Trade, Exchanges and Productivity Growth

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Abstract

Many studies suggest the positive causal effects of trade openness on productivity and growth. However, controversies are still prevalent among vast empirical studies on the issue. In this paper, we propose a standard empirical framework for investigating economic growth and apply the framework to estimate the growth effects and transmission processes of per capita trade. Based on prior information, theoretical reasoning and various empirical evidences, we tend to conclude that the international exchanges have positive independent effects on economic performances.

1. Introduction

In this paper, we propose a standard empirical framework for investigating economic growth and apply the framework to estimate the growth effect and transmission processes of per capita trade. Historical reviews and casual observations suggest that the creation and transmission of technology and knowledge have been extremely important in the development processes. The familiar sources of gains from trade, which include specialization according to comparative advantage and realization of scale economies, suggest that an open economy will enjoy a higher level of income. But they do not necessarily imply that an open economy will grow faster. Grossman and Helpman (1991) proposed that trade can enhance productivity growth by raising the variety of intermediates available and in general, international technology, knowledge and idea spillovers to the citizens involved. Both import and export activities can raise the number of international contacts and exchanges among the population involved. The level of trade openness can therefore raise an economy's productivity growth.

Many findings suggest the positive causal effects of trade openness on productivity and growth. However, controversies are still prevalent given the vast empirical studies on the issue. (among many others, Rodrik, et al, 2004; Rodriguez and Rodrik, 2000; Yanikkaya, 2003; Baldwin, 2003) The major problem in the studies is that most of the empirical models are generally ad hoc, with diverse indicators of trade openness and estimation methods. Conclusions are difficult to be reached from many more similar studies.

1.1 Index for the Level of International Exchanges

Why would trade openness promote growth? What index can capture the effects of openness on growth? Answering the questions is essential for choosing an appropriate index in related empirical studies.

A common index for 'realized trade openness' is the share of total trade in nominal income. However, Alcala and Ciccone (2004) argue that this conventional measurement understates the actual level of openness. When trade raises the productivity of an economy, it may raise the relative price of non-tradable to tradable goods that results in a decrease in the nominal trade share. Therefore, they suggest using the share of total trade in purchasing power parity GDP to calculate an index for 'real openness'.

International trade is a major source of international exchanges and interactions. Grossman and Helpman (1991) suggests that trade can enhance economic growth by raising the variety of intermediates and 'stock of knowledge capital' available to an economy. These dynamic gains from the international exchanges have to go through the learning process of citizens. Total trade per capita (TPC) can indicate the average intensity of exposure to international exchanges among citizens. Therefore, we use it to capture the theoretical effects of international exchanges on productivity growth in an economy. Under this rationale, per capita trade should be interpreted as an index for realized international exchanges rather than the traditional 'trade openness' index although they are highly correlated.[1]

The common measurements of 'policy openness' include average tariff rates, non-tariff barriers, black market exchange rate premium and types of economic systems. They are much less effective in capturing the level of international exchanges available to citizens. Theoretically, it is the realized level of international exchanges that determines the rate of productivity growth. In many cases, government interventions can promote the level and the dynamic gains from international exchanges. It is not the government interventions themselves but the appropriateness of government interventions that determines the realized level of international exchanges and its dynamic gains. Examples are common that

[1] The correlation coefficient between the share of trade in nominal income and trade per capita equals 0.73 in our sample.

appropriate industrial and trading policies can facilitate international exchanges, absorption and creation of technology and ideas of citizens. (for instance, Krueger, 1990; Weiss, 2005)

Although international trade is an important source of international exchanges, TPC is not a perfect indicator for capturing the dynamic gains. To the citizens involved, trading in goods with a complex production process can generate much more interaction and learning opportunities than trading in simple raw materials. Therefore, some kind of trading activities are more effective than others in raising productivity growth. This is not captured by the index as it does not differentiate types of trading activities. However, as long as the effect is not systematically correlated with the explanatory variables, the imperfection will not affect the estimations.

Another problem of the index is that it is likely to be pro-cyclical. Higher growth rate caused by random shocks is likely to result in higher total trade per capita. This shortcoming can be solved by studying related problems with duration long enough to even out the business cycle effects in cross-sectional studies. However, the characteristic also renders estimations to be very sensitive to model specification as TPC can easily capture the effects of omitted variables in growth regressions. As a result, correct specification is essential for identifying the true effects of TPC and ample sensitivity tests are required for establishing conclusions from the estimations.

2. The Theoretical Framework

Extending the supply-side framework developed in Mo (2000, 2001) to incorporate the plausible demand-side effects, we develop a theoretical foundation for our empirical models in this study.

2.1 The Supply-side

Suppose there are n identical firms having technology of constant return to scale and the economy is under a competitive environment. The objective of a representative firm 'i' is to maximize its profit (π):

$$\pi = P*Tf^i(K^i, L^i) - rK^i - wL^i$$

where P is the output price, T is the total factor productivity, r, w, K^i and L^i are the nominal interest rate, wage, capital and labor employed by the firm respectively.

Profit-maximization implies that the inputs employment level of firm 'i' depend on the output and input prices, such that:

$$K^i = K^{i*}(P, w, r) \; ; \; L^i = L^{i*}(P, w, r) \text{ , and}$$

$$Y^i = Tf^i(K^{i*}, L^{i*}), \qquad (1)$$

with K^{i*}_P , $L^{i*}_P > 0$, $K^{i*}_r < 0$, $L^{i*}_w < 0$, K^{i*}_w , $L^{i*}_r > 0$.

Let L^c and K^c denote the fixed labor and capital endowment in the economy that have positive effect on the supply of the respective resources. Assume competitive input markets and that labor and capital have the simple market supply functions of:

$$\log L = \theta_1 \log w + \theta_{11} \log L^c \text{ ,} \qquad (2.1)$$

with: $\theta_1 > 0$, $w > 1$, $0 < \theta_{11} < 1$, when $L < L^c$; and $\theta_1 = 0$ when $L = L^c$;

$$\log K = \theta_2 \log r + \theta_{21} \log K^c \text{ ,} \qquad (2.2)$$

with: $\theta_2 > 0$, $r > 1$, $0 < \theta_{21} < 1$, when $K < K^c$; and $\theta_1 = 0$ when $K = K^c$;

The simplified supply functions are specified to capture the vital facts that the supply of an input depends on its price and is constrained by their endowments in the economy. In order to introduce the possible aggregate demand effect, we assume input prices are rigid downward such that markets are not always clear.[2] Since the magnitude of the parameters

[2] Under the price rigidities, excess capacity can exist due to various reasons like imperfect information, efficiency wage, coordination failures, minimum wage and labor contracts, etc.. Besides observing the resource utilization rate among economies directly, the validity of excess capacity can be empirically tested by observing the significance of aggregate demand variables on GDP growth.

θ_1 , θ_2 , θ_{11} , θ_{21} have no effect on our conclusions, they are dropped in the following analysis for simplifying our calculations.

Profit maximization implies that the aggregate demand for input is determined by equalizing the respective market price and its marginal revenue product. With a Cobb-Douglas production function:

$$Y = T L^{\alpha} K^{\beta} \text{ , with } \alpha + \beta = 1; \quad \text{and} \tag{3}$$

$$w = \alpha PT L^{\alpha-1} K^{\beta} , \tag{3.1}$$

$$r = \beta PT L^{\alpha} K^{\beta-1} \tag{3.2}$$

where Y is the aggregate production function, L and K are the demand of the respective inputs.

At equilibrium, supply equals demand. Substitute (2.1) and (2.2) into the log form of (3.1) and (3.2), the input market equilibriums imply:

$$w = w^*(L^c , K^c, PT), \quad \text{and} \quad r = r^* (K^c , L^c, PT) \tag{4}$$

with $w^*_{L}{}^{c}$, $r^*_{K}{}^{c} < 0$; $w^*_{K}{}^{c}$, $r^*_{L}{}^{c} > 0$; and w^*_{PT} , $r^*_{PT} > 0$.

Each firm takes the input prices as given. Substituting (4) into (1), we have the firm's supply function:

$$Y^i = Tf^i\{K^{i*}[P, w^*(L^c , K^c, PT), r^* (K^c , L^c, PT)] , L^{i*} [(P, w^*(L^c , K^c, PT), r^* (K^c , L^c, PT)])$$

With some simplifying assumptions, the firm's supply function equals:

$$Y^i = T f^i [K^{i*}, L^{i*}] = Tf^i(K^c, L^c, P) \tag{5}$$

with $Y^i_K{}^c$ and $Y^i_L{}^c > 0$; $Y^i_P = 0$ when $Y = Y^c = Y(K^c, L^c)$ = the capacity output;

and $Y^i_P > 0$ when $Y < Y^c$;

and $Y^i_{KK}{}^c$, $Y^i_{LL}{}^c$ and $Y^i_{PP} < 0$, assuming diminishing returns.

Summing up the supply of n individual firms, we have the aggregate supply function with identical characteristics of the firm's supply curve:

$$Y = T\, f\,[K^{*}, L^{*}] = Tf(K^{c}, L^{c}, P) \qquad (6)$$

Total differentiate equation (6) and divided by Y, we have:

$$\frac{dY}{Y} = \frac{dT}{T} + Tf_{K^{c}} \frac{dK^{c}}{Y} + \frac{f_{L^{c}} L^{c}}{f} \frac{dL^{c}}{L^{c}} + \eta \frac{dP}{P}.$$

where η is the elasticity of output supplied to the price level; $\eta=0$ when $Y = Y^{c} = Y(K^{c}, L^{c})$ = the capacity output; and $\eta>0$ when $Y< Y^{c}$.

Rearrange the terms:

$$\frac{dP}{P} = \frac{1}{\eta}\left(\frac{dY}{Y} - \frac{dT}{T} - Tf_{K^{c}} \frac{dK^{c}}{Y} - \frac{f_{L^{c}} L^{c}}{f} \frac{dL^{c}}{L^{c}}\right). \qquad (7)$$

2.2 The Demand-Side

When there is excess capacity in an economy and the input prices are not flexible enough to clear the markets, proper aggregate demand management can enhance GDP growth by raising the utilization rate of resources.[3] The role of macroeconomic variables in the aggregate demand management can be illustrated by the standard simple Keynesian model as follows:

$$AD = C + I + G + NX \text{ and } C = a + bY - vP$$

where AD is the Aggregate Demand for domestic goods; C, I and G are the consumption, desired investment and government purchases for domestic goods; NX is the net export that is assumed to be determined by public policies and relative

[3] Casual observation and empirical studies suggest that excess capacity is prevalent across countries, particularly among the less-developed economies.

productivity between nations; P is the price level; `a' is autonomous consumption, `b' is the marginal propensity to consume and Y is the real income or GDP; a, b, v > 0.

The price level has negative effect on consumption and AD of domestic goods as it reduces the real purchasing power of savings, among others. At the demand-side equilibrium, output equals aggregate demand, that is Y = AD. The net export can affect the growth rate through its effect on the aggregate demand, such that:

$$\frac{dY}{Y}=\frac{1}{1-b}\left(-v\frac{P}{Y}\frac{dP}{P}+\frac{dI}{I}\frac{I}{Y}+\frac{dG}{G}\frac{G}{Y}+\frac{dNX)}{Y}\right), \quad \text{or}$$

$$\frac{dY}{Y}=\varepsilon\frac{dP}{P}+\frac{1}{1-b}\left(\frac{dI}{I}\frac{I}{Y}+\frac{dG}{G}\frac{G}{Y}+\frac{dNX}{Y}\right), \tag{8}$$

where ε is the absolute value of the elasticity of aggregate demand to the price level.

At equilibriums, the price and output level of the supply and demand sides move at the same rate. Substituting (7) into (8) and rearranging the terms, we have:

$$\frac{dY}{Y}=\frac{R_P}{(1+R_P)}\left(\frac{dT}{T}+Tf_{K^c}\frac{dK^c}{Y}+\frac{f_{L^c}L^c}{f}\frac{dL^c}{L^c}\right)+\frac{1}{(1-b)(1+R_P)}\left(\frac{dI}{I}\frac{I}{Y}+\frac{dG}{G}\frac{G}{Y}+\frac{dNX}{Y}\right),$$

where $R_P=\frac{\varepsilon}{\eta}$. (9)

The expression in (9) is simplified as follows:

$$GR = g(\gamma, IY, dLL, dIY, dNXY, dGY) \tag{10}$$

where GR is the growth rate of real output, γ is the growth rate of productivity, dLL is the growth rate of population, dIY is the change of investment over output, dNXY is the change of net export over output and dGY is the change of government expenditure over output.

Introducing the possible factors driving the growth rate of productivity, equation (9) or (10) provides the theoretical foundation for our empirical models.

3. Data

Employing a reliable data source for testing a new analytical framework can reduce the potential difficulties caused by the quality of data. Second, in our study, we rely on the prior information about the import substitution industrialization development strategy of Latin American (LAAM) to provide more credibility on our findings. The development strategy in LAAM began to change in late 1980's. Given this constraint and considering the quality of data, we choose the period 1970-1985 for our study. The Barro and Lee (1994) data set is just fine for our purpose. The data set covers cross-country panel observations from 1960-1985 and have generated consistent results in various investigations. Recent financial crises in the world reveal that short-term economic growth among countries can fluctuate wildly according to their country-specific conditions. The 15 year duration with a relatively stable international environment is suitable for investigating the level of international exchanges on long-term economic performance across countries.

The correlation and descriptive statistics of the major variables employed in this study are summarized in Table A. The variables are defined in the notes to the table.

Insert Table A about here

Table A: Descriptive Statistics and Correlation Coefficient

	Mean	S.D.	Max	Min	GR	TPC	dNXY	IY
GR	3.61	2.33	8.79	-0.87	1			
TPC	1029.7	1746.0	12005	16.37	-0.14	1		
dNXY	-0.222	0.531	0.770	0.3.25	-0.09	-0.09	1	
IY	0.15	0.052	0.283	0.045	0.32	0.22	0.18	1
y0	3190.1	4272.2	34024	283.0	-0.27	0.89	-0.13	0.13
Y70	77715764	4272.2	1.94E9	383040	-0.04	0.06	0.13	0.09
GY	0.178	0.069	0.384	0.047	-0.14	-0.22	-0.23	-0.14
HUM	4.572	2.77	11.26	0.45	-0.05	0.51	0.27	0.53
INSTAB	0.272	0.398	1.85	0	-0.19	0.27	-0.03	-0.29
RIGHT	3.483	1.95	6.89	1	0.03	-0.38	-0.34	-0.62
CIVLIB	3.476	1.76	1.67	1	0.08	-0.46	-0.31	-0.6
dLL	2.03	1.13	5.75	0.04	0.14	-0.18	-0.37	-0.45
ASIAE	---	---	---	---	0.43	-0.05	0.06	0.24
LAAM	---	---	---	---	-0.21	-0.21	0.15	-0.1
OECD	---	---	---	---	-0.11	0.43	0.24	0.47
SAFRI	---	---	---	---	-0.15	-0.28	-0.26	-0.32

Table A (Continue)

	y0	Y70	GY	HUM	INSTAB	RIGHT	CIVLIB	dLL
y0	1							
Y70	0.25	1						
GY	-0.27	-0.15	1					
HUM	0.51	0.38	-0.16	1				
INSTAB	-0.22	-0.12	0.03	-0.27	1			
RIGHT	-0.37	-0.3	0.22	-0.74	0.29	1		
CIVLIB	-0.43	-0.3	0.22	-0.77	0.30	0.96	1	
dLL	-0.1	-0.26	0.11	-0.67	0.16	0.66	0.66	1
ASIAE	-0.12	-0.07	-0.11	0.005	0.08	0.03	0.03	0.06
LAAM	-0.1	-0.12	-0.17	-0.05	0.24	-0.002	-0.02	0.06
OECD	0.41	0.38	-0.19	0.67	-0.25	-0.66	-0.68	-0.69
SAFRI	-0.32	-0.16	0.43	-0.5	-0.002	0.55	0.55	0.41

Notes:

GR = growth rate of real GDP; TPC: total trade per capita; IY = share of private investment in GDP; y0 = per capita real income in 1970; Y70 = GDP at 1970; GY = share of government consumption in GDP; HUM = average schooling years of total population over age 25; INSTAB = measure of political instability; RIGHT = index of political rights; CIVLIB = index of civil liberty; dLL = growth rate of population; ASIAE = dummy for East Asian countries; LAAM = dummy for Latin-American countries; OECD = dummy for OECD countries; SAFRI = dummy for Sub-Saharan African countries.

Number of observations = 82. Data such as TPC, GY and IY are the averages of the data available during the

period 1970-1985. The annual growth rate of a variable is approximated by fitting the compound interest rate formula. All the growth rate variables, such as GR, POPG are measured in percentage.

4 The 'Natural Causality Sequence' of Growth Regressions

One of the common problems in growth regressions is finding proper instrumental variables for solving the suspected simultaneity problem between growth rate and the right-hand-side variables. We try to sketch a general framework for understanding the problem.

After we define the production function as in equation (3), equation (11) is in fact an identity, that is, it is by definition true. This implies that all the supply-side determinants of GR must go through the 'production variables' (PV's), namely, γ, IY and dLL.

$$GR = F[\gamma, IY, dLL], \tag{11}$$

In economic theories, these PV's are determined by the optimizing choices of economic participants. Some choices are growth promoting and some are not. The corresponding regression model is expressed as:

$$GR = \alpha_o + \Sigma_i \alpha_i PV_i (OC_i) + \varepsilon ; \quad i = \gamma , IY, dLL. \tag{12}$$

where OC_i is a vector of optimal choices.

If the regression model is specified correctly, ε must be independent to the RHS variables and captures the production errors caused by 'acts of nature'.[4] Given the assumption, the identification of the determinants of growth relies on correct specification and choosing proper indexes for various determinants. That is, the growth estimation is a specification problem rather than a simultaneous problem. However, the problem is still complicated as

[4] Zellner et al (1966).

various OC's and their determinants are likely to be endogenously determined and closely interacting with each other.

The choices of economic participants are not random but affected by the cost and benefit calculations which are determined by the environmental variables (EV) under which the choices are conducted. Some socio-political environments (SPE) are the aggregate results of the behaviors of all participants. Therefore individual choices and SPE may be interactive. However, to an individual, SPE is usually given, either because the SPE is historically determined or his/her individual effect on the SPE is negligible. The other kind of environment is the natural environment (NE) that includes geographic locations, natural resources, temperature, rainfall etc. that are independent to individual choices and institutions. Since economic growth is the outcome of the optimizing choices of participants, the NE and SPE factors cannot enter (12) directly but through the OC's and PV's.

Based on equation (10) and the above-mentioned reasoning, the structure of our empirical models is specified as follows:

$\gamma = \gamma$ (SPE, NE) ;

IY = IY(γ, Z_{IY}) ;

dNXY = dNXY (γ, Z_{NX}) ;

TPC = TPC (γ , Z_{TP}) ;

GR = g (γ , TPC, IY, dLL , dIY , dNXY , dGY) . (13)

The specification suggests that the incentive environment captured by the socio-political variables is driving the production variables and/or the optimizing choice variables that include IY, dNXY and TPC. The focus of our investigation is trade per capita. Since the effects of the exogenous factors denoted as Z_{IY}, Z_{NX} , and Z_{TP} are respectively captured by the optimizing choice variables already, their absence in empirical estimations will not jeopardize our conclusions.

5. Empirical Estimations

Although various theoretical and empirical works suggest positive effects of trade on productivity and growth, Rodrik (2000) and Rodrik et al (2004) find that the quality of institutions drives everything such that trade has essentially no independent effect on growth. Our work represents another attempt to look into the controversy with a new index and with a structured analytical framework.

Higher productivity growth may cause higher levels of exports, imports and even population while higher per capita trade can raise productivity growth rate. Per capita trade is therefore likely to be in part caused by the factors that may have a direct effect on productivity growth such as the quality of institutions. Per capita trade therefore suffers from the possibility that countries experiencing fast productivity growth for reasons other than trade will have higher trade per capita. Therefore, it is very important to include appropriate control variables for finding the independent effect of international exchanges.

Just as international exchanges may enhance a country's productivity growth, domestic exchanges among residents may have similar effects. The level of domestic exchange opportunities depends on the varieties of intermediates and the population in an economy. As real GDP is positively correlated with the amount and varieties of intermediates as well as population, we use the initial real GDP (Y70) to capture the domestic exchange opportunities in a country. (Alesina et al, 2005) Second, countries that have higher growth rate for reasons other than trade are likely to have better institutions, infrastructure and transportation systems. Variables like political rights, civil liberty, the level of human capital stock, political instability, ratio of government consumption, initial GDP per capita, and regional dummies are introduced in the models to control the possible institutional factors and quality of infrastructure that may be correlated with trade per capita.

The variables included in the model can be classified into several categories. The first is the institutional, historical and geographical variables that are totally or largely

independent to individual choices. They include initial per capita income, initial size of the economy, government size, political stability, stock of human capital and regional dummies. The second is the individual choice variables. They include the investment ratio and the change of net export. TPC is heavily affected by public policy. However, it is also a result of individual optimal choices. The third category is the demand-side variable including the changes of investment, government consumption and net export. Finally, the dependent variable, the economic growth rate, is the market outcome variable that is the final result of aggregate choices. Although market outcomes like economic and productivity growth may have feedback effects on some institutions, the effects may not be systematic, require long duration and likely to have only minor importance in a relatively short period. In the empirical studies, we presume the individual choices and the market outcome are totally driven by the historical and institutional variables while the possible feedback effects are assumed to be of no importance and are captured by the error term, if they exist.[5]

The following empirical models can be classified into two categories: the equilibrium models and the extended models (the AS-AD models). The extended models include both supply-side and demand-side variables while the equilibrium models include the supply-side variables only. In the equilibrium models, coefficients of the supply-side variables are capturing the supply-side as well as their demand-side effects, and the coefficients estimate their effect on the equilibrium growth rate. In the case of the extended models, the coefficients of the supply-side variables indicate their effects on aggregate supply only.

5.1 International Exchange and Productivity Growth

[5] Beside public and private organizational structures, institutions include collective choices, norms, beliefs and rules that direct behaviors by determining the subjective costs and benefits of individual choices. Institutions tend to be independent of individual actions, rigid and stable overtime and are the major driving forces of market choices and outcomes.

Trade may have significant impact on GDP, but there are many other factors that are related to trade, institutions and growth at the same time. All the plausible institutional variables along with the regional dummies that may affect the growth rate are included in the equilibrium Model 1 and the extended Model 2 in order to reduce the possibility that it is the omitted variables driving the results. We can also observe the robustness and the differences by comparing the results of the two models.

Estimations B1P and B2P report the results of the most comprehensive equilibrium and extended models respectively. The results indicate that per capita trade does have significant positive effect on the productivity growth in both models. Since the positive productivity effect of TPC is likely to have positive spillovers to the demand-side, as expected, the estimate of TPC decreases in magnitude and significance in the extended model.

In estimation B2P, the models can explain up to 80 per cent of the variance in GDP growth across nations. However, the issue about the independent effect of trade in the literature is still unresolved. The possibility cannot be eliminated that TPC is capturing the effect of omitted variables even though the extensive control variables are included.

Insert Table B about here

Table B: International Exchange and Productivity Growth

Estimations	B1P	B1T	B1TPC	B2P	B2T	B2TPC
			Dependent Variables			
	GR	GR	TPC	GR	GR	TPC
Indep. Var.						
TPC	0.000633	---	---	0.000343	---	---
	3.4***			2.5**		
IY	15.04	17.763	---	2.8216	---	---
	2.9***	3.9***		0.7		
GY	-5.90	-5.966	-365.39	-7.53	-7.37	-482.11
	2.1**	2.2**	0.4	2.3**	2.2**	0.4
HUMAN	0.616	0.560	29.46	0.3271	0.322	13.67
	1.6	1.5	0.2	1.0	1.0	0.1
HUMAN2	-0.02	-0.018	-0.68	-0.015	-0.016	-1.81
	0.8	0.7	0.04	0.7	0.7	0.12
INSTAB	-1.3	-1.432	-121.6	-0.4011	-0.367	-98.19
	3.3***	3.4***	0.84	1.1	0.9	0.6
y0	-0.00107	-0.000819	0.3277	-0.000506	-0.000370	0.3979
	3.7***	2.9***	3.9***	2.8***	2.3**	4.1***
y02	1.64N8	1.62N8	7.05N7	6.38N9	6.33N9	2.0N7
	1.3	2.0**	0.28	1.5	1.4	0.07
Y70	19.95N10	9.31N10	-1.69N6	13.1N10	7.43N10	-1.65N6
	3.5***	1.98***	4.0***	2.7***	2.0**	3.9***
RIGHT	-0.287	-0.0621	342.98	-0.155	-0.02	390.7
	0.7	0.2	1.9*	0.5	0.07	2.3**
CIVLIB	0.597	0.35	-486.8	0.25	0.06	-547.1
	1.4	0.9	2.2**	0.8	0.2	2.6**
dNXY	---	---	---	0.6967	0.83	393.3
				1.5	1.8*	1.6
dIY	---	---	---	1.82	1.95	397.4
				5.4***	6.0***	2.1**
dGY	---	---	---	1.33	1.37	103.1
				3.4***	3.4***	0.6
dLL	0.89	0.74	-170.3	0.68	0.61	-200.6
	3.4***	2.8***	1.6	3.3***	3.0***	2.0*
LAAM	-1.6209	-2.01	-761.965	-0.69	-0.9141	-644.106
	2.4**	3.3***	3.2***	1.0	1.5	3.0***
ASIAE	-0.205	0.15	25.3	-0.25	-0.3218	-193.15
	0.23	0.2	0.08	0.4	0.5	0.7
OECD	0.0476	-0.287	-347.6	0.57	0.449	-399.7
	0.06	0.4	0.9	1.0	0.8	1.1
SAFRI	-2.515	-2.54	-104.0	-1.06	-1.023	127.3
	3.7***	4.0***	0.7	1.8*	1.7*	0.7
CONST.	0.832	1.29	1244.5	1.29	1.59	899.1
	0.5	0.8	2.6**	0.8	0.9	1.8*
R^2	0.651	0.658	0.89	0.797	0.789	0.89
Sample size	82	86	85	82	82	82

Notes:

1. Numbers following the coefficients are the absolute values of White Heteroskedasticity-adjusted t-statistics. *, ** and *** represent 10%, 5% and less than 1 % significant level respectively.
2. HUMAN2 and y02 equal to the square of HUMAN and y0 respectively.
3. Please refer to the notes in Table A also.

5.2 Latin America, Import Substitution Policy and International Exchanges

In the literature, even regional characteristics that are usually employed to solve most endogenous problems suffer from skepticism. The concern is that it is the systematic differences among different parts of the world driving the results. That is, the regional characteristics drive institutions, openness as well as the rate of productivity and economic growth. In that case, empirical results based on regional characteristics may not be caused by trade openness, but by other features in different regions. However, the prior information about the openness policy of Latin America can generate more credibility about the independent positive effect of TPC on productivity growth.

Trade openness is always a major public choice in nations. However, only Latin America (LAAM) has the unique well-documented regional industrial policy. From the early 1950s, the import-substitution ideas for LAAM were supported by the Economic Commission for Latin America. They adopted a deliberate inward-looking development policy through import-substituting industrialization (ISI) development strategy by various distortional trade policies. (Edwards, 1994) This historical background in the region is revealed in the substantial lower level of per capita trade as indicated in B1TPC and B2TPC. LAAM began to open up to the rest of the world in the late 1980s. Our sample period of study is particularly suitable for investigating the effect of ISI. This prior information can provide the causality sequence for verification running as follow: LAAM's ISI strategy → realized international exchanges (TPC) → productivity growth rate → GDP growth rate.

The causality hypothesis is verified in the results reported in Table B1. As indicated in the estimation B1T, LAAM has significantly lower productivity growth of (-2.01) than the reference group. The prior information suggests that part of its effect may be due to the lower level of international exchanges caused by the ISI. Estimation B1P has identical specification as in B1T except that TPC is included. The magnitude of the coefficient of LAAM is expected to be lowered as the effect of the ISI is captured independently by the variable TPC. Although TPC is heavily affected by public policies, it is also an optimizing choice variable that is likely to be affected by the rate of productivity growth. Therefore, the historical, government, institutional and regional dummy variables may affect the international exchange index. Model B1TPC tries to estimate this possibility. The significant negative effect of LAAM (-762) in the estimation matches the prior information while all the other variables have the expected signs. Based on the estimation, the total effect (-2.01) of LAAM on productivity growth rate can be decomposed into the direct effect (-1.62) and its effect through the ISI policy (-0.48). Similar decomposition can be applied to the extended model B2. Column (d) in Table B1 reports the calculations based on the estimates in BiP's and BiTPC's. The calculated total effects (d) match the estimated total effects (a) closely. The consistency between the prior information and empirical evidences suggest that international exchanges do have independent significant effects on productivity growth. The estimations indicate that about 24 percent of the lower productivity and GDP growth rate in LAAM can be explained by their particular ISI policy.[6]

Insert Table B1 about here

[6] Mo (2003) performs similar decomposition on land distribution inequality for explaining the difference of productivity growth between LAAM and ASIAE. In this study, only LAAM having the unique regional industrial policy has the decomposition characteristics. All the other regional dummies have no such feature.

Table B1: ISI, International Exchange and Productivity Growth

Model	(a)= dγ / d LAAM	(b)= ∂γ / ∂ LAAM	(c)= ∂γ / ∂TPC* ∂TPC/ ∂LAAM	(d) = (b) + (c)	(e) = (c) / (d)	(f) = (d)/(a)
B1	-2.0091	-1.6209	0.000633*(-761.965)= -0.4823	-2.103	0.23	1.05
B2	-0.9141	-0.691	0.000343*(-644.11)= -0.221	-0.912	0.24	1.00

Note: Columns (a) and (d) are the estimated and calculated total effects respectively. Their ratio in column (f) indicates the proximity of the alternative estimations.

5.3 Domestic Exchanges versus International Exchanges

Theoretically, higher domestic exchange opportunities reduce the need for international exchange activities. This is revealed in the estimations that the higher the initial real GDP, the lower the TPC in the countries as in B1TPC and B2TPC. With TPC being held constant, the coefficients of Y70 in BiP's estimate the direct effect of the GDP on productivity growth. The substitutability between domestic and international exchanges implies that the total effect of initial GDP is lower than its direct effect. Applying the same decomposing process as in Table B1, the direct and indirect effects of initial GDP on productivity growth rate are reported in Table B2. As expected, our results indicate that the size of an economy has positive effect on productivity growth. However, larger domestic exchange opportunities tend to reduce the level of international exchanges. This indirect effect reduces the direct positive effect of Y70 on productivity growth by 55 and 43 percent in the equilibrium and extended models respectively.[7]

Insert Table B2 about here

[7] Note that the 'productivity growth' in the equilibrium models incorporated the aggregate demand effects.

Table B2: Domestic Exchanges, International Exchanges and Productivity Growth

Model	(a)= dγ / dY70	(b)= ∂γ / ∂ Y70	(c)= ∂γ / ∂TPC * ∂TPC/ ∂Y70	(d) = (b) + (c)	(e)# = (c) / (b)	(f) = (d)/(a)
B1	9.31N10 [0.02]	19.5N10 [0.04]	0.000633*(-1.69N6)= -10.6977N10	8.803N10	0.55	0.95
B2	7.43N10 [0.016]	13.1N10 [0.028]	0.000343*(-1.65N6)= -5.6595N10	7.4405N10	0.43	1

Notes:

1. Number inside the […] is the elasticity of the estimation evaluated at their means.
2. Please also refer to the notes in Tables A and B1.

In absolute values.

5.4 Per Capita Output, International Exchanges and Productivity Growth

International exchanges are more prevalent where institutional arrangements and infrastructures favorable to domestic and international exchanges are present. Therefore, it is commonly observed that countries with higher per capita income for reasons other than trade may trade more. Although various socio-political variables like human capital stock and level of civil liberty are included in the models, the per capita GDP in a country may still capture the institutional quality that is favorable to international exchanges and therefore have a positive partial effect on per capita trade. Estimations in BiTPC's confirm that countries with higher initial income per capita do tend to trade more.[8] The decomposition results in Table B3 reveal that international exchanges can reduce the negative effect of 'economic maturity' suffered by high income countries. Higher international exchanges in the high income countries can raise the productivity growth rate that can mitigate the negative effect of economic maturity on productivity growth up to 27 per cent as estimated in model B2.

[8] Evaluated at their means, the elasticity of per capita trade to per capita income equals (0.3979 *3190)/1030 = 1.23 according to the estimate in B2TPC.

Insert Table B3 about here

Table B3

Per Capita Output, International Exchanges and Productivity Growth

Model	(a)= $d\gamma / d\ y0$	(b)= $\partial\gamma / \partial\ y0$	(c)= $\partial\gamma / \partial TPC$ * $\partial TPC / \partial y0$	(d) = (b) + (c)	(e)# = (c) / (b)	(f) = (d)/(a)
B1	-0.000819	-0.00107	0.000633*(0.3277)= 0.0002074	-0.0008626	0.194	1.05
B2	-0.000370	-0.000506	0.000343*(0.3979)= 0.0001365	-0.0003695	0.27	1

Notes:

1. Please also refer to the notes in Tables A and B1.
2. The calculations related to y0 are based on its first order effect.

In absolute values.

5.5 Section Summary on Identification

The basic difficulty in trying to estimate trade openness on economic growth is that trade openness may be endogenous with many other institutional variables. Therefore, countries whose growth is higher for reasons other than trade may trade more. (for instance, Rodrik et al, 2004) Even we include most of the plausible factors as in Model 2 and having 80 per cent explanatory power, the possibility still exists that some relevant variables are omitted and their effects are captured by TPC. Latin America is observed to have a substantially lower level of TPC. Without prior information, this may be due to historical, geographic, cultural or even unknown fundamental factors specific to Latin America which have lowered TPC and productivity growth at the same time. Fortunately, the reason can be traced back to its well-documented inward-looking ISI. Given the prior information, we can be more certain that the significant lower level of TPC in the region is caused by the regional policy rather than other regional characteristics. We estimate Model C1LA to

identify the effect of the regional policy on the TPC. After including the extensive institutional variables that are likely to have effect on TPC, the model explains 89 percent of the TPC variation and all coefficients are of expected signs. Moreover, in the equilibrium and extended models, both estimations suggest that the effect of TPC explains about 24 percent of the lower GDP growth in Latin America. In addition, the calculated and estimated effects are of close proximity. The prior information and the amazing coincidences suggest that the index of the realized international exchanges is actually driven by the ISI and it in turn drives the market outcome of growth performance in the region. The results provide additional confidence that the TPC is actually capturing the effects of the realized level of international exchanges rather than capturing other omitted institutional factors driving the growth rate in the models.[9] With the additional observations in the decomposition exercises in Tables B2 and B3, we tend to conclude that TPC does have independent effect on productivity growth and it is driven by fundamental factors like public policy, initial GDP and per capita income. In the next sections, we try to estimate the effects of TPC on investment, growth of net export and, at the same time, observe the robustness of our analytical framework and estimations.

5.6 International Exchange, Productivity Growth and Investment

Among all economic variables, investment is known to be volatile, sensitive to expectations and market environment. As a result, it is most likely to be driven by the rate of productivity growth that is determined by fundamentals like the realized level of international exchanges and various institutions in an economy.

Models C1 to C3 are the equilibrium models designed to decompose the investment effect of TPC. To observe the robustness of the estimations, only variables that are most unlikely to be simultaneously determined with the per capita trade are included in model

[9] One can still argue that the ISI strategy may be determined by other even more fundamental factors not included in the models. However, this is beyond the scope of our analyses.

C1. The specification may suffer from the omitted variables problem. In model B2, we introduce the factors that are likely to have close correlation with the TPC. Similarly, Model 3 introduces the political variables RIGHT and CIVLIB as the additional control variables for institutional characteristics. Under our framework, although the estimates and interpretations are different, all three models generate valid estimates on the effects of TPC. The coefficients of TPC and IY in Model 3 reveal the partial effects of international exchanges and investment respectively when all the plausible interactions with the included institutional variables are controlled while the same coefficients in Models 1 and 2 capture all the possible interactions and/or correlations with the omitted institutional variables.

Insert Table C and equations (CiV)'s about here

Table C: International Exchange, Productivity Growth and Investment Ratio

Dependent Variable: GDP Growth Rate (GR)

Estimations	C1T	C1P	C2T	C2T	C3T	C3P
Indep. Var.						
TPC	0.000681	0.000499	0.000883	0.000714	0.00102	0.000854
	2.1**	2.0**	4.4***	4.1***	4.2***	4.1***
IY	---	21.0	---	15.735	---	15.789
		4.8***		3.0***		3.2***
GY	---	---	-9.854	-8.907	-10.23	-9.606
			3.2***	3.3***	3.2***	3.5***
HUMAN	---	---	1.0348	0.6349	0.9409	0.634
			4.2***	2.4**	3.6***	2.5**
HUMAN2	---	---	-0.041	-0.017	-0.0296	-0.011
			2.1**	0.9	1.5	0.6
INSTAB	---	---	-1.5732	-1.2129	-1.5153	-1.2184
			4.0***	3.2***	4.4***	3.3***
y0	-0.000383	-0.000636	-0.00125	-0.00122	-0.00129	-0.00120
	2.0**	3.2***	5.2***	4.6***	5.5***	4.7***
y02	-5.83N10	9.62N9	1.84N8	2.09N8	1.87N8	1.98N8
	0.17	1.9*	2.8***	2.8***	2.9***	2.8***
Y70	2.01N9	2.24N9	2.35N9	2.29N9	2.34N9	2.33N9
	2.3**	3.6***	3.5***	4.1***	3.3***	3.9***
RIGHT	---	---	---	---	-0.88	-0.71
					2.1**	1.8*
CIVLIB	---	---	---	---	1.02	1.00
					2.1**	2.0**
dLL	0.50	0.443	0.802	0.74	0.83	0.71
	4.4***	1.7*	2.6**	2.5**	2.7**	2.5**
CONST.	2.78	0.55	2.98	1.63	2.58	0.49
	5.7***	0.5	2.1**	1.2	1.6	0.3
R^2	0.15	0.30	0.46	0.51	0.49	0.54
Sample size	100	100	85	82	85	82

Note:

1. Please refer to the notes in Table A and B.
2. C3T and C3P are the 'true' equilibrium models with estimates on the total and direct effects of TPC respectively.

(C1V) IY = 5.87N6 TPC + 9.23N6 y0 - 9.23N6 y02 - 1.51N11 Y70 - 0.0065 dLL

(1.2) (2.3)** (3.0)*** (0.8) (0.8)

$R^2 = 0.29$; No. of Obs.: 100

(C2V) IY = 1.06N5 TPC -0.068 GY +0.024 HUMAN -0.0015 HUMAN2

(1.8)* (0.03) (3.8)*** (3.0)***

+ 1.22N7 y0 - 2.15N10 y02 -2.97N14 Y70 -0.02 PINSTAB +0.39 dLL

(0.03) (1.7)* (0.0) (1.9)* (0.5)

$R^2 = 0.45$; No. of Obs.: 82

(C3V) IY = 1.05N5 TPC -0.049 GY +0.019 HUMAN -0.0011 HUMAN2

(1.8)* (0.6) (2.4)** (2.0)**

+ 3.48N6 y0 - 1.07N10 y02 -2.73N12 Y70 -0.02 INSTAB

(0.8) (0.9) (0.2) (1.8)*

- 0.012 RIGHT + 0.003 CIVLIB + 0.71 dLL

(1.2) (0.3) (0.9)

$R^2 = 0.50$; No. of Obs.: 82

The estimations of the three models reported in Table C indicate that TPC have positive effect on productivity growth and all coefficients have the expected signs. Since higher productivity growth raises the profitability of investment, TPC is expected to have positive effect on the investment ratio. (CiV)'s estimate the effect of TPC on investment ratio under the respective models with the expected signs. Accompanied with the estimations on the total and direct effects in Table C, we can decompose the total effect of TPC into the direct and investment effects that are reported in Table C1.

Insert Table C1 about here

Table C1: International Exchange, Productivity Growth and Investment Ratio

Model	(a)= dγ / dTPC	(b) = ∂γ / ∂TPC	(c)= ∂γ / ∂IY*∂IY/ ∂TPC	(d)= (b)+ (c)	(e) = (c) / (d)	(f)= (d)/(a)
C1	0.000681	0.000499	(21.03)*(5.87N6)= 0.0001234	0.000623	0.20	0.91
C2	0.000883	0.000714	(15.74)*(1.06N5)= 0.0001668	0.0008808	0.19	1.00
C3	0.00102 [0.29]	0.000854 [0.244]	(15.789)*(1.05N5)= 0.0001658	0.00102	0.16	1.00

Notes:

1. Number inside the […] is the elasticity of the estimation evaluated at their means. The mean of GR is equal to 3.61.
2. Please refer to the notes in Tables A and B1.

Table C1 indicates that the direct and the indirect investment effects of TPC jointly raise the equilibrium growth rate. In the estimations of Model 1 and 2, the investment channel accounts for about 20% of the total effect. According to the estimate of the 'true' equilibrium model C3, a one percent increase in TPC raises the GDP growth rate by 0.29 per cent and the investment channel account for 16 percent of the total effect.

5.7 Productivity Growth Rate and the Change in Net Export

Higher productivity level increases the international competitiveness of a country's product by lowering the cost of production. A higher rate of productivity growth will therefore result in higher growth rate in net export that in turn raises economic growth through its aggregate demand effect. In various models, TPC, GY and y0 are found to have significant effects on productivity growth with expected signs. We try to look into their effect on the growth of net export by examining Models D1 and D2. For observing the robustness of the results, Model D1 excludes the regional dummy variables. In Model D2, except the

individual choice variable investment ratio, all the plausible variables are included. The results in Table D1 and D2 suggest that the rate of productivity growth does have positive effect on the change of net export. This implies that higher productivity growth directly raises GDP growth and also promotes the growth of net export. For instance, domestic and international exchanges not only raise productivity growth directly, they also raise the growth rate of net export that enhances GDP growth also. In Model D1, the net export effect of TPC accounts for 21 percent of the total effect in the sample period. Our results also suggest that, other things equal, low income level countries under the catching up process can enjoy a higher rate of growth in net export. Estimation D1P is the 'true' extended model. It indicates that a one percent increase in TPC raises the productivity growth rate by 0.11 percent. After the net export effect is incorporated, the elasticity of TPC to GDP growth increases to 0.14.

Table D: Productivity Growth and Growth of Net Export

Estimations	D1P	D1T	D1NX	D2P	D2T	D2NX
			Dependent Variables			
	GR	GR	dNXY	GR	GR	dNXY
Indep. Var.						
TPC	0.000380	0.000477	0.000126	0.000345	0.000449	0.000142
	2.7***	3.8***	1.5	2.5**	3.5***	1.6
IY	2.1434	3.1428	---	---	---	---
	0.5	0.8				
GY	-8.219	-9.840	-2.0448	-7.439	-8.1518	-0.9761
	3.0***	3.2***	1.5**	2.3**	2.4**	0.6
HUMAN	0.1604	0.2162	0.0831	0.3518	0.3357	-0.022
	0.7	0.9	1.6	1.1	1.1	0.3
HUMAN2	-0.0028	-0.000962	0.00124	-0.0178	-0.0124	0.0074
	0.16	0.06	0.3	0.86	0.58	1.5
PINSTAB	-0.241	-0.363	-0.157	-0.399	-0.5865	-0.257
	0.65	0.9	1.5	1.1	1.4	2.1**
y0	-0.000386	-0.000489	-0.000122	-0.000486	-0.000562	-0.000105
	2.0**	2.3**	1.6	2.7***	2.7***	1.2
y02	4.04N9	4.41N9	8.88N11	5.72N9	5.44N9	-3.77N10
	0.8	0.8	0.05	1.3	1.1	0.2
PRIGHT	-0.31	-0.44	-0.17	-0.183	-0.322	-0.190
	1.1	1.6	1.5	0.6	1.1	1.8*
CIVLIB	0.33	0.47	0.168	0.245	0.390	0.199
	1.0	1.5	0.5	0.76	1.2	1.7*
Y70	1.36N9	1.46N9	9.7N11	1.25N9	1.33N9	1.2N10
	2.5**	2.6**	0.7	2.6**	2.6**	0.8
dNXY	0.7899	---	---	0.7301	---	---
	1.9*			1.6		
dIY	2.11	1.78	-0.373	1.913	1.60	-0.424
	6.1***	4.4***	2.5**	5.5***	3.9***	2.7***
dGY	1.41	1.20	-0.25	1.362	1.16	-0.272
	3.3***	3.4***	0.8	3.5***	3.8***	0.98
POPG	0.49	0.53	0.06	0.70	0.74	5.507
	2.8***	3.0***	0.75	3.4***	3.5***	0.66
LAAM	---	---	---	-0.615	-0.5204	0.1293
				0.95	0.8	0.94
ASIAE	---	---	---	-0.133	0.188	0.4395
				0.21	0.27	1.97*
OECD	---	---	---	0.707	0.7598	0.0722
				1.23	1.26	0.42
SAFRICA	---	---	---	-0.956	-1.124	-0.2302
				1.6	1.9*	0.95
CONST.	1.68	1.80	0.309	1.54	1.80	0.36
	1.1	1.2	0.9	0.97	1.1	0.9
R^2	0.77	0.76	0.52	0.795	0.78	0.58
Sample size	82	82	82	82	82	82

Note: Please refer to the notes in Tables A and B.

Table D1: Productivity Growth and Growth of Net Export (Model D1)

F	(a) = dGR / dF	(b) = ∂γ/ ∂F	(c) = ∂GR/∂dNXY * ∂dNXY/∂F	(d) = (b) + (c)	(e)= (c)/(d)	(f)= (d)/(a)
TPC	0.000477 [0.14]	0.000380 [0.11]	0.7899*0.000126= 0.00009953	0.000480	0.21	1
GY	-9.840	-8.2191	0.789875*(-2.0448) = -1.4152	-9.834	0.14	1
y0	-0.000489	-0.000386	0.789875*(-1.22N4) = -0.00009637	-0.000482	0.20	1

Notes:

1. Number inside the […] is the elasticity of the estimation evaluated at their means.
2. Please refer to the notes in Tables A and B1.
3. The calculations related to y0 are based on its first order effect.

Table D2: Productivity Growth and Growth of Net Export (Model D2)

F	(a) = dGR / dF	(b) = ∂γ/ ∂F	(c) = ∂GR/∂dNXY * ∂dNXY/∂F	(d) = (b) + (c)	(e)= (c)/(d)	(f)= (d)/(a)
TPC	0.000449 [0.13]	0.000345 [0.10]	0.730056*0.000142= 0.0001037	0.0004487	0.23	1
GY	-8.152	-7.4391	0.730056*(-0.009761)= -0.713	-8.152	0.087	1
y0	-0.000562	-0.000486	0.730056*(-0.000105)= -0.00007666	-0.000563	0.14	1

Notes:

1. Number inside the […] is the elasticity of the estimation evaluated at their means.
2. Please refer to the notes in Tables A, B1 and D1.

5.8 The Robustness of Estimations and Findings

The consistency of the results among varieties of specifications has provided ample support for the robustness of our results. We tend to conclude that per capita trade does have independent positive effect on productivity growth. Furthermore, in order to eliminate the possibility that it is the outlier observations driving the results, we exclude three outlier observations including Hong Kong, Singapore and Luxembourg in our estimations and find that our conclusions remain intact.

Among the results of various estimations, D1P, C3P and C3T provide the 'true' estimates of the TPC partial effects on economic performance. The extended model D1P provides the point estimate on the effect of TPC on productivity growth that equals 0.000380 or in elasticity, 0.11. The equilibrium model C3T provides the point estimate on the overall effect of 0.00102, or in elasticity, 0.29.[10]

6. Conclusion

Despite all the empirical evidences, prior information and the theoretical reasoning, the potential endogeneity problem that plagued the empirical studies in the literature is not resolved. Our results are potentially sensitive to alternative econometric approaches like simultaneous estimation methods. Up to this stage, the most systematic work to deal with the problem is done in Frankel and Romer (1999). However, it is criticized that their model does not control by institutional variables. The same geographic characteristics may drive the trade variable and economic growth at the same time. Therefore, their findings may be spurious. During the research process, we feel that the controversy will never be fully resolved by simultaneous estimation methods. The reason is that the long-lasting exogenous geographic characteristics in their paper are driving the trade variable. However, they also determine the international competitive level and interaction environment facing

[10] Although the estimates may be linear approximations, we find no consistent dimishing return of per capita trade in quadratic specifications.

all participants in an economy which drives all kinds of institutional evolutions in the very long run.[11] Schematically expressed:

→ international competitive level → institutional arrangements

Geographic characteristics

→ trade openness

Therefore, the construction process of the instrumental variable based on geographic characteristics implies that it must suffer from severe multicollinearity problem with the institutional variables and the identification problem will never be resolved without prior information about causality. With this understanding, we will not be surprised to have the conclusion that institutions trump everything else in the study by Rodrik, et al (2004)

In this paper, we rely on the prior information about LAAM to provide the causality sequence on the level of international exchanges and investigate whether the empirical evidences in conjunction with the implications of the prior information. Additionally, the robustness of our conclusions is supported by observing the effects of pre-determined environmental factors like GDP70 and initial per capita GDP on TPC. Also, the effects of TPC on the individual choice variables like investment ratio and the change of net export are also investigated. Our results appear to be robust and lead us to conclude that ISI policy in and before the sample period has caused the economic underperformance in LAAM through its negative effect on the TPC. Also, TPC has independent positive effect on productivity growth, on reducing the negative effect of 'economic maturity', and promoting growth of capital stock and net export. However, TPC is just an index for the level of realized international exchanges in our models. The general conclusion of our findings is that institutions, besides international and domestic trade, which can facilitate exchanges, creation, and absorption of ideas, knowledge and technology among citizens, will promote economic performances from both the supply and demand sides.

[11] For instance, Mo (1995, 2004).

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