln G + \beta_5 \ln HC + \Delta\varepsilon_{i,t}$$

Table 1: Annual Data Cross-country Growth regression (1960-1990) CPEs' Sample

Dependent variable change in Ln(RGDP per capita)

Dependent Variable Δin y	(1) OLS	(2) OLS	(3) OLSDV	(4) 2SLSIV t	(5) 2SLSIV	(6) Panel Within Fixed Effects
Constant	0.05122	–0.12121*	0.03034	0.25061***	–0.016123**	–0.15458
	(-0.62)	(–1.61)	(0.61)	(2.39)	(–1.95)	(–1.45)
Ln (I/Y)	0.06115***	0.06942***	0.00372***	0.09053***	0.054434 **	0.10355***
	(3.20)	(3.67)	(4.83)	(4.68)	(2.47)–	(4.23)
Ln OPEN	-0.0137**		– 0.001328***	–0.04022***		–0.399***
	(-2.00)		(-4.31)	(– 4.06)		(–3.45)
Δln OPEN		–0.05903*			–0.076999**	
		(–1.85)			(–2.24)–	
PRIM		0.00080***			0.00077**	
		(2.80)			(2.21)	
SECON		–0.00094***				
		(–3.24)				
AVERSCH				– 0.02195		
				(–1.13)		
Ln POP				–0.03124***		
				(–4.17)		
Δln POP	–1.7745*	-1.28658			0.40315	0.500718
	(–1.51)	(–1.11)			(0.44)	(1.54)

the impact of human capital still remains a puzzle in the empirics of growth since the coefficient, either negative or positive, is never significant.

Ln G		–0.01302**	–0.00388	–0.006189	–0.01157*	(–0.13467
		(–2.15)	(-0.28)	(–1.15)	(–1.36)*	(–0.59)
Dummy1			–0.08126***			
			(–2.68)			
Dummy3			–0.02950			
			(–0.87)			
Dummy4			–0.03633			
			(–1.03)			
Dummy5			–0.03285**			
			(–2.12)			
Dummy6			–0.05219**			
			(-2.46)			
Dummy7			–0.02138			
			(– 0.75)			
Dummy8			–0.01151***			
			(-3.57)			
Observations	186	186	185	136	136	186
R^2	0.15	0.14	0.23	0.22	0.12	0.19

Notes

*** denotes significance at a 1% level
** denotes significance at a 5% level
* denotes significance at a 10% level
t statistics are in parentheses
In equation (5) the instrumented variable is the natural logarithm of investment on GDP and the additional instruments (other than all the exogenous variables) are ln $(I/GDP)_{t-2}$ and ln$AVER\ SCHOOL_{t-2}$
In equation (6) the instrumented variable is the natural logarithm of investment on GDP and the additional instruments (other than all the exogenous variables in the regression) is ln $(I/GDP)_{t-1}$

The estimation of equations (1)-(2) without any consideration of possible country specific effects can generate misleading results. We perform estimations with country dummies in regression (3) and 2SLS with instrumental variable in regressions (5)-(6). The instrumented variable is investment and the instruments are lags of investment as well as all the other exogenous regressors in the specification. The investment coefficient maintains its sign and significance and the coefficient of Openness becomes significant at a 1% level in regression (5) and Openness growth at a 5% level in regression (6) in which primary education has been included. This last

variable, among other measures of human capital, is the only one that shows a positive (even if not large) coefficient, significant at a 5% level. However, among the different regressions estimated we noticed that the introduction of average years of schooling (AVERSCH) either as a regressor or an instrument, reinforces the effect of the other regressors, specifically the natural log of the investment/GDP ratio.

In column 6 of table 1 we show the findings of the panel estimator (Fixed Within effects) which confirm the positive impact of investment. The coefficient of Openness still remains strongly negative and significant.

In the table below we report the results for the same panel of countries but using 5-year averages data.

Table2: Five-Year Panel Regression (1960-1990) CPEs' Sample

Dependent Variable $\Delta ln\ y_{t-1}$	*(1)* *OLS*	*(2)* *OLSDV*
Constant	0.259286**	0.194343
	(2.04)	(1.27)
Ln (I/Y)	0.0762981***	0.056660***
	(3.10)	(2.49)
Ln OPEN	–0.0418483***	0.013908**
	(–3.79)	(1.97)
ΔLn POP		–0.001513
		(–0.16)
Ln G	–0.0054767	
	(–0.85)	
Ln SECON		0.01318
		(0.98)
Ln AVERSCH		–0.024232
		(–0.80)

Ydum (1965-69)		0.041272**
		(2.26)
Ydum (1970-74)		0.054774***
		(3.17)
Ydum (1975-79)		0.043575***
		(3.32)
Ydum (1980-84)		0.008820
		(0.65)
Ydum (1985-90)		–0.011359
		(–1.07)
N. of observations	37	37
R^2	0.28	0.66

Notes.
*** denotes significance at a 1% level
** denotes significance at a 5% level
* denotes significance at a 10% level
t statistics are in parentheses

What emerges from five-year averages panel regressions is that previous results are confirmed. In regression 1 this is true for the main variables: investment and openness. When we include time dummies (regression 2) to exploit time variation of the data in addition to the cross sectional dimension, the result is a positive coefficient for openness. Most of the time dummies for the periods 1965-1969, 1970-1974, 1975-1979, are significant and make openness positive and significant at a 5% level. Time dummies are generally considered as proxies for TFP which progressively increased in these countries until the end of the Seventies.

5. Openness, trade structure and growth in transitional economies

The transition to the market of former CPEs has been associated with dramatic changes in their foreign trade. Imports and exports have been strongly affected by processes of geographical reorientation (especially towards the EU) and sectoral restructuring. In this section we try to

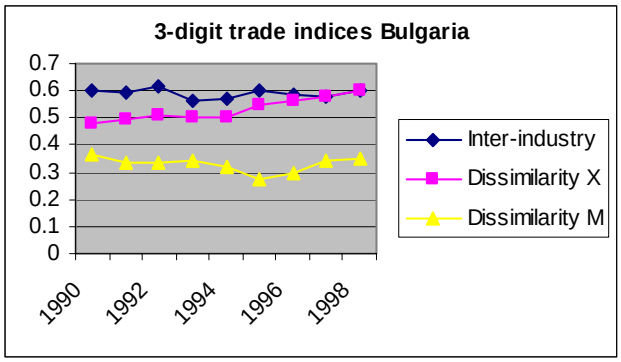
evaluate the relationship between openness and growth for a group of TEs[2] in the period 1990-2000.

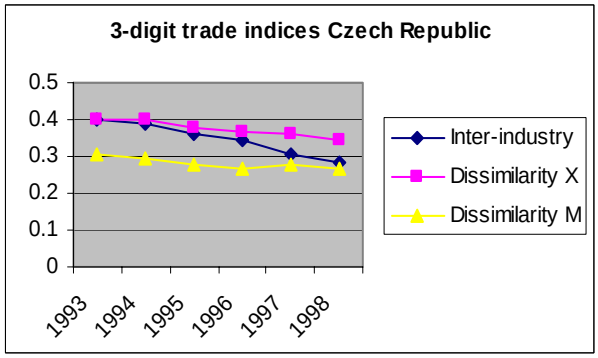
Following Amable (2000), in addition to the standard openness measure, we consider as explanatory variables some indices of sectoral composition of trade flows, such as the inter-industry index and the dissimilarity index, in order to better qualify the link between trade and growth[3]. The use of such trade structure indicators seems particularly appropriate for countries showing relevant changes in the composition of their trade flows. Such indices should signal if inter or intra-specialisation promote growth in accordance with different theories of trade integration: (i) models based on comparative advantages deriving from factor endowments and technology or (ii) models based on scale economies, product differentiation, etc.

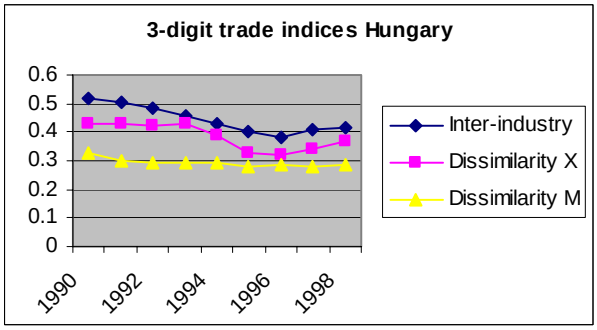
We complement inter-industry and dissimilarity measures with intra-industry indices calculated at a 8-digit level of disaggregation (at product level). Such indices allow separating out the share of trade flows differentiated by quality (vertical intra-industry trade) from the share of trade flows differentiated by product attributes (horizontal intra-industry trade)[4]. This further qualification of the trade-flows structure is significant in order to disclose comparative advantage dynamics operating inside both intra-industry (in the form of vertical intra-industry trade) and inter-industry trade flows. If the vertical component is the dominant part in intra-industry trade, then trade could be better explained according to traditional arguments based on factor proportion and differences in technology rather than theories based on imperfect competition. Hence, we complement inter (intra)-industry indices calculated at a 3-digit level with indices of vertical and horizontal intra-industry trade calculated at a 8-digit level. Figure 1 shows the evolution of the 3-digit trade indices.

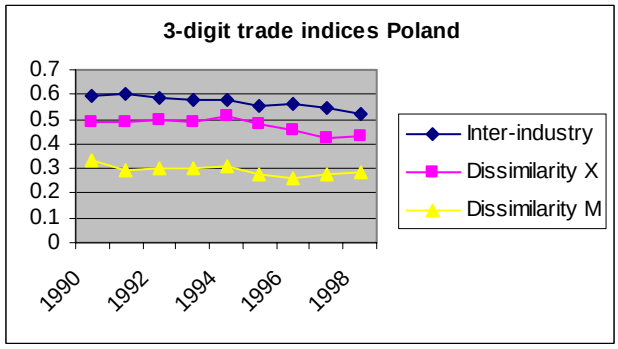
Figure 1

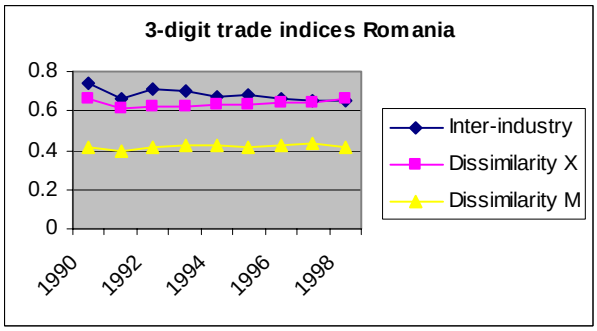
[2] We have considered 11 transition economies: Hungary, the Czech Republic, Slovakia, Poland, Bulgaria, Russia, Romania, Slovenia, Latvia, Estonia, Lithuania.
[3] Details on the construction of all trade indices used are in the appendix.

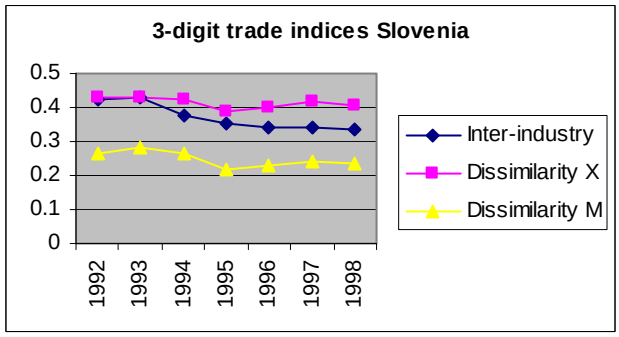


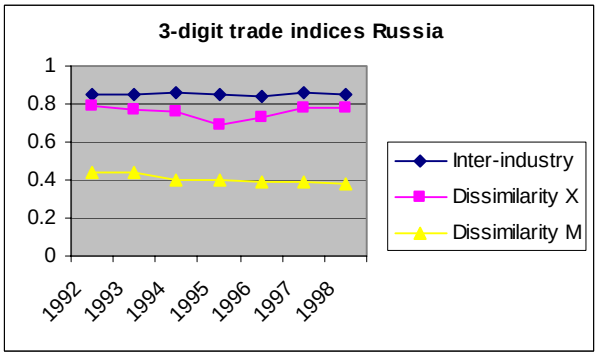


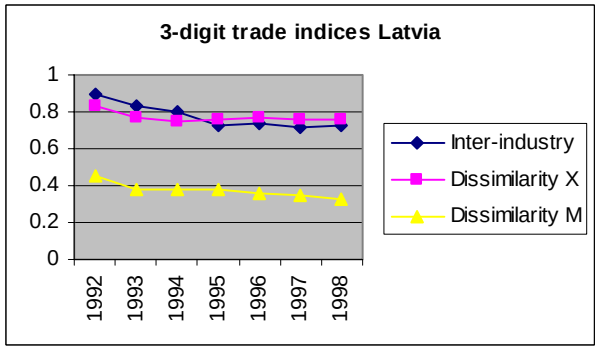




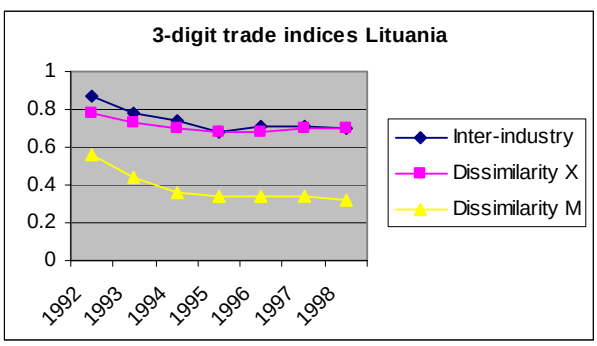


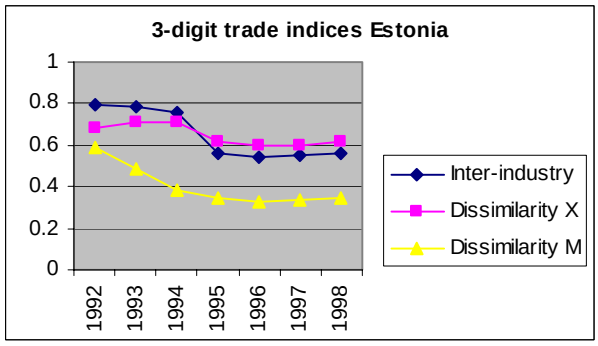






[4] We follow the methodology of Greenaway, Hine and Milner (1995). They adjust the intra-industry trade index, originally proposed by Gruber-Lloyd (1975), by using the information content of unit values of imports and exports in order to disentangle vertical and horizontal components. See appendix for details

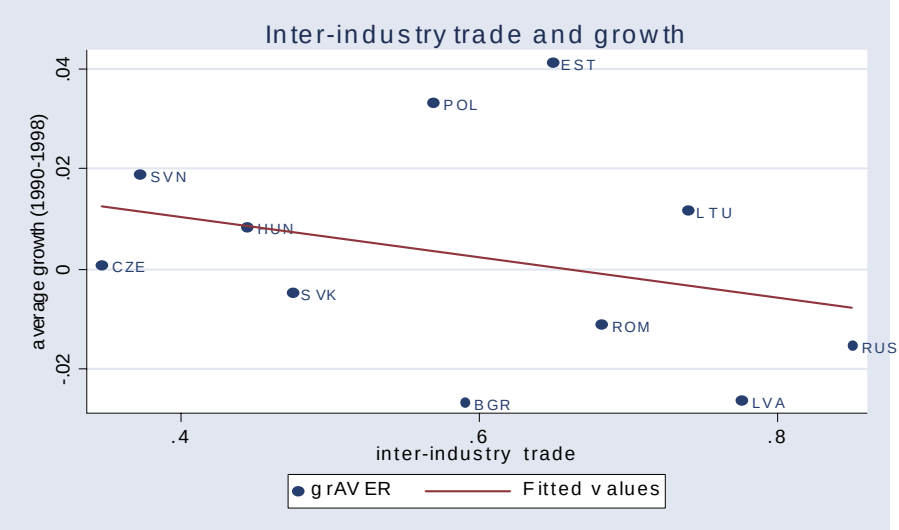




When we look at inter-industry and dissimilarity trade indices (both calculated towards the EU) in figure 1, only Bulgaria shows an increasing divergence from the EU in trade structure. During the Nineties all the other countries experimented a convergence to the EU (with the exception of Russia whose indices did not change at all). The intensity of the convergence process has not been uniform. A group of countries such as the Czech Republic, Hungary, Poland, Slovenia has reached very low levels in trade dissimilarity (with values of the index less than 0.5). At the beginning of the period, these countries had already achieved a good degree of convergence in trade structure towards the EU and afterwards they strengthened their similarity. On the contrary, other countries, such as Russia, Romania, Estonia, Latvia, Lithuania, still display high levels of inter-industry trade and trade dissimilarity, although some of them started to converge towards the EU trade structure (particularly Estonia).

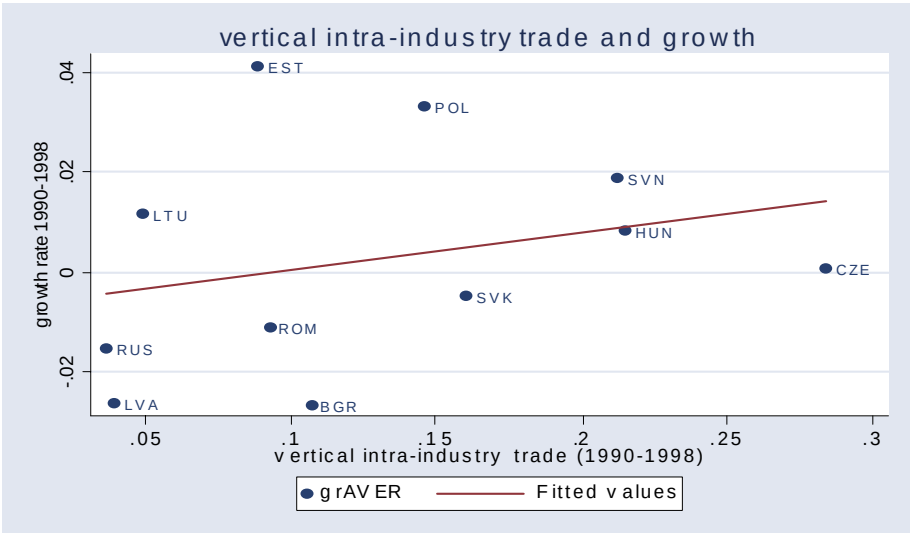
Has this change in sectoral composition of trade promoted growth in TEs? The simple evidence reported in Figure 2 seems to suggest a negative relationship between inter-industry trade and growth for the TEs in the period 1990-98: more intra-industry trade (less inter-industry trade) is associated with more growth.

Figure 2



However, in figure 3, in which the trade index has been calculated at the product level (8-digit), we can observe that *vertical* intra-industry trade is positively associated with growth. In this case, we cannot dismiss the traditional explanation based on comparative advantages because vertical intra-industry is theoretically founded on the dynamics of specialisation based on factor proportion (for example, different qualities incorporate different skill intensities).

Figure 3

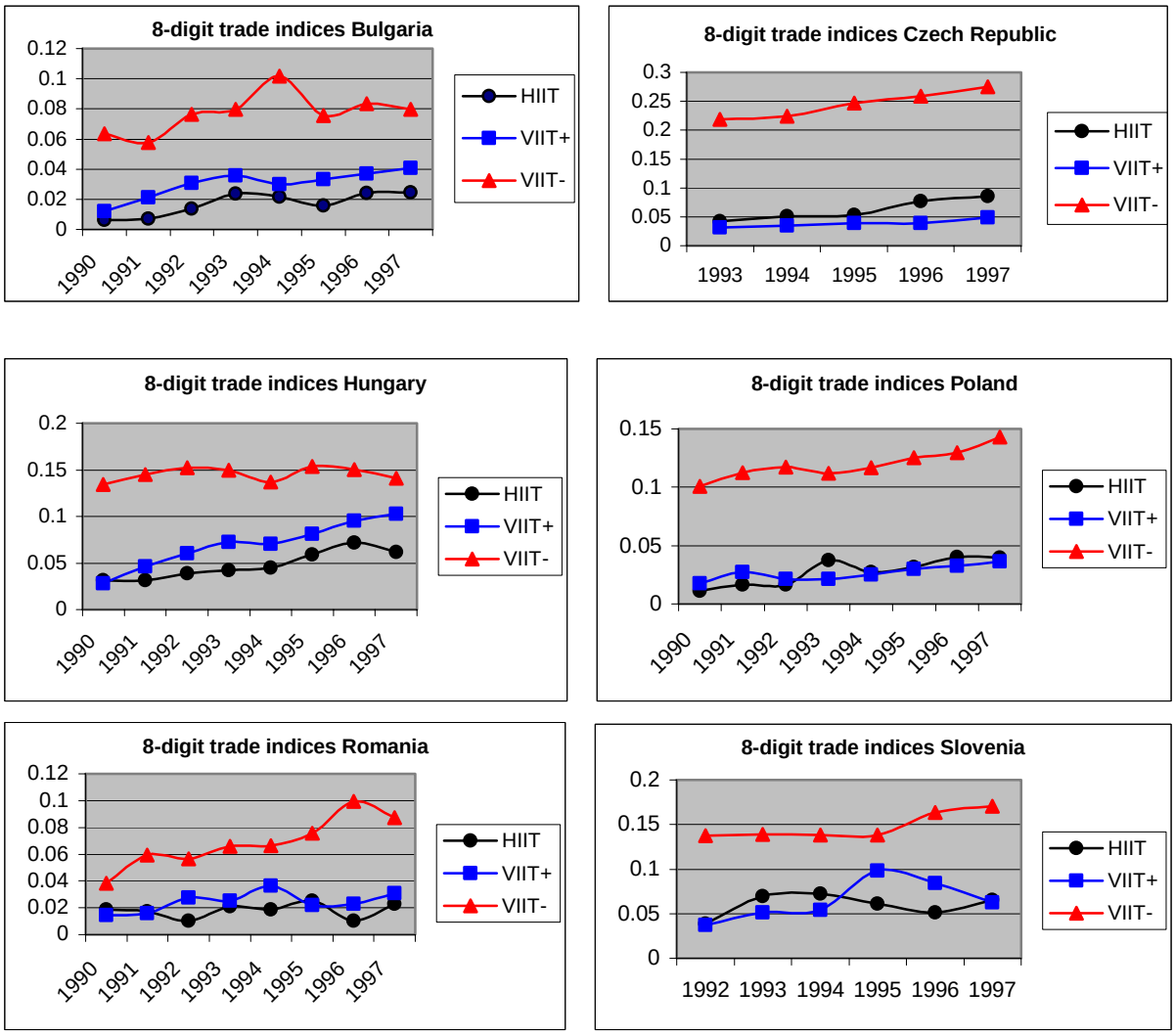


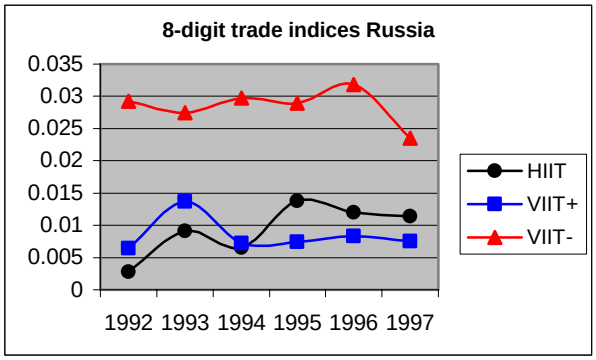
This preliminary evidence of the link between trade composition and growth justifies the importance of complementing the 3-digit trade indices with the 8-digit trade indices. In figure 4,

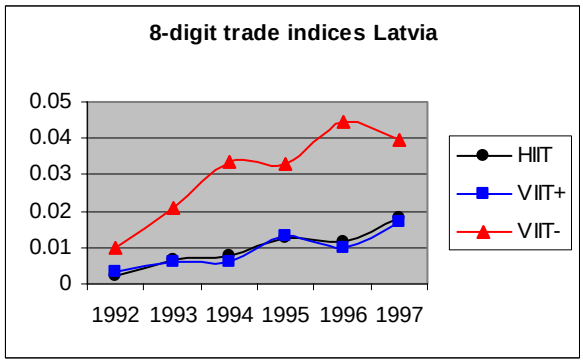
where the 8-digit trade indices are reported, we observe that the vertical component of intra-industry trade (VIIT) dominates in all countries. In particular, it is the down-graded part of vertical industry trade ($VIIT^-$) that shows the highest value. In other words, all TEs export mostly vertically differentiated products of low quality.

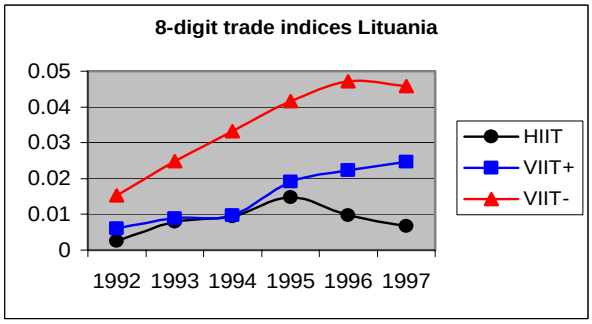
However, the picture is not homogeneous. Countries such as Hungary, the Czech Republic, Poland and Slovenia display high values of HIIT, $VIIT^-$ and $VIIT^+$, while other countries such as Russia, Latvia and Lithuania record very low shares of vertically and horizontally differentiated trade flows. Looking at the dynamics of the indices in the Nineties, Hungary performed a substantial upgrading of trade flows: $VIIT^+$ increased to 10% of total trade.

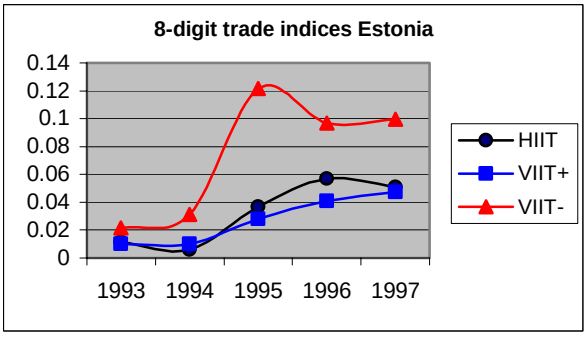
Figure 4











In order to investigate the possible impact of trade flow dynamics on growth, we have carried out a regression analysis. Table 3 and table 4 describe results for the sample of TEs in the period from 1990 to 2000. In particular, table 3 reports regression results when trade indices at the 3-digit level are considered as regressors, while table 4 shows results when trade indices at the 8-digit level are included.

Table 3. Trade and growth in transition economies. Annual Data Cross-country Growth Regression (1990-2000). Dependent variable $\Delta \ln y_t$. Trade indices at the 3-digit level of disaggregation

Regressors	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Constant	–0.1702129***	–0.0163795	–0.0320176	0.0163638
	(–2.41)	(–0.33)	(–0.62)	(0.29)
Ln (I/Y)	0.0239028**	0.0268431**	0.0288855***	0.0283628***
	(1.95)	(2.10)	(2.23)	(2.29)
ΔLnPOP	–0.4277895	0.0179621	0.0407094	0.0671807
	(–0.86)	(0.04)	(0.09)	(0.15)
Ln OPEN	0.0250144**			
	(1.86)			
INTER		–0.086166**		

		(–1.89)		
DISS(X)			–0.0726609	
			(–1.37)	
DISS(M)				–0.262331***
				(–2.26)
No. of Observ.	83	58	58	58
R^2	0.08	0.17	0.15	0.19

Notes. *** denotes significance at a 1% level, ** at a 5% level, * at a 10% level. t statistics in parentheses

In column (1) of table 3, the coefficient associated with Openness is positive and significant. This finding contrasts previous results relative to CPEs and supports the idea of a positive influence of trade flows on growth when market mechanisms are in action. Columns (2), (3) and (4) of table 3 show regression results when alternative measures of trade integration are considered. In column (2), the inter-industry index is considered (INTER). This index has been measured as the complement to one of the Grubel-Lloyd intra-industry trade index calculated at the 3-digit level. The finding is that a negative and significant relationship emerges between inter-industry trade and growth (at a 5% level). However, as mentioned before, it is important to investigate the type of intra-industry specialisation before inferring conclusions about the model in action. In column (3), following Amable (2000), we consider the dissimilarity index of exports as a regressor . This index measures to what extent the export composition by sector of a transitional economy diverges from the export composition by sector of the EU (value 1 indicates complete divergence, value 0 indicates complete convergence). The coefficient associated with DISS(X) is negative but not significant. In column (4), we use the import dissimilarity index. The coefficient associated with DISS(M) is negative and significant (at a 1% level). This should imply that a convergence towards the EU structure of demand for final goods and input requirements promotes the growth of TEs. By looking at the other explanatory variables, investment is significant in all specifications, thus confirming the results obtained for CPEs.

In table 4 the coefficients of intra-industry trade indices are significant in almost all specifications. In column (5), the Grubel-Lloyd intra-industry trade index calculated at the 8-digit level (GL) is positively associated with growth (at a 5% level of significance). In columns (6) and (7) both components of intra-industry trade – horizontal and vertical - are positively related to growth (coefficients associated with GLH and GLV variables are significant at a 5% level). However, when we split the vertical intra-industry trade index in up-market (GLV^{+}) and down-market (GLV^{-}) components, only the latter displays a significant coefficient. This means that growth is positively related to specialisation in low quality goods.

In general, findings by using trade indices calculated at product level (8-digit) show that both types of product differentiation dynamics, horizontal and vertical, have a positive influence on growth. In such a case investment becomes insignificant. A likely explanation is that trade indices, which signal product quality, should be better complemented by measures of human capital rather than physical capital.

Table 4. Trade and growth in transitional economies. Annual Data Cross-country Growth regression (1990-2000). Dependent variable $\Delta \ln y_t$. Trade indices at 8-digit level of disaggregation

Regressors	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS
Constant	0.083245	–0.072732**	–0.08573**	–0.081206**	–0.08564**
	(0.04)	(–1.85)	(–2.14)	(–2.01)	(–2.14)
Ln (I/Y)	0.020747	0.018537	0.021809	0.0251768*	0.0217913
	(1.39)	(1.22)	(1.47)	(1.71)	(1.47)
ΔLn POP	0.130432	–0.0041935	0.1599507	0.1143399	0.1389768
	(0.25)	(–0.01)	(0.31)	(0.22)	(0.27)
GL	0.191316**				
	(1.92)				
GLH		0.845921**			
		(2.00)			

GLV			0.234801**		
			(1.85)		
GLV^+				0.5074098	
				(1.44)	
GLV^-					0.319964**
					(1.82)
Observ.	58	58	58	58	58
R^2	0.16	0.16	0.15	0.13	0.15

Notes. *** denotes significance at a 1% level, ** at a 5% level, * at a 10% level. t statistics in parentheses

5. Conclusions

This paper has investigated the relationship between real trade Openness (import +export in GDP) and growth in the same sample of countries in two historical and institutional periods: the former communist countries (CPEs) for the period 1960-1989 and the same group of countries (even if their borders have been politically changed) after the collapse of the communist regime. These economies are all transition economies that we have termed CEECs, most of which have accessed recently to the EU.

The econometric results are as expected. During the communist regime openness in these countries created great diversion of resources because of lack of (i) market incentives, (ii) international prices, (iii) multilateral trade, (iv) comparative advantages. International trade was conducted solely through a government foreign trade organization which decided international trade for political reasons rather than those of comparative advantages. What is perhaps most significant from our regressions is that the role of openness has becoming more important after the dramatic institutional changes of the '90s. These changes in the degree and quality of openness are captured by the econometric specifications. The coefficient of trade openness is positive after the collapsing of the Berlin Wall in which the main trade partners of TEs became the EU countries. Before that event the degree of openness was high but the trade partners involved were, even if not exclusively, communist countries and in particular the former URSS

(trade was primarily bilateral with the URSS). According to the theoretical and empirical literature we believe that trade openness should work differently when trade is undertaken with high income countries. One of the predictions of the new growth theories is that openness is beneficial for growth when trade is carried out with advanced economies, since what is important is not only trade of goods but knowledge spillovers and technological diffusion. Although that prediction seems partly verified by our findings we need further studies and further data for the next years for a definitive response.

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Appendix

Samples

We use two samples. The first one is composed by historically planned economies (CPEs) which includes: Czechoslovakia, Poland, Hungary, Bulgaria, Romania, East Germany (DDR), USSR and Yugoslavia. In earlier PWT only 3 of these countries were included in the data set (Hungary, Poland and Yugoslavia). All the countries participated at the 1996 benchmark comparisons carried out through the OECD and have been treated individually by the updated Penn World Table [PWT 6.1, 2002]. Estimates of components of GDP and related variables for these countries are subject to some measurement errors. To signal the relative reliability of the estimates, HS&A have assigned to the data quality of these countries a rating scale between B and C against a rating scale of A which is assigned to all the countries in the former EU (SH&A 2002, p. 13, Data Appendix of Penn World table 6.1).
In the panel of transition economies the following countries have been included: Hungary, Czech Republic, Slovakia, Poland, Bulgaria, Russia, Romania, Slovenia, Latvia, Estonia, Lithuania.

List of Variables

POP: population is from the World Bank World Development Indicators 2001 and United Nations Development Centre for sources prior to 1960. The series has been taken from HS&A [2002]
RGDP*xx* : real GDP per capita (1995 international prices) for 19*xx* (RGDPCH in HS&A [2002])
INV*xx* : investment share of RGDP (KI in HS&A [2002])
OPEN*xx* (KOPEN in HS&A [2002]) is the ratio of export plus imports in exchange rate US $ relative to **GDP** in PPP (US$ PPP/GDP).
GOV *xx:* Government share of RGDP (KG in HS&A [2002]).

Trade indices

INTER: inter-industry trade index calculated as 1 – GL index,

$$GL_j = 1 - \frac{\sum_i |X_i - M_i|}{\sum_i (X_i + M_i)} = \frac{\sum_i (X_i + M_i) - \sum_i |X_i - M_i|}{\sum_i (X_i + M_i)},$$

where *j*= country, *i*=3-digit industry, *X*=exports, *M*=imports

DISS(X)$_j$ = export dissimilarity index = $1/2 \sum \left| \frac{X_{ij}}{X_j} - \frac{X_{ieu}}{X_{eu}} \right|$

where *eu*= EU

DISS(M)$_j$ = import dissimilarity index = $\mathbf{1/2 \sum \left| \frac{M_{ij}}{M_j} - \frac{M_{ieu}}{M_{eu}} \right|}$

GLH$_j$ = horizontal intra-industry trade index = $\frac{\sum_{p \in H} (X_p + M_p) - \sum_{p \in H} |X_p - M_p|}{\sum_p (X_p + M_p)}$

where p= 8-digit product, UV_p are the unit values of exports (x) and imports (m), $\alpha = 0.15$ and the summation $p \in H$ in the numerator is over those 8-digit commodities for which

$$1 - \alpha \le \frac{UV_p^x}{UV_p^m} \le 1 + \alpha,$$

GLV$_j$ = vertical intra-industry trade index = $\frac{\sum_{p \in V} (X_p + M_p) - \sum_{p \in V} |X_p - M_p|}{\sum_p (X_p + M_p)}$

where the summation $p \in V$ is over those 8-digit commodities for which

$$\frac{UV_p^x}{UV_p^m} \le 1 - \alpha \quad \text{or} \quad \frac{UV_p^x}{UV_p^m} \ge 1 + \alpha$$

GLV$_j^+$ = up-market vertical intra-industry trade index = $\frac{\sum_{p \in U} (X_p + M_p) - \sum_{p \in U} |X_p - M_p|}{\sum_p (X_p + M_p)}$

where the summation $p \in U$ is over those 8-digit commodities for which $\frac{UV_p^x}{UV_p^m} \ge 1 + \alpha$

GLV$_j^-$ = down-market vertical intra-industry trade index = $\frac{\sum_{p \in D} (X_p + M_p) - \sum_{p \in D} |X_p - M_p|}{\sum_p (X_p + M_p)}$

where the summation $p \in D$ is over those 8-digit commodities for which $\frac{UV_p^x}{UV_p^m} \le 1 - \alpha$

Since the sets V and H are mutually exclusive and exhaustive and since the sets U and D are mutually exclusive and exhaustive of V, it follows immediately that

$$GL_{j\,(8-digit)} = GLH + GLV^{+} + GLV^{-}$$

Data Sources

Data for the main variables listed above are from Heston, Summers, and Aten (2002), Penn World Tables, version 6.1.
Data for human capital (PRIM, SECON, AVERAGE) are taken from Barro and Lee (1993), updated by Barro and Lee (2000). PRIM (LP in Barro and Lee [2000] is the percentage of primary school attained in the total population. SECON is the percentage of secondary school attained in the total population (LS in Barro and Lee [2000] and AVERAGE is the average schooling years in the total population (PYR in Barro and Lee [2000])
Trade data are taken from the EUROSTAT COMEXT database (CD-ROM). From this database, we have considered 135 3-digit sectors classified according to NACE-CLIO and 13724 8-digit products classified according Combined Nomenclature.