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Trade Openness and Economic Growth

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1. Introduction

Trade liberalization has been central to the discussion of development policy in recent decades. In the 1990s, the Washington Consensus, a set of 10 major development policy recommendations from Washington-based institutions such as the International Monetary Fund (IMF) and the World Bank (WB), regarded trade openness as essential to the achieve higher economic growth. Trade policy, according to the Washington Consensus, should focus on lowering tariffs on imports, especially cheap intermediate inputs that give countries competitive edges in export industries. Although acknowledging the negative effects this type of policy could have on competing domestic industries, the Consensus believed that protection would create "costly distortions that end up penalizing exports and impoverishing the domestic economy" while generating a "massive potential" of corruption (Williamson 1990). This pro-trade-liberalization view garnered early support from academia, as evidenced through a host of cross-country econometric studies by Sachs and Warner (1995), Harrison (1996) and Edwards (1998), among others. All these papers suggest that trade liberalization has a positive impact on economic growth.

Historically, countries did indeed lower their barriers to trade in the early 1990s. Figure 1 shows the trends in global average tariff rate from 1986 to 2009. We can see that except for high income non-OCEDs countries whose tariff levels remained the same during the period, other groups (developing countries and high income OECDs) have reduced their average tariff rates significantly since 1992, especially among developing nations. Overall, the world tariff level also fell by a great margin (around 15%) from 1992 to 2009.

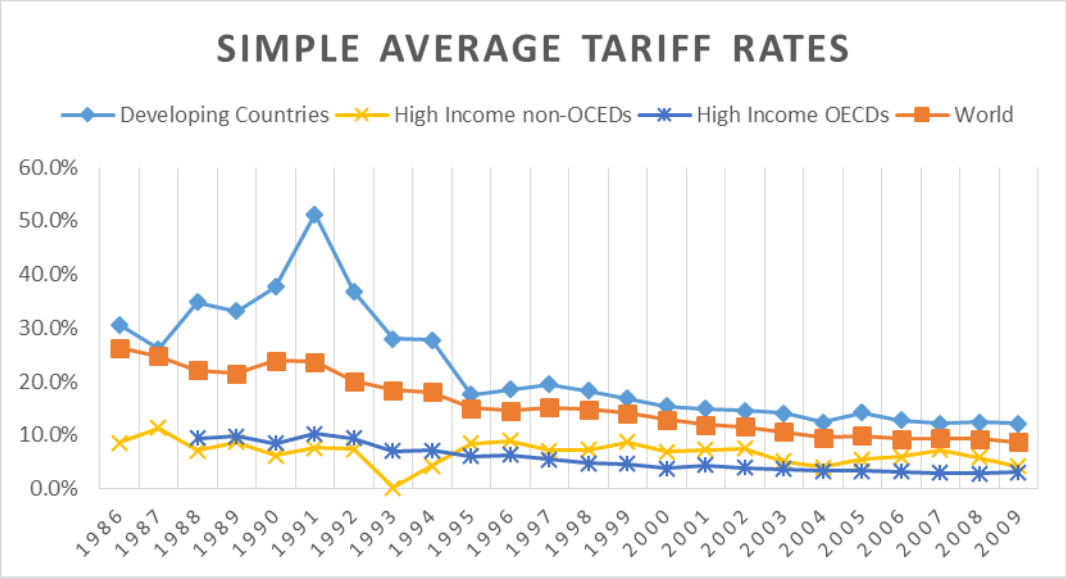

Figure 1. Global Average Tariff Rates Trends from 1986 to 2009. Source: World Bank

In 2001, the World Trade Organization (WTO) further advanced liberalization efforts by introducing the Doha Development Agenda, its ninth round of multilateral negotiations carried out after World War II. The Doha round, advocated by developing countries, aimed at creating a global commitment to reduce tariffs and adhere to a new set of trade rules across the board for agricultural, industrial and services products. It was met, however, with resistance in the developed world, especially from farmers and labor unions who faced declining profits and wages when competing with much cheaper products from the third world. Thus, after 13 years of negotiation, no agreement has yet been reached among WTO members. At the same time, in academia, a once overwhelming consensus on the positive growth effects of trade liberalization was now being seriously challenged. Rodrik (2006), in his "Learning from Reform" review for the World Bank, which he entitled "Goodbye Washington Consensus, Hello Washington Confusion", argued that the focus needs to shift from getting policies right ("the policy view") to getting institutions right ("the institution view"). He believes that the set of policies suggested by Williamson is superficial in the sense that it did not require deep-seated institutional changes. Policy reform, in his opinion, would not be able to produce lasting effects unless the institutions in place are up for it. For example, trade liberalization would likely fail when fiscal institutions fail to compensate for lost trade revenue, capital markets fail to supply sufficient funds to expanding sectors, customs officials are corrupted and incompetent, labor-market institutions fail to properly handle transitional unemployment, and so on. Rodrik and Rodriguez (2000) also raised questions about the validity

of the methodologies used in previous empirical studies on trade liberalization and economic growth, especially the Sachs and Warner (1995) paper.

Thus, the impact on growth of trade liberalization is far from settled within both the policymaking realm and academia. We need to acknowledge, however, that international trade has become more and more integral to economies around the world. According to a report from the World Bank, world trade has grown more than three times from 1980 to 2002, while world output has only doubled (Dean and Sebastia-Barriel, 2003). During this period, the trade (the sum of exports and imports) to GDP ratio has increased significantly across countries, with Asia (excluding Japan) leading at 50 percentage points, followed by the euro area, the UK and Latin-America at 15 percentage points. The only exceptions are Japan, the US and Eastern-Europe, with less than a 10 percentage point increase in trade share of GDP. During the same period, however, growth has experienced a mixed pattern (Berry and Serieux, 2006). Overall, the average annual growth rate of real world output decreased from 3.81% in the 70s to 2.86% in the 80s and then to 2.46% in the 90s. The average annual growth rates of real output among developing countries declined from 4.75% in the 70s to 3.59% in the 80s but rose to 4.63% in the 90s. For industrial countries, the growth rates declined from 3.14% in the 70s to 2.75% in the 80s and went down further to 2.41% in the 90s. The question, hence, remains whether greater global economic integration can actually positively affect economic growth.

In this paper, I will empirically investigate the relationship between trade openness and economic growth for 71 developing and developed countries from 1980 to 2009 using pooled OLS regression and panel data techniques. My results show that trade liberalization has a positive and significant impact on economic growth; indeed, a one standard deviation increase in the measure of trade openness would result in a 0.24 percentage-point increase in growth rate. This finding could provide some useful insights into current debates about globalization and the ongoing negotiations of the latest Doha Round, as to whether increased integration into the world economy necessarily means higher growth for a country.

The rest of the paper is organized as follows. Section 2 presents the relevant theoretical and empirical literature. Section 3 describes historical trade and growth patterns. Section 4 discusses the empirical model. Section 5 presents the empirical results and interprets those findings, whilst section 6 contains my conclusions.

2. Theory and Literature Review

In the late 1980s and early 1990s, a new wave of trade theory emerged, focusing on the study of the dynamic linkages between international trade and economic growth. Rather than looking at the gains from trade at a certain point in time - the static view - economists then wanted to understand the mechanisms through which trade affects growth and how these mechanisms evolve over time - the dynamic view.

A key channel through which trade can lead to economic expansion is productivity growth. As a country opens up to trade and invests in research and development (R&D), its comparative advantage can evolve over time towards the production of products with larger profit margins due to the higher level of differentiation generated. Using an endogenous growth model, Grossman and Helpman (1989) study the evolution of comparative advantage through the allocation of resources to R&D and find that the human-capital rich country is a net exporter of differentiated products and a net importer of labor intensive traditional products at every moment in time. In addition, they establish that if product development is human-capital intensive relative to the production of current differentiated products, the volume of trade as a fraction of world GNP or world expenditure grows over time. Building upon this model, Romer (1990) finds that an economy with a larger total stock of human capital, the main resource for R&D, will experience faster growth. Thus trade liberalization can act to speed up growth in underdeveloped countries with low levels of human capital through access to a larger pool of global human capital. Grossman and Helpman (1991) advance this notion by showing that the lowering of trade barriers would generate spillovers to the local economy through contacts with foreign businessmen and markets while also raising incentives for local R&D. Coe and Helpman (1995) and Keller (1998) further develop the productivity growth effect of trade openness through the "international R&D spillovers" phenomenon, which states that a country benefits from R&D done elsewhere through the importing of intermediate and capital goods from other parts of the world.

In addition to productivity growth, other sources of gains from international trade that have been examined include gains from an increased variety in consumption (Romer (1994) and Feenstra (1994)). Merlitz (2003) posits that by opening up to trade, market shares would be reallocated to the most productive firms, as less productive ones are forced to exit. Similarly, Tybout (2001) looks at plant efficiency and shows that increased competition from international

trade causes the market for efficient plants to expand and intra-plant efficiency to improve. Acemoglu et al. (2002) find that openness to trade leads to the adoption of institutions that protect property rights, which is crucial to the creation of a sustainable economy with faster growth. Krugman and Venables (1995), through economic geography, suggest that market access could raise agglomeration benefits, and thus induce higher income levels.

Despite the extensive literature on the mechanisms through which countries would gain from international trade, whether a country should adopt a free trade regime is still a hotly debated topic. The most notable counter argument is that of infant industry protection. For a newly created industry to survive, the government needs to protect it from foreign competition until its production process becomes more efficient and cost-effective. In other words, through strategic industrial policy, one could turn a latent comparative advantage into an effective one (Harrison and Rodriguez-Claire, 2009). However, to judge the merits of such a policy, one has to consider both the costs incurred and potential benefits reaped from that protected industry. For example, the Mill test requires that the protected sector needs to eventually survive international competition while the Bastable test takes this notion further in demanding that discounted future benefits from the protected industry have to exceed the present costs of protection. Bardhan (1971), Redding (1999) and Merlitz (2005) outline other conditions under which benefits from protection justify losses in consumer welfare.

There exists a large amount of empirical literature that examines the effect of international trade on economic growth. Within the growth regression framework put forth by Barro (1996), economists often regress an outcome of interest for a country (real per-capita GDP growth rate, total factor productivity growth rate or real GDP per worker), on a certain measure of openness and a set of controls. Different measures of openness have been used, most notably trade shares (the ratio of exports plus imports over GDP), or a direct measure of trade policy such as tariff rates or a constructed index of openness (Sachs and Warner, 1995).

Using trade shares as a measure of openness, the literature seems to at first agree on the positive relationship between trade and economic growth. Edwards (1992) examines cross-sectional data for 30 developing countries from 1970 to 1982 and finds a strong positive correlation between the two variables. Harrison (1996) also looks at developing countries (51 of them) from 1960 to 1987 and reveals that openness has a positive and significant impact on growth.

Vamvakidis (2002) finds that trade shares have a positive impact on growth among 62 developing and developed countries from 1970 to 1990, but the two variables are uncorrelated for the period from 1950 to 1970. Though they differ in their outcomes of interest, all these studies use a similarly structured set of controls based on neoclassical growth model, which include a measure of the economy's initial condition, a level of human capital and a level of physical capital.

Later studies improve this econometric model by controlling for other variables such as institution and geography. Economies that have institutions in place to protect property rights and enforce the rule of law fare better than those who do not (Acemoglu et al., 2002), while landlocked countries would not have the same market access as those with long shore lines and thus could not enjoy the same agglomeration benefits (Krugman and Venables, 2005). It is worth noting, however, that these studies ignore the previous controls and focus solely on distinguishing the growth effects of trade through institution and geography by using two-stage instrumental variable (IV) estimation. The results from these studies are mixed. Rodrik et al. (2004) look at cross-sectional sets of countries in 1995 and conclude that only institutions matter to economic growth. On the contrary, Alcala and Ciccone (2004) examines countries around the world in 1985 and 1990 and finds that trade openness still plays a significant role in promoting growth while institution does not directly affect growth.

There are also a number of studies that use IV techniques but focus instead on finding growth-independent variable(s) as instrument(s) for trade shares in their growth regressions. Frankel and Romer (1999) use geographic characteristics between two countries in a bilateral trade situation, while Romalis (2007) uses US market access as instruments. Instrumental variable (IV) estimates in both studies suggest a positive relationship between openness and growth. Rodriguez and Rodrik (2000) and Irwin and Tervio (2002), on the other hand, find that the IV estimates of trade shares are no longer robust if geographical variables, such as latitude and tropical climate, are used as instruments instead.

Studies that have not used trade shares as an openness measure have also yielded mixed results. Harrison (1996) and Edwards (1998) use estimated tariff and non-tariff barriers and find a significant, negative relationship between tariff rates and growth. Yanikkia (2003), on the other hand, presents evidence that trade barriers can induce higher economic growth in developing countries. Estevadoral and Taylor (2008) study the growth effect of average tariff rates on capital,

intermediate and consumption goods. Their findings suggest that tariffs on capital and intermediate goods negatively correlate with growth, while the relationship between tariffs on consumption goods and growth is ambiguous. Sachs and Warner (1995) constructed a more comprehensive openness measure based on the level of nontariff barriers, average tariff rates, black market exchange rate, economic system (socialist or not) and monopoly on major exports. Subsequent studies have either modified the index (Vamvakidis, 1999), or updated the classification of countries over a more recent period (Warcziag and Welch, 2008). All studies, including the original one, find a negative correlation between a closed trade regime and growth. The index, however, has been heavily criticized by Rodriguez and Rodrik (2000), who show that the main driving force of this index is indeed the black market exchange rate, which does not reflect trade policy, as opposed to the first two measures of tariff and nontariff barriers.

In this paper, I will focus on the most readily available measure – trade shares – and use it as my openness indicator, since the data for direct measures of trade policy are often less available, especially for developing countries, and lack precision. I will extend the current literature by empirically examining the relationship between trade shares and economic growth over recent periods from 1980 to 2009 for a set of 71 developed and developing countries. As the Vamvakidis (2002) results show, trade shares may have a different relationship with growth depending on the studied periods, so I hope to provide relevant results for the most recent wave of integration in the 1990s and 2000s.

3. Trade and Growth Patterns

To examine the global trends in trade and growth from 1980 to 2009, I collected data for 71 countries from four main geographical regions – Asia & Pacific, America, Middle East & North Africa and Europe (for a full list of countries included in the study, refer to Table 6 in the Appendix). Within each region, there are both developed and developing countries, along with some emerging market/newly industrialized economies. Trade patterns are measured through the changes in trade shares, which is defined as the ratio of exports plus imports over GDP, while growth evolution is reflected through annual per-capita real GDP growth rates. Each indicator is computed as the average over a five-year period to minimize the effects short-term cyclical fluctuations, starting with the five-year period from 1980 to 1984. My data set covers a total of 6

five year periods. From now on, I will refer to the five-year average annual growth rate as just growth or growth rate, and the average trade shares as just trade shares.

Table 1 in the Appendix shows the summary statistics for both trade shares and growth. The maximum growth rate is 10.26%, attained by China from 2005 to 2009, while the minimum growth rate is negative 6.26%, attained by Albania from 1990 to 1994. Figure 2 below shows the average annual growth rate for the different regions from 1980 to 2009. Asia & Pacific attains the most robust growth rate, averaging 3.16% annually for the last 30 years. Main drivers include China, India, the old Asian tigers (South Korea, Singapore, and Hong Kong) and the new emerging markets (Thailand, Indonesia, and Malaysia), who achieved growth rates of more than 5% annually on average at different five-year periods within my sample. Middle East & North Africa and Europe have roughly similar rates (around 1.8% annually), but fall far behind Asia – their growth rates are roughly 60% of Asia & Pacific countries. Examples of exemplary growth (more than 5% annually for a five year period) include Ireland, Egypt, Luxembourg, and former Eastern Bloc nations (Albania, Poland, Romania and Bulgaria). America has the slowest growth rate overall, averaging only 1.3% annually from 1980 to 2009. Key contributors for the region are Caribbean islands (Trinidad & Tobago, Panama and Dominican Republic) and Latin American nations (Argentina, Chile and Uruguay).

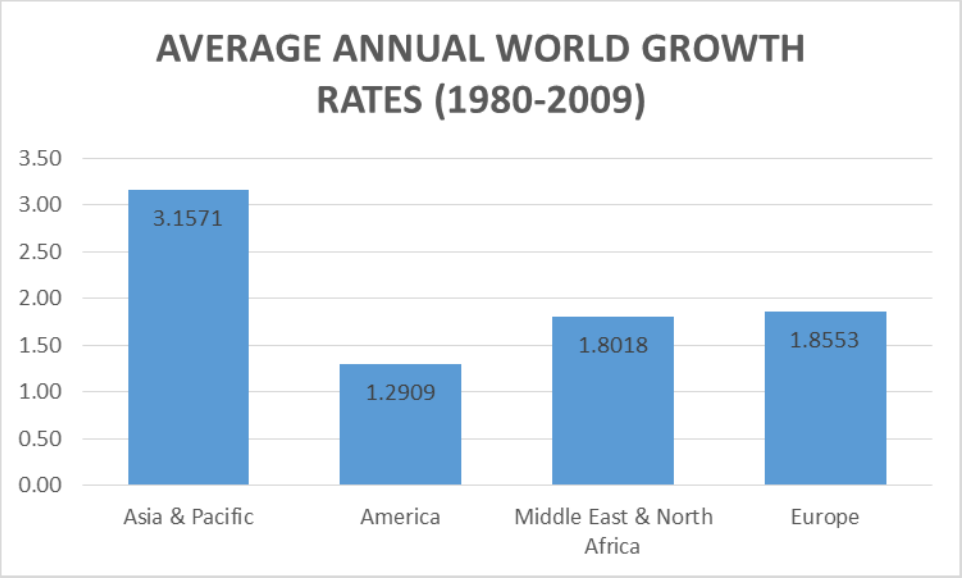

Figure 2. Average Annual Growth Rates around the World (1980-2009)

Figure 3 shows the trends in growth across regions. Asian countries suffered during the 1997-1998 Asian Financial crisis but seemed to have recovered well, though growth slowed down during the recent 2007-2008 financial crisis. For America, there is an overall upward trend in growth despite an initial period of declined economic activity from 1980 to 1984. Growth accelerated afterward until the internet bubble burst, which slowed it down around the turn of the millennia. From 2005 to 2009, growth recovered just before the recent financial crisis. For Middle East and North Africa, the region suffered severely from the decline in oil prices in the late 80s, but growth accelerated after that and remained steady since the five-year period starting in 1990. Europe's growth rates fluctuated the most, with the early rise in growth before the oil crisis slowing down to nearly 0% in the five-year period starting in 1990. After that growth recovered, but then slowed down during the Asian financial crisis and plummeted during the recent global financial crisis. Though going through different paths, overall, countries around the world grew on average 1.99% annually over the 30 years from 1980 to 2009.

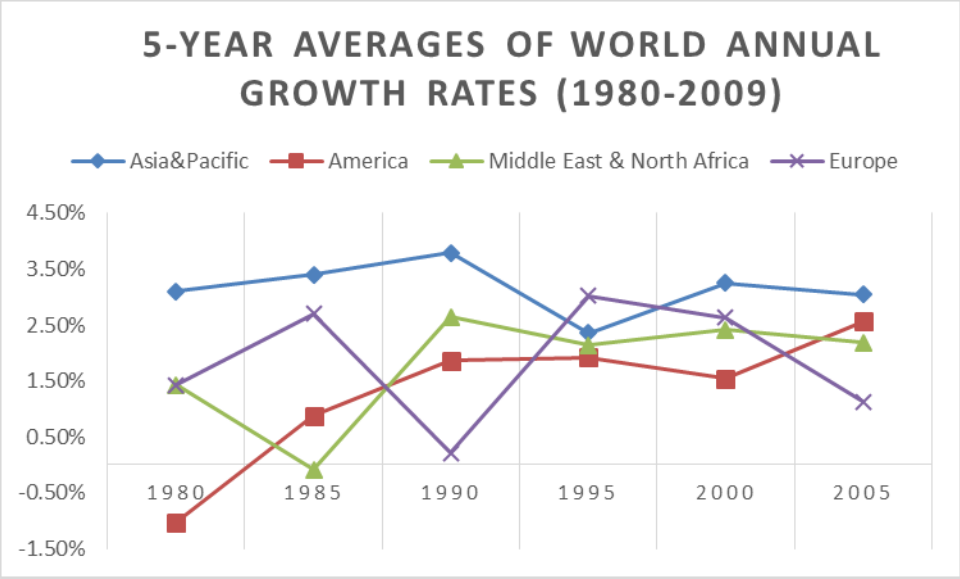

Figure 3. Global 5-year Average Annual Growth Rates from 1980 to 2009

As economies expanded, they also became more integrated through international trade. From Table 1, the maximum trade share is 4.10 or 410% for the city-state of Singapore from 2005 to 2009, while the minimum trade share is 0.13 or 13% for India from 1985 to 1989 (India was closed until 1991). Figure 4 shows the trends in trade shares for different regions across the world during my sample period. Overall, trade shares increased for all regions, except for Middle East &

North Africa, which already had high trade shares initially compared to other regions. At the start of my sample, Middle East & North Africa had the highest trade to GDP ratio of 104.77% while America bottomed at 59.52% largely due to Latin America's commitments to import substitution in the 1980s. As major Asian economies opened up and relied on exports to promote growth (China in 1979 and India in 1991), trade shares accelerated for the region. By the end of my sample period, Asia & Pacific had become the most integrated in the world economy with trade shares reaching 111.72%. On the other end of the spectrum, Latin American countries only opened up in the early 1990s as part of the Washington Consensus, so it is not surprising that America as a region still stood at the bottom after 30 years, with trade accounting for 99.25% of GDP in the period from 2005 to 2009. For Europe, integration did not start until the early 1990s, when the USSR dissolved and Eastern Bloc nations reverted back to market economies. The creation of the Single Market in 1993 also aided greatly in the integration process; as a result, trade shares grew consistently from 1990 onwards. For Middle East & Africa, many countries increased their participation in the global economy since 2000; thus by the five-year period starting in 2005, trade shares had recovered to the level reached initially by the region from 1980 to 1984.

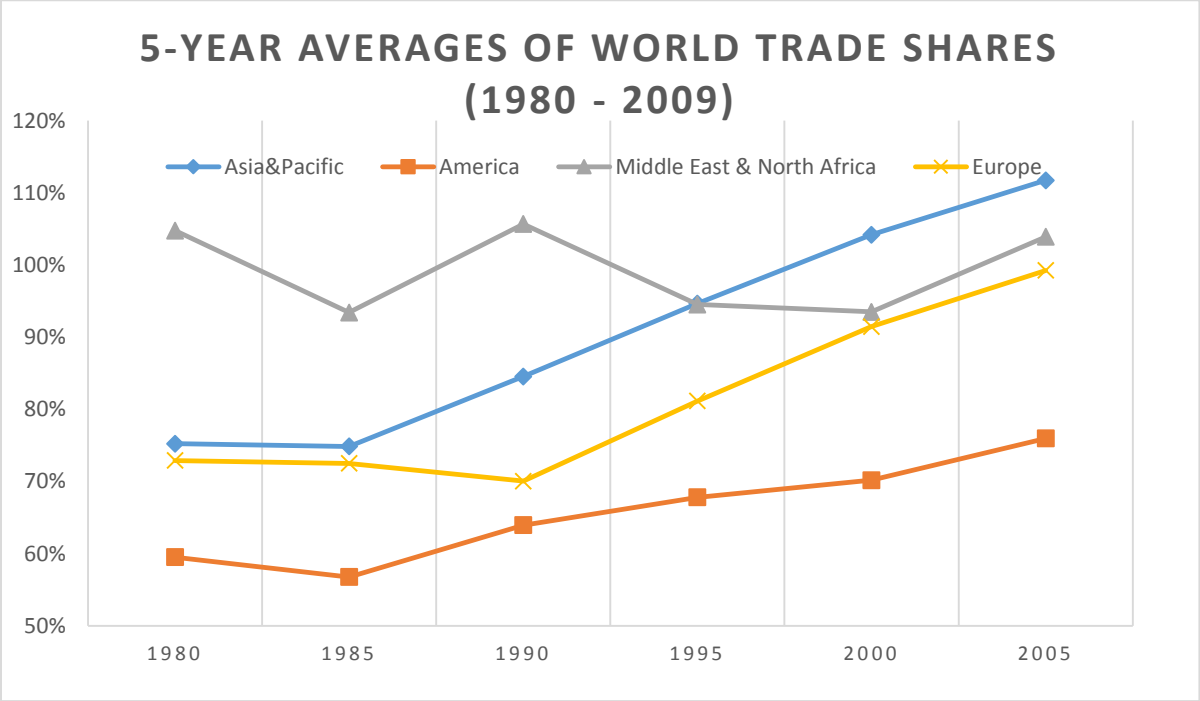

Figure 4. Average Trade Shares for 5-year Periods from 1980 to 2009

In general, while trade shares for all regions, except for Middle East & North Africa, grew steadily over the 30 years from 1980 to 2009 as the liberalization trend spread worldwide, growth experienced a mixed pattern of evolution with much greater fluctuation. Figure 5 in the Appendix shows the scatter plot of trade shares and growth in my sample. The plot shows a slight positive correlation between the two variables, mostly thanks to trade-dependent, high-growth countries such as Singapore, Hong Kong and Luxembourg. The coefficient of correlation between trade shares and growth is 0.1155, which indicates a possible positive relationship between them since their movements seem to synchronize (Table 2 in the Appendix reports the correlation coefficients between all variables in my study). The rest of this paper will formally examine this relationship using the empirical model presented in the next section.

4. Empirical Model

As stated previously, in this paper I will use trade shares, defined as the ratio of exports plus imports over GDP, as a proxy for trade openness due to its popularity within the literature and availability of data for a multitude of developing countries. The empirical model I use follows the framework of Barro (1996), who tested growth determinants based on the neoclassical growth model using OLS regression. In this study, I will also run various OLS regressions, but will incorporate panel data estimation techniques to control for country fixed effects (country-specific components), time fixed effects (time-specific components) and random effects. The following estimation equation is used for my study:

$$rgdpg_{it} = Constant + \beta * X_{it} + \gamma * tr_{it} + \alpha_i + \tau_t + \epsilon_{it}$$

where $rgdpg_{it}$ is the real per-capita growth rate of GDP for a country i at time t, X_{it} is a set of control variables, tr_{it} is the trade share (my openness measure), α_i is the country dummy, τ_t is the time dummy and ϵ_{it} is the random component. Following most of the literature, I include in the set of controls a measure for the initial condition (the natural logarithm of real initial per-capita GDP in 1975), human capital measures (secondary school enrollment, life expectancy at birth, and population growth), a physical capital measure (share of gross capital formation), as well as a fiscal policy measure (share of government consumption), and an institutional quality measure (a legal system and property rights index).

As neoclassical growth theory suggests, I expect the initial condition measure to have a negative sign, reflecting the conditional convergence phenomenon that countries with lower income levels will grow faster than those already at a higher income level. Human capital and physical measures, on the other hand, are expected to positively influence growth, as they are the main resources for production and thus represent the potential for expansion of an economy. For the fiscal policy measure, or the ratio of government consumption to GDP, its effect is ambiguous since the quality of government operation can vary worldwide. For example, public investment projects in infrastructure such as hospitals, roads or schools would positively affect growth while excessive government spending can significantly raise a country's debts, thus dampening its growth potential. On the contrary, the institutional quality measure is expected to have a positive sign, as property rights and the rule of law are crucial in developing a sustainable economy. For the full definition and expected sign of each variable, refer to Table 3 in the Appendix.

Table 1 in the Appendix provides summary statistics for all of the variables. Flow variables (real per-capita GDP growth, shares of gross capital formation, shares of government consumption, population growth and trade shares) are averaged over five-year periods. Following convention, I only consider the value at the start of each five-ear period for the stock variables (secondary school enrollment, life expectancy at birth and the legal system and property rights index). Data for all GDP-related variables, except for trade shares, are taken from Penn World Table version 8.0. Secondary school enrollment is calculated from the Barro and Lee Educational Attainment data set. The legal system and property rights index is obtained from various Economic Freedom of the World Annual Reports, published by the Fraser Institute. The rest of the variables (including trade shares) are downloaded from the World Bank's World Development Indicators database.

5. Empirical results

The empirical results of my models are provided in Table 4. The dependent variable is the average annual real per-capita GDP growth rate of 71 countries worldwide over 6 five-year periods from 1980 to 2010. From now on, I will refer to the dependent variable as just growth rate or growth. In the first model, I treat my data as a cross-section and carry out a pooled OLS regression of growth on the set of 8 control variables mentioned in the previous section. Consistent with a lot of cross-country studies in the literature, I find a positive and significant (at the 10 percent level)

VARIABLES	Model 1 pooled	Model 2 fixed_country	Model 3 fixed_time	Model 4 fixed_both	Model 5 random
ln_igdp	-0.0125***		-0.0128***		-0.0121***
	(0.00212)		(0.00317)		(0.00291)
se	0.00754	0.00908	0.00950	0.00704	0.00688
	(0.00687)	(0.0180)	(0.00719)	(0.0201)	(0.00746)
le	0.000399	0.000256	0.000464	-0.000257	0.000417
	(0.000373)	(0.000890)	(0.000453)	(0.00156)	(0.000466)
g	-0.0293*	-0.0288	-0.0294*	-0.0250	-0.0280*
	(0.0152)	(0.0210)	(0.0153)	(0.0215)	(0.0151)
i	0.0765***	0.0885***	0.0800***	0.105***	0.0800***
	(0.0168)	(0.0250)	(0.0186)	(0.0285)	(0.0185)
popg	-0.448***	-1.087***	-0.441***	-1.051***	-0.517***
	(0.169)	(0.209)	(0.167)	(0.215)	(0.136)
lp	0.00114	-0.000899	0.000921	-0.00163	0.000660
	(0.000963)	(0.00122)	(0.00102)	(0.00148)	(0.00108)
tr	0.00366*	0.000691	0.00373**	0.00350	0.00378*
	(0.00190)	(0.0102)	(0.00188)	(0.0107)	(0.00196)
Constant	0.0808***	0.00169	0.0748***	0.0295	0.0785***
	(0.0218)	(0.0539)	(0.0218)	(0.107)	(0.0276)
Sample size	403	403	403	403	403
F-stat/Wald-stat	12.98	7.38	117.15	6.18	101.57
R-squared	0.209	0.131	0.226	0.159	0.114
Number of Country	71	71	71	71	71

Note: the dependent variable is rgdpg in each equation

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Regression Results

coefficient of 0.00366 for trade shares. This implies that a 10 percentage-point increase in trade shares would result in a 0.04 percentage-point increase in growth rate, or a change of one standard deviation in this openness measure (an increase of 0.6) would lead to a 0.24 percentage-point rise in growth. The pooled regression also shows that investment has a positive effect on growth, with a significant coefficient of 0.0765 at the 1 percent level. This means that a 10 percentage-point increase in investment share of GDP would result in a 0.76 percentage-point increase in growth rate. On the other hand, population growth, initial GDP level and government consumption share of GDP have negative effects on growth. The coefficient for each variable, respectively, is -0.448, -0.0125 (both significant at the 1 percent level) and -0.0293 (significant at the 10 percent level). A positive change of 10 percentage-points in each variable would then result in a respective decrease of 4.48, 0.125 and 0.293 percentage-points in growth rates. These results are consistent with my expectations outlined earlier and with most of the literature (see Barro (1996), Sachs and Warner (1995), Edwards (1992), Harrison (1996) and Vamvakidis (2002)), with government consumption actually slowing growth down here. On the other hand, secondary school enrollment, life expectancy and legal and property rights are all insignificant. The empirical literature also does not generally find the coefficient for life expectancy to be significant, but secondary school enrollment's coefficient is shown to be significant in Vamvakidis (2002) and Harrison (1996). For the institutional quality measure, as pointed out before, Rodrik et al. (2004) find its growth effect to be statistically significant while Alcala and Ciccone (2004) do not.

One drawback of the pooled regression is that it ignores the time-component of my data. Thus, to improve upon the first model, I run a panel regression with both fixed and random effects to capture some of the heterogeneity that can exist across countries or time. Model 2 presents the results using panel fixed effects with country dummies only. By adding country dummies (70 dummy variables for 71 countries), I aim to control for the influence that any country-specific factor may have on growth that my initial model has not accounted for. With the addition of country fixed effects, trade shares no longer has a significant effect on growth with a coefficient of 0.000691. The coefficient for trade shares is not only insignificant at the 10 percent level but also much smaller in magnitude compared to its value in my initial model. Investment level (0.0885) and population growth (-1.087) are still significant at the 1 percent level (a 10 percentage-point increase in each variable would result in a 0.885 percentage-point increase in growth rate and a 10.87 percentage-point decrease in growth rate respectively), but while the coefficient for

investment slightly increases in magnitude, population growth's coefficient is now much larger. Meanwhile, government consumption has become insignificant. Also note that in this model I no longer consider initial GDP as a predictor due to its multicollinearity with the country dummies.

In the third model, instead of using country dummies, I include time dummies for each five-year period as predictors. By incorporating these time dummies, I want to incorporate the effects that time-specific factors such as any regional or global crisis may have on growth. In this model, trade shares has a positive and significant (at the 5% level) coefficient of 0.00373. This implies that a 10 percentage-point increase in trade shares would result in a 0.04 percentage-point increase in growth rate, or a change of one standard deviation in this openness measure (an increase of 0.6) would lead to a 0.24 percentage-point rise in growth. We can see that the coefficient of trade shares is of approximately the same magnitude as it was in my first model, but now it has become significant at a higher level. Investment level (0.08), population growth (-0.441), government consumption (-0.0294) and initial GDP (-0.0128) still have the same directional and significant effects on growth as they did in my first model. The magnitudes of these coefficients are also very close to the values of those found in Model 1.

For the fourth model, I include both the country and time dummies in the regression to control for both country-specific and time-specific factors, and I find largely the same results as with my second model. Trade shares show no significant relationship with growth (probably due to the country dummies), though the coefficient now stays closer in magnitude to its value in the initial model (perhaps due to the time dummies). Population growth (-1.051) and investment level (0.105) still have significant effects (both at the 1 percent level) on growth, just as they do in the first model but the magnitudes of their effects are much larger. Meanwhile, government consumption is no longer a significant predictor. Once again initial GDP is dropped due to its multicollinearity with the country dummies.

In the fifth model, I use random effects to analyze my data set. Contrary to the fixed effects models, by employing random effects, I assume that random factors, instead of country-specific or time-specific ones, may be the cause of cross-country variation in my data. The results indicate that trade shares has a positive and significant effect on growth. The coefficient for trade shares is 0.00378, and significant at the 10% level. This implies that a 10 percentage-point increase in trade shares would result in a 0.04 percentage-point increase in growth rate, or a change of one standard

deviation in this openness measure (an increase of 0.6) would lead to a 0.24 percentage-point rise in growth. The control variables, investment level (0.08), population growth (-0.517), government consumption (-0.028) and initial GDP (-0.0121) still have the same significant effects (at the 1, 1, 10, and 1 percent level respectively) on growth as they did in my first model. This means that a positive change of 10 percentage-points in each variable would result in a respective 0.8, -5.17, -0.28 and -0.121 percentage-point change in growth rate. These results are consistent with what I find in the first model. The magnitudes of these coefficients are also very close to the values of those found in Model 1.

In summary, trade shares has a positive and statistically significant impact on growth in the pooled regression, the fixed effects with time dummies and the random effects models, while the fixed effects models with country dummies and with both country and time dummies do not yield statistically significant results. To check the desirability among my panel data models, I run two diagnostic tests whose results are provided in Table 5 in the Appendix. First of all, including the time dummies is better than not doing so within the family of fixed effects models. In other words, time-specific factors significantly affect the sample cross-country variation. Thus, Models 3 and 4 are more appropriate than Model 2. Secondly, when comparing the fixed effects to the random effects model, the Hausman test indicates that the random effects model is more appropriate. This means that the variation across countries is better explained by random factors rather than country-specific factors. Thus, Model 5 is better than Models 2, 3 and 4. For the panel data models, we should therefore only consider the results presented in Model 5, while Model 1 should be considered as a point of comparison.

My results suggest that trade openness, measured through trade shares, positively affects economic growth. The magnitude of influence of trade openness on growth are also found to be pretty consistent across the different models, as a 10 percentage-point increase in trade shares results in an approximately 0.04 percentage-point increase in growth rate even with the different model specifications. This finding aligns with the results of previous papers that also use OLS and panel data estimation techniques. The positive relationship between trade openness and growth implies that countries can gain from opening up their borders to international trade, and that a closed economy would not fulfill its growth potential until it begins to liberalize trade.

6. Conclusion

This paper investigates the relationship between trade liberalization and economic growth for a panel of 71 countries worldwide over 6 five-year periods from 1980 to 2010. To build upon the empirical literature that examines the growth effects of trade openness, I use the commonly adopted measure of trade shares, defined as the ratio of exports plus imports over GDP, as a proxy for trade openness and extend past analyses by considering a more recent data set and using panel data techniques in addition to pooled (or cross-country) OLS regression. Besides trade shares, I also include a set of 8 other control variables, following most of the literature, to control for the human capital level, physical capital level, the initial condition, as well as fiscal policy and institutional quality.

Consistent with past findings, I find a positive and significant relationship between trade shares and economic growth. The coefficient has a magnitude of approximately 0.004 across Models 1, 3 and 5 (pooled regression, fixed effects with time dummies, and random effects, respectively). This implies that a 10 percentage-point increase in trade shares would result in a 0.04 percentage-point increase in growth rate, or a change of one standard deviation in this openness measure (an increase of 0.6) would lead to a 0.24 percentage-point rise in growth. Moreover, the coefficient is significant at the 5 percent level in Model 3, compared to a 10 percent significance level in Models 1 and 5.

These results provide another point of reference to the debate on the relationship between trade liberalization and economic growth. Here I replicate past empirical methods (pooled regression) on current data and find the same result as before: the more a country is open to international trade, the faster its economy will grow. The new panel models with fixed and random effects also point to the same conclusion. Thus, this study confirms that the widespread trade liberalization support among think tanks and international organizations before 2000 was indeed legitimate. Many countries have successfully opened their economies and enjoyed robust growth in the 80s and 90s (e.g. the Asian tigers) and now in the new millennia, others have followed their footsteps and achieved remarkable growth rates such as China, Brazil, India and the Southeast Asian nations.

On another note, my study does not support Rodrik's (2006) argument that institutional quality trumps trade policy, as the institutional quality index does not produce a significant

coefficient in my results. This is far from suggesting that quality of institutions do not matter for economic growth. Instead, its contribution to growth may not be a direct one, but may rather be indirect through other significant factors such as investment level and government consumption.

It is worth noting that a weakness of my study is that it does not address the issue of reverse causation; as countries grow, they also trade more in international markets to find cheaper source of goods and services, as well as to expand their domestic production. In other words, faster growth rates may result in an increase in trade shares. Thus, future research attempts should be directed at addressing this issue using more sophisticated econometric techniques such as instrumental variables or dynamic GMM estimation. In addition, other trade openness indicators should be considered, especially those that directly measure the size and scope of trade policy. Since trade shares could also be influenced by other factors such as geography, exchange rate volatility or shifts in terms of trade, it cannot truly reflect a country's trade policy.

Appendix

Figure 5. Trade shares and Economic growth around the world, 1980-2009

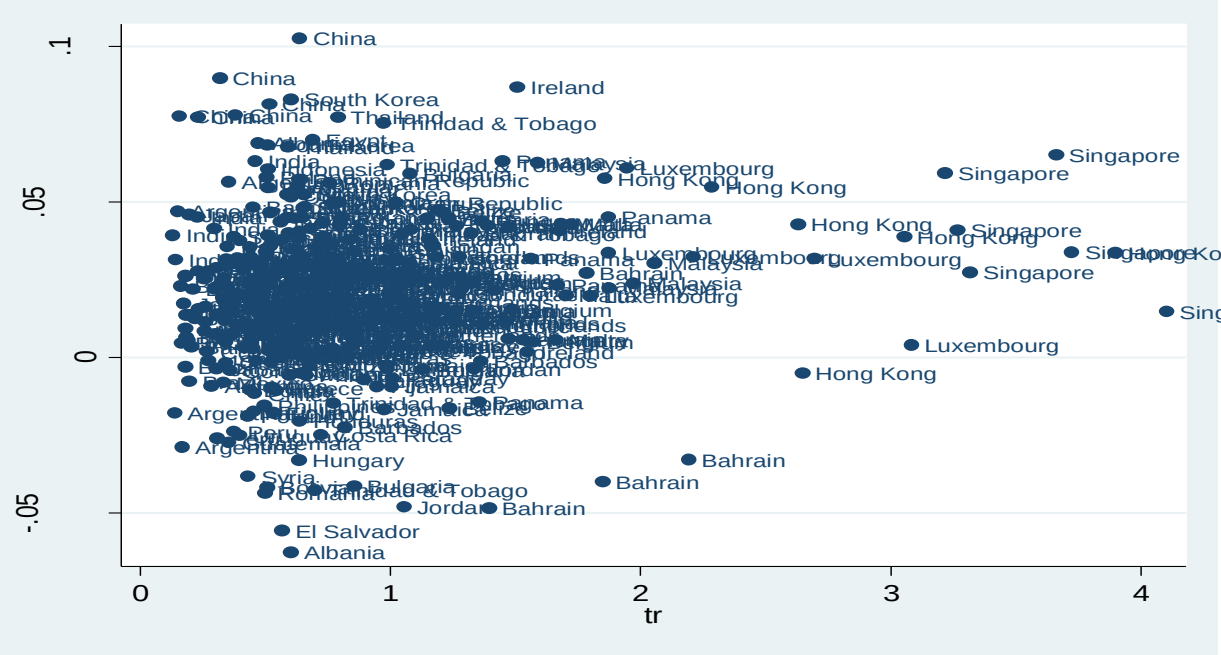

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
rgdpg	426	0.01994	0.023508	-0.06263	0.102575
ln_igdp	426	8.654946	0.944171	6.551192	10.12144
se	426	0.518174	0.20911	0.0807	0.97
le	426	71.66514	5.989048	47.65341	81.92512
g	426	0.183231	0.081139	0.05065	0.920585
i	426	0.22015	0.079108	0.066962	0.636811
popg	426	0.012845	0.010264	-0.01074	0.074616
lp	407	6.074008	1.904701	1.666273	9.62463
tr	420	0.811436	0.589961	0.130438	4.102467

Table 2. Correlation Matrix

	rgdpg	ln_igdp	se	le	g	i	popg	lp	tr
rgdpg	1								
ln_igdp	-0.1452	1							
se	0.0598	0.5948	1						
le	0.0744	0.752	0.6851	1					
g	-0.0941	-0.2044	-0.0835	-0.1699	1				
i	0.247	0.3075	0.2425	0.4288	-0.2173	1			
popg	-0.1463	-0.3274	-0.4048	-0.3651	-0.0053	-0.0708	1		
lp	0.076	0.7433	0.5854	0.7397	-0.1943	0.4398	-0.432	1	
tr	0.1155	0.1858	0.1775	0.2979	-0.0616	0.3447	0.1268	0.2221	1

Table 3. Variables used in analysis

Variable name	Definition	Source	Expected Sign
rgdpg	Real GDP per capita growth at constant national prices (benchmark year is 2005). Calculated as the difference in logarithms of real GDP per capita of a 5-year period, divided by the number years elapsed (5).	PWT version 8.0	N/A
ln_igdp	Expenditure-side real GDP per capita at current PPPs in 2005 US$. Calculated as the natural logarithm of real GDP per capita in 1975.	PWT version 8.0	(-)
se	Percentage of population aged 15 and over enrolled in secondary level education (regardless of completion status). Used initial year's value for a 5-year period data point.	Barro and Lee	(+)
le	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Used initial year's value for a 5-year period data point.	WDI	(+)
i	Gross capital formation, calculated as percentage of real GDP at current purchasing power parity. Shows the acquisition less disposal of produced assets for purposes of fixed capital formation, inventories or valuables. Used the average over 5 years for each 5-year period.	PWT version 8.0	(+)
g	General government final consumption expenditure (or government consumption), calculated as percentage of real GDP at current	PWT version 8.0	(?)

	purchasing power parity. Consists of expenditure, including expenditure whose value must be estimated indirectly, incurred by general government on both individual consumption goods and services and collective consumption services. Used the average over 5 years for each 5-year period.		
popg	Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin. Used the average over 5 years for each 5-year period.	WDI	(-)
lp	Composite score on Area 2 – Legal System and Property Rights from Economic Freedom of the World, computed as the average of subcategory scores. These include judicial independence, impartial courts, protection of property rights, military inference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts, regulatory restrictions on the sale of real property, reliability of police and business costs of crime. The index ranges from 0 to 10; the higher the score, the better the legal system is. Used initial year's value for a 5-year period data point.	EFW	(+)
tr	The sum of exports and imports of goods and services measured as a share of gross domestic product. Used the average over 5 years for each 5-year period.	WDI	(+)

Note: PWT – Penn World Table, WDI – World Development Indicators, EFW – Economic Freedom of the World. WDI definition are taken directly from the database.
http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators

Table 5. Desirability tests between panel models

***Hausman* Test** (Fixed effects versus random effects model)

	(b)	**(B)**	**(b-B)**	**sqrt(diag(V_b-V_B))**
	Fixed	Random	Difference	S.E.

se	0.009078	0.0068823	0.0021957	0.01404
le	0.000256	0.0004171	-0.0001614	0.000525
g	-0.02884	-0.0280477	-0.00079	0.014239
i	0.088491	0.0799761	0.0085145	0.01727
popg	-1.08733	-0.5167119	-0.5706172	0.196645
lp	-0.0009	0.0006598	-0.001559	0.000935
tr	0.000691	0.0037809	-0.0030903	0.00687
	b = consistent under Ho and Ha; obtained from xtreg			
	B = inconsistent under Ha, efficient under Ho; obtained from xtreg			

Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 13.46

Prob>chi2 = 0.0617

The null hypothesis is that the preferred model is the random effects (to the fixed effects with only country-dummies). In this case, we fail to reject the null hypothesis at the 5% level (but not at 10% level). Thus, the model that the Hausman test suggests we use is the random effects.

Time-dummies test

testparm i.Year

(1) 1985.Year = 0

(2) 1990.Year = 0

(3) 1995.Year = 0

(4) 2000.Year = 0

(5) 2005.Year = 0

F(5, 70) = 2.38

Prob > F = 0.0469

The null hypothesis is that all time coefficients are equal to 0. Here, we can reject the null hypothesis and thus, time-dummies coefficients are necessary.

Table 6. Country list

Albania	Denmark	Italy	Poland
Argentina	Dominican Republic	Jamaica	Portugal
Australia	Egypt	Japan	Romania
Austria	El Salvador	Jordan	Singapore
Bahrain	Fiji	Luxembourg	South Korea
Bangladesh	Finland	Malaysia	Spain
Barbados	France	Malta	Sri Lanka
Belgium	Germany	Mexico	Sweden
Belize	Greece	Morocco	Switzerland
Bolivia	Guatemala	Nepal	Syria
Brazil	Honduras	Netherlands	Thailand
Bulgaria	Hong Kong	New Zealand	Trinidad & Tobago
Canada	Hungary	Norway	Tunisia
Chile	Iceland	Pakistan	Turkey
China	India	Panama	UK
Colombia	Indonesia	Paraguay	Uruguay
Costa Rica	Ireland	Peru	USA
Cyprus	Israel	Philippines	

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