ECCB STAFF RESEARCH PAPER

The Impact of Technology on External Competitiveness in the Caribbean, Latin and South America

By

Kari Grenade

Research Department

Eastern Caribbean Central Bank, St. Kitts

Winston Moore[1]

Department of Economics

University of the West Indies

Cave Hill Campus, Bridgetown, BB11000, Barbados

October 2007

Abstract:

Disclaimer:
The Eastern Caribbean Central Bank (ECCB) strongly supports academic freedom and a researcher's right to publish and encourages such activity among its employees. However, the ECCB as an institution does not endorse the viewpoint of an employee's publication or guarantee its technical correctness. The views and opinions expressed in this paper are solely those of the author(s) and do not necessarily state or reflect those of the Eastern Caribbean Central Bank. No part of this publication shall be used for advertising or product endorsement purposes.

This paper provides an empirical assessment of the impact that technology can have on external competitiveness. Using a production function approach, a model of external competitiveness is formulated and estimated over the period 1990 to 2004 using annual observations on 31 Caribbean, Latin and South American countries. The findings show that technological development and ICT infrastructure are more relevant than ICT diffusion in boosting external competitiveness.

[1] Corresponding author: W. Moore, Department of Economics, University of the West Indies, Cave Hill Campus, Bridgetown, BB11000, Barbados. Tel.: +246-4174279; Fax:+246-4174260; Email: winston.moore@uwichill.edu.bb

Keywords: External competitiveness; Technology; Latin America and the Caribbean; Panel data

JEL Classification: O33; F10; C23;

1. Introduction

According to the World Economic Forum's Report on Global Competitiveness, in 2006, only sixteen countries from the Caribbean and the Americas were ranked in the top 100. This begs the following questions; how can these countries move up their global competitiveness rankings? How equipped are they to respond to the global competitiveness challenge? What can governments do to improve the relative positions of their countries? These are the pertinent questions that have motivated this study on the impact of technology on the external competitiveness of countries in the Caribbean and the Americas. Conventional wisdom is that technological enhancements lead to higher productivity and by extension, external competitiveness. However, a systematic empirical approach that links technology and external competitiveness is yet to undertaken, especially for the Caribbean region.

Issues such as competitiveness and technology have become important ones for small and vulnerable countries in the Caribbean and the Americas as they become more immersed into the global economy. By their very natures, these concepts cannot be de-linked from globalisation, since the competitiveness of a nation is assessed in a global context and technology is a necessary condition for developing countries to compete effectively in the global arena.

Competitiveness and technology are indeed elusive concepts In terms of the former, differences in conceptualisation, definition, measurement and the effects of competitiveness abound in the literature. The analytical framework of competitiveness is usually discussed at two broad levels: national (macro) and firm (micro). At the national or macro level, one definition of competitiveness is the extent to which a country can, under free and fair market conditions, produce goods of an international standard while simultaneously increasing the real incomes of its citizens. The ability of a country to maintain a favourable position in the international arena hinges on many factors, for example, a low-cost export production base that attracts large inflows of foreign capital, high productivity, advancements of research and development programmes, development of technology and a highly trained and skilled labour force (see Rajaram and Zahra, 2000). At the micro level, competitiveness of a firm generally refers to its ability to match the standards of industry leaders. Some of the factors influencing firms' competitiveness include their ability to harness intellectual capital and innovativeness (see Porter 1990).

Technology is also a multi-dimensional concept. It can viewed in terms of the following; (1) physical devices that enhances technical performance, (2) knowledge that drives technological innovation, (3) Processes and applications that begins and ends with solutions and (4) Activities of people - their skills methods and procedures. Indeed the debate over the definition, measurements and classifications of technology has increased over the years.
Notwithstanding their conceptualisations, competitiveness and technology are perceived by policy makers to be key for sustained economic growth
It is a known truism that competitiveness, both at the macro and micro levels, imbued by technological advancements can have a significant impact on economic growth and development. This is also supported by empirical evidence. Fagerberg et al (2004) empirically investigated the nexus between the competitiveness of countries and differences in economic growth and trade performance. Their study placed specific emphasis on the role played by four aspects of competitiveness, namely; technology, capacity, cost and demand. Using a sample of 49 countries over the period 1993 to 2001, giving particular focus to the ECE region, they found that technology competitiveness was the propellant for the growth of the 'Asian Tigers' relative to major other country groups. In regards to the low-income countries in Europe, deteriorating capacity competitiveness was the main factor inhibiting their catch–up in technology and economic growth.

More recently, Dahlman (2007) investigated the role of technology on economic growth and competitiveness over the last fifty years of some of the fastest growing economies and found that technology is an increasingly critical facet of globalisation and a necessary pre-requisite for developing countries to effectively compete internationally. In addition to economic growth, Waheeduzzaman (2002) finds that that international competitiveness (proxied by the global competitiveness index) influenced per capita income and human development positively and may have also reduced the inequality in some countries. They cautioned, however, that the cross-sectional focus of the study and the small sample size could jeopardise the full validity of their findings.

Recent research on competitiveness in the Caribbean has tackled a diverse number of issues. Amuedo-Dorantes and Pozo (2004) investigated the impact that worker remittances can have on the real exchange rate in a panel of 13 Caribbean and Latin American countries. The authors found that remittances can reduce the external competitiveness by bidding up the price of the exchange rate. Barclay (2005) examined the impact that trade liberalisation can have on small, less-developed countries, using the case of Trinidad and Tobago. The study found that many of the manufacturing firms in Trinidad and Tobago may not be able to compete in a liberalised trading environment without the help of purposeful policy interventions. Wint (1998), however, in examining the attempts by Caribbean governments to enhance the competitiveness of their economies, argued that there is no simple choice to make between selective and functional interventions. Instead, Wint (1998) proposed that Caribbean governments can manage the process of functional interventions and reduce the risk and improve selective interventions.

The previous literature for the Caribbean (in particular) and to some extent, the Americas has ignored the role that technology can play as an alternative to government interventions as a means of boosting external competitiveness. In addition to filling this gap in the literature, the study makes other noteworthy contributions; first, it provides empirical estimates of the impact that technology can have on external competitiveness. Second, it evaluates whether different components of technology (i.e. development, infrastructure, or diffusion) are more relevant than others. And finally, policy simulations of the potential contributions emanating from greater technological investments are provided.

The remainder of this paper is organised as follows; section 2 reviews the relevant literature, while section 3 deals with the methodology and data. Section 4 presents some stylised facts of the key indicators used in the study while section 5 reports and discusses the empirical results. Section 6 concludes.

2. Literature Review

At the micro level, the competitiveness framework developed by (Porter 1990), in particular, his Business Competitive Index (BCI) is one of the most common approaches used in analysing competitiveness. (Porter 1990) developed a broad-based integrative analytical tool referred to as the “Diamond” to assess the competitiveness of the business environment of a given location. He models the many factors that affect competitiveness by classifying them into the following four aspects; the firm’s strategy, structure and rivalry, their factor inputs, demand conditions they face and the related and supporting industries (clusters)[2]. The role of clusters (local and traded) and demand conditions have unique roles in Porter's competitiveness framework. Traded clusters in particular, are important because they register higher productivity and higher innovative activity than local clusters.

Within the broad framework (Porter 1990) also distinguishes between sophistication with which the companies operate and the quality of the business environment. Porter (2004) finds that imbalances between these two factors can inhibit prosperity. He finds for example in Germany, higher business sophistication compared with the quality of business environment creates a disjunction that is not likely to be sustainable over time and could undermine the quality of companies activities in the country. For the United Kingdom, Porter and Ketels (2003) find that its productivity gap with its peers was as a result of weak management consistent with a business environment which focussed on intense rivalry.

Notwithstanding its widespread use, "cluster thinking" has been met with some criticisms. One of the more important criticism is that the notion of cluster is too vague and its conjecture of high company productivity is exposed to too little empirical testing, Martin and Sunley (2003). There have been other criticisms of Porter's framework for example, the role of Governments. The scepticism hinges on the suspicion that Porter's work is used to camouflage a wide array of harmful Government interventions.

Micro studies also look at the impact of research and development (R&D) on firms' competitiveness. Berman (1990) examined the impact of R&D consortia, (the emphasis being on technology diffusion), on the competitiveness of American companies. After surveying 143 consortia, he concluded that R&D consortia are not a major force increasing the US technological competitiveness, since only 41 consortia were actively engaged in research for competitiveness. In light of his findings, he conjectured that R&D consortia may have been more influential on firms that are catching – up technologically. Landesmann and Pfaffermayr (1997) also proffer the "catching –up" argument as a possible explaination for the differences in the effectiveness of R&D efforts on the competitiveness of OECD exports. Bhavani (2002) in his study of the impact of technology on the competitiveness of the Indian small manufacturing sector found that the usage of advance technology as represented by sophisticated machinery had a significant positive impact of sales turnover and the competitiveness of the firms.

---

[2] Defined as the geographic concentration of companies and institutions active in a specific economic field. (Porter 1998).

Competitiveness studies underpinned in macro foundations relate competitiveness to the productivity of a nation, its trade performance and the economic well being of its citizens. Some studies, however, in particular, Porter (1990), Markusen (1992) and Ezeala-Harrison (1995) have cautioned that trade performance does not adequately reflect the competitiveness of a country. Markusen (1992), for example, advocates the use of an index of productivity efficiency as a more reliable gauge of a country's competitiveness than trade performance.

Fagerberg (1988) develops and test a model of differences in international competitiveness and economic growth across 15 OECD countries over the period 1961-1983. The author's model linked the development of domestic and external market shares to the ability to compete in technology, capacity and price. Fagerberg's results suggest that over the medium and long run, technology and capacity rather than price are more important for market share and growth. Berndt and Morrison (1995) examined broad correlations of information technology (IT) with labour productivity as well as multifactor productivity and found that IT was correlated with significantly increased demand for skilled labour. In addition, they also document positive correlations between IT capital and some measures of economic performance. Laursen (1996) also demonstrates that a positive relationship exists between changes in economic growth and changes in technological capabilities in his study of 20 countries over the period 1965 -1988.

Some studies have also found that technology can enhance export diversification. Gouvea (2002) in his empirical examination of technology on export diversification and international competitiveness of 19 countries worldwide found that countries with a high technology intensive export structure were generally more competitive. Similarly, Fabio and Francesco (2005) undertook an econometric exploration of the relationship between technological activities and export performance of 9 large developing countries and 25 primary and secondary sectors over the period 1985 to 1998. The results suggest that technology generates exports gains in high technology sectors. In addition, structural changes in innovative activity are a critical conduit through which technology is transmitted to improved export performance. Most recently, Fagerberg, Srholec and Knell (2007) in their empirical analysis of 90 countries with varying levels of development during 1980-2002 found technology to be on e of the relevant factors contributing to growth and development.

This study also embraces the micro and macro facets of competitiveness, but pays particular focus to the role of technology on the external competitiveness of countries in the Caribbean and the Americas. The focus on technology is important because as small developing countries immersed in the global system, their economic survival essentially hinges on their ability to exploit innovations and technological initiatives. The global economic realities require the harnessing of technology as a key propellant to the further economic development of these small vulnerable countries.

3. Methodology and Data

3.1 Econometric Model and Approach

Assume that the aggregate production function for the economy follows a Cobb-Douglas specification with constant returns to scale between capital and labour:

$$Y_t = A_t K_t^{\alpha} H_t^{\beta} L_t^{1-\alpha-\beta}$$

where Y_t is output, A_t is an index of the level of technology, K_t, H_t and L_t are stocks of physical capital, human capital and labour respectively. An increase in A suggests that the country will experience an improvement in the production function which, in turn will have a positive impact on the marginal productivities of both capital and labour.[3] Dividing both sides by the labour force and taking logarithms, one obtains:

$$y_t = b_1 a_t + b_2 h_t + b_3 k$$

The level of technology is not observed. Assume that the unobserved level of technology is a function of three factors, (1) technological development (td); (2) ICT infrastructure ($ictinfr$), and; (3) ICT diffusion ($ictdiff$):

$$a_t = f(td, ictinfr, ictdiff)$$

Following Fagerberg, Knell and Srholec (2004) technological development captures innovation in the country and is made up of

[3] To see the impact that a change in technology can have on the productivity of labour and capital, differentiate the production functions with respect to capital and labour to obtain the marginal product of capital and labour, respectively. Then differentiate these expressions with respect to A, technology, and evaluate the sign of the resulting expression.

research and development expenditure (R&D) (% of GDP), patent applications (per million) and scientific and technical articles (per million). ICT infrastructure refers to the resources the country have available to exploit technological developments. This measure is composed of the number of personal computers (per 1000 persons) and telephone mainlines (per 1000 persons). The final technology indicator, ICT diffusion, attempts to capture the ability to quickly put new technologies to use and is composed of information and communication technology (% of GDP) and gross capital formation (% of GDP).

Substituting Equation (3) into Equation (2), gives:

$$y_t = bf(td_t, ictinfr_t, ictdiff_t) + b_2 h_t + b_3 k$$

In Equation (4), an increase in the technology indicators would lead to a rise in A and therefore an increase in the marginal productivity of capital and labour. Since productivity is a proxy for external competitiveness, Equation (4) can therefore provide an evaluation of the impact of technology on external competitiveness.

Equation (4) may be re-written in a panel error correction form:

$$\Delta y_t = \lambda_1 y_{it-1} + \lambda_2 td_{it-1} + \lambda_3 ictinfr_{it-1} + \lambda_4 ictdiff_{it-1} + \lambda_5 h_{it-1} + \lambda_6 k_{it-1} + \sum_{i=1}^{n} \gamma_i \Delta Z_{it-1} + u_{it}$$

where λ_i is an estimate of the error correction mechanism. The long-run coefficients are given as λ_i / λ_1. The main advantage of the ECM representation of the model is that standard estimation and inference methods can be employed regardless of the order of integration of the explanatory variables. However, to obtain valid coefficient estimates, the ECM must exists (the adjustment parameter must be negative and significant), the residuals must be uncorrelated and the explanatory variables must be strictly exogenous. To ensure that these assumptions are satisfied, the adjustment parameter is tested for significance using a normal t-test, an AR tests is employed to investigate whether the errors are correlated. The equation is estimated using the method of ordinary least squares.

In addition to using the output per labour ratio to measure external competitiveness, a competitiveness index is also employed as the dependent variable in Equation (5). Two of the main indicators of external competitiveness are export demand and foreign direct investment inflows. The authors therefore develop an index of external competitiveness using these two indicators. The index is derived as the un-weighted average of the index of exports of good and services per capita and gross foreign direct investment as a ratio of GDP. Equation (5) is therefore re-estimated using this proxy of external competitiveness in order to evaluate the robustness of the results.

3.2 Data

The study uses annual observations on 31 Caribbean, Latin and South American countries over the period 1990 to 2004. Output is proxied by real GDP in US dollars taken from the United Nation's National Accounts Database (UNNAD), available online at www.unstats.un.org. Labour is proxied by the number of persons aged 18-64 and is taken from the World Bank's World Development Indicators (WDI) CD-Rom for 2005, while physical capital stocks are obtained using the perpetual inventory method and data on domestic investment from UNNAD for the period 1970 to 2004. For the revealed competitiveness index data on exports of goods and services (per capita) and gross foreign direct investment (% GDP) are taken from the WDI database.

The technology variables are composite indicators. All the input indicators are converted to indices with a base year of 2000 and an unweighted average is calculated to obtain the aggregated indices. Technological development is composed of relative R&D (% of GDP), patent applications (per 1000 persons) and scientific and technical articles (per 1000 persons) The technological diffusion indicator is composed of gross capital formation (% of GDP) and information and technology expenditure (% of GDP), while the technology infrastructure index is made up of the relative number of personal computers (per 1000 persons) and telephone mainlines (per 1000 persons).[4] All the technology data are taken from the WDI CD-ROM 2005.

The two remaining indicators employed in the study are human capital and the rule of law. The human capital index is calculated similar to the technology indicators. It is an unweighted average of the base year 2000 indices of secondary school and tertiary enrolment rates taken from WDI CD-ROM 2005. The rule of law is obtained from Kaufman, Kraay and Mastruzzi (2007) World Governance Indicators database available online at www.govindicators.org.[5]

[4] For some of the indicators there were missing values. Missing data points were filled using a linear trend between the nearest neighbor, average annual growth over the available period or group mean substitution.

4. Stylised Facts

This section presents some stylised facts of the key development and technology indicators used in this study:

GDP per Capita

Figures 1 and 2 show the per capita GDP (in $US 2000) and the average GDP per capita growth over the period 1990 to 2004 respectively of all the countries used in the study. Most countries can be seen clustering between a per capita GDP level of US$500 and US$3500 which is below the sample average of US$ 3883.80. Six CARICOM countries (including two from the OECS) and five Latin American countries had per capita GDP levels above the sample average. Bahamas had the highest GDP per capita level and Nicaragua the lowest on average over the sample period, in contrast, Chile recorded the fastest growth on average while Venezuela the lowest (Figure 2). Some countries for example, The Bahamas and Barbados with high GDP per capita levels have experienced relatively low growth on average over the period, while other countries such as Chile, Guyana and the Dominican Republic which have recorded low per capita GDP levels have been growing relatively fast over the period. This could be indicative of some degree of income convergence. The two figures highlight the tremendous diversity in economic performance across countries.

Technological Development Indicator

This is a composite index comprising: R&D (% of GDP), the number of patents per capita and a measure of the science base of a country proxied by the number of scientific and technical articles published. This composite index is intended to give a more reliable picture of the technological development or innovativeness of countries as opposed to any one component by itself. Table 1 provides observations on each component of this indicator. Foremost, developing countries in the Caribbean, South and Latin America have expended very little on R&D as a proportion of GDP. Brazil was the best performer, expending about 0.9 % of GDP on average over the sample period while El Salvador rounded up the bottom with 0.009 % of its GDP on average. Another observation is that CARICOM countries have been lagging behind their Latin and South American counter-parts. Trinidad and Tobago is the only CARICOM country with an average R&D to GDP ratio exceeding 0.1 %, on average, over the sample period.

---

[5] The governance indicators are only available from 1996 to 2006. Therefore a linear trend is employed to extrapolate the missing years from 1990 to 1995.

In relation to patent applications, Table 1 shows that most countries in the sample have had a very small number of patent applications. This could indicate a low propensity to patent or limited patentable outputs over the study period. Some South and Latin American countries in particular, Brazil, Argentina and Chile have had more patent applications per capita than the CARICOM countries with the exception of Barbados which recorded about seven patented inventions on average over the sample period, Jamaica, about five on average and Trinidad and Tobago about three on average on a per capita basis. The other CARICOM countries had zero patents per capita on average over the study period. In addition, there were very few published science and technology articles by the CARICOM countries with the exception of Jamaica, Barbados and Trinidad & Tobago. In general however, the number of published scientific and technical articles published over the study period was generally low for all countries. Notable exceptions included Brazil and Argentina where the number of articles published more than doubled between 1990 and 1999. Mexico, Chile, to some extent Venezuela and Colombia also recorded relatively healthy numbers of publications over the period.

Technological Diffusion Indicator

This is a composite index of gross capital formation (GCF) per capita and information communication technology (ICT) expenditure as a percentage of GDP. From Table 2 it can be seen that GCF per capita has been rising for most of the countries over the sample period with Paraguay being the only outlier. ICT expenditure as a percent of GDP has also been on the uptrend. Although the percentage increases among countries have not been very pronounced, certain countries stand out. For example, Brazil expended around 5.5 percent of its GDP on ICT in 1990 and by 2004 the ratio had climbed to almost 7.0 percent. For Venezuela, the ratio was 3.6 percent in 1990 and by 2004 it had rose to 5.2 percent.

Technological Infrastructure Indicator

This indicator is comprised of the relative number of personal computers (PCs) (per 1000 persons) and number of telephone mainlines (TLs) (per 1000 persons). In observing the trends in the individual components, it is noted that more persons have had access to personal computers over the study period; this is true for all countries in the sample. Indeed, the increases have been spectacular in most countries. For instance, PCs per 1000 persons in Belize was 2.93 in 1990, this increased to 106.86 in 1999 and to 138.34 in 2004.

St Kitts and Nevis, Grenada, Costa Rica and Uruguay also stand out. The picture is much the same for TLs, however, the increases have been less spectacular (Table 3).

5. Empirical Relationship between Technology and External Competitiveness

5.1 Regression Results

Table 4 provides the empirical results of the potential contribution of technology to the external competitiveness of some selected Caribbean, South and Latin American countries. Long-run coefficient estimates are presented for all the explanatory variables. The second and third columns of the table use the production function approach to evaluate external competitiveness (i.e output per labour as the dependent variable). The model augments the production function with various measures of technology (development, diffusion and infrastructure) to quantify the impact on the nation's production function and in turn, its external competitiveness.

Due to missing observations, an unbalanced panel is employed to obtain the coefficient estimates. Looking first at the test statistics, the empirical fit of the models is adequate explaining more than 50 percent of the fluctuations in external competitiveness (in the case of the productivity model) during the sample period. The null hypothesis of no autocorrelation in the residuals from the two models is accepted at the 5 percent level of testing.

Colum 2 of Table 4 assumes that the error correction mechanism across all the countries is similar (i.e homogeneous model). The estimated coefficient on the error-correction term is negative and significant, indicating the existence of a long-run equilibrium relationship between the output labour ratio and the chosen explanatory variables. The estimate suggests that if there is a shock that disturbs the long-run equilibrium between the variables, it takes just under three years to return to equilibrium (or about 35% in the first year).

The coefficient estimate on the capital labour ratio indicates that a 1 percent increase in this ratio, increases output per unit of labour by 0.3 percent and is in line with previous empirical estimates of the production function (Barro and Sala-i-Martin, 2004). The human capital index is positive and statistically significant at normal levels of testing, confirming that a higher quality workforce should increase the level of production per worker. The other control variable included in the regression is a governance indicator, the rule of law, which captures the impact that institutions can have on productivity. In line with *a priori* expectations, the greater the level of economic agents' confidence in the rules of the society, the higher the output labour ratio.

The remaining indicators in column 2 of Table 4 all measure some aspect of the technology of a country. In general, the regression results provide empirical evidence that technological developments are positively related to external competitiveness in the Caribbean, South and Latin America. The overall technology index indicates that a 10 percent increase should increase the output labour ratio by 2 percent. The effects of technological development, however, can be boosted if the country also makes additional investments in upgrading its IT infrastructure. A 10 percent increase in this variable boosts productivity by about 1 percent. Although this coefficient might appear small, this 1 percent increase in output per labour might make a meaningful contribution to the economic growth and development of some of the very poor countries in the Caribbean and the Americas. Further research is therefore needed to quantify the effect of increases in competitiveness/productivity on economic growth. The combined effects of greater technological development as well as ICT infrastructure investment are on par with those obtained from increasing the capital labour ratio. The ICT diffusion index is, however, insignificant at normal levels of testing as the effects of diffusion may be captured by the other technology indicators.

The results reported earlier, assume a homogenous error correction mechanism across countries; i.e. if there is a shock to the equilibrium of the empirical model, the mechanism whereby the variables return to equilibrium is similar. This assumption is somewhat restrictive given that the database contains a diverse group of countries with differing economic structures. The authors therefore relax this assumption by allowing the adjustment process to differ in each country. The error correction estimate reported in column 3 of Table 4 is therefore the un-weighted mean of these terms (see Table 5 for the estimate for each country). The mean and individual country estimates of the error correction term are quite similar across countries and close to that obtained from the homogenous error correction model. The coefficient estimates for the control variables and technology indicators are quite similar to those obtained earlier.

The empirical results reported thus far are obtained from a simultaneous equation system that models the impact of technology on competitiveness using a production function approach. Alternatively, one could have employed a more direct approach.

Columns 4 and 5 of Table 4 therefore use an index of revealed external competitiveness as the dependent variable. Examining the results for the homogenous and heterogeneous[6] error correction models, the coefficient estimates are somewhat different but the key findings remain unchanged. Therefore, the results seem to be robust to changes in the indicator or model of external competitiveness employed. Human capital and the rule of law have a positive and statistically significant impact on the indicator of external competitiveness. The technology indicators are all positively associated with external competitiveness. Technological development and infrastructure, however, tend to be important over the long-run. However, the revealed competitiveness models do not perform as well as the productivity models and as such, cautioned must be taken when interpreting these results.

5.2 Policy Simulations

The coefficient estimates from the productivity model are used to undertake some policy simulations. Six scenarios are considered: (1) technological development index grows at the country's historical average; (2) ICT infrastructure index grows at the country's historical average; (3) both the technological development and ICT infrastructural development index grow at the country's historical average; (4) technological development index grows at 5% above the country's historical average; (5) ICT infrastructure index grows at 5% above the country's historical country average, and; (6) both the technological development and ICT infrastructure indices grow at 5% above the country's historical average.

Table 6 shows that in the absence of any shift in the present policy regime, i.e. if the technological development and ICT infrastructure indices increase at the country's historical average, this should raise the output labour ratio by on average of 0.102 and 0.045 percentage points per annum, respectively. The combined effect of both variables growing at their historical averages is about 0.147 percentage points per annum. The final three scenarios consider the potential impact of a 5% expansion in technological expenditure above the historical average. The table shows that the annual average growth in the output labour ratio would rise to 0.16 percentage points over a ten year period.

---

[6] The error correction estimates for each country in the heterogeneous model of

6. Conclusions

Most of the previous literature on external competitiveness in the Caribbean and the Americas has focussed primarily on the need for government intervention (for example subsidies) to aid external competitiveness. The literature, however, does not yet examine the role that technology can play as an alternative to such government interventions. The focus on technology is critical especially as small developing counties are forced to be compliant with global trading rules that sanction the use of domestic polices to boost external competitiveness which may be viewed as protectionist. Countries in the Caribbean and the Americas must therefore be concerned with devising other feasible strategies, such as harnessing technological development to enhance their external competitiveness. The paper attempts to fill the gap in the literature by providing empirical estimates of the impact that technology can have on external competitiveness.

The empirical model uses relative productivity as a measure of external competitiveness. As a result, a reduced form production function model is estimated to investigate the impact that technology can have on shifting or improving the production function and thereby productivity and competitiveness. The results from the study suggest that technological development and ICT infrastructure have a positive and statistically significant impact on external competitiveness for the group of countries studied. Indeed, the results suggest that for every 1 percent increase in technological development and ICT infrastructure indices, external competitiveness should rise by about 0.329 percent. Over a ten year period, the cumulative impact on external competitiveness would be around 3.29 percent. These results were robust to changes in the measure of external competitiveness employed. In addition, good governance and human capital of the highest quality are important prerequisites for countries in the Caribbean and the Americas to move up their global competitiveness rankings.

The study has shown clearly the role technology has played and can play in enhancing the competitive strengths of countries in the Caribbean and the Americas. Policy makers in the region must therefore maintain and strengthen the overall efficiency of their nation’s science and technology system. To this end, adequate investment in research and development, updating the ICT infrastructure, improving the business environment for innovation and educating new generations of research professionals are essential for achieving greater gains in external competitiveness and ultimately technology-led economic development, which, incidentally, will be the define tomorrow's global economy.

This study therefore suggests the following strategies to enhance external competitiveness through technology; firstly, the share of resources earmarked for R&D must be significantly increased. The study shows that developing countries in the Caribbean, South and Latin America have expended very little on R&D as a proportion of GDP resulting in very few patent applications. Increase R&D can be achieved through international investment and other strategic alliances with specialised institutes and or research centres. The application of already existing technology is critical for these developing countries which may not necessarily have the means to develop new technologies. The technological capabilities to make use of exiting technology are therefore critical. Secondly, governments must maintain and strengthen where necessary, the technology infrastructure. In addition, a business climate conducive for technological innovation must be fostered that will ensure exports are driven by high tech firms. Finally, governments must ensure that the skills of the workforce are strengthened. To this end, actions such as skill grants, student loans reforms and tax concessions for education should be considered by policy makers.

The authors are cognisant that technology is not a panacea, while on the one hand it confers enormous economic and other benefits; on the other hand it carries great risk especially for developing countries in terms of economic dislocations and marginalisation. This however, is beyond the scope of this study.

The lack of distinction between the Caribbean and the Americas especially in the empirical estimations is acknowledged by the authors as a limitation of the study. However this approach can be justified for the following two reasons, firstly, in a global context, the Caribbean and the Americas region can be considered as a single block for comparative purposes with other regions such as East Asia and Europe. Secondly, an expanded series allow for more degrees of freedom in the estimations and hence more robust results.

References

Amuedo-Dorantes, C. and Pozo, S. (2004) "Workers' Remittances and the Real Exchange Rate: A Paradox of Gifts," *World Development* vol. 32(8), pp. 1407-1417.

Barclay, L.A. (2005) "The Competitiveness of Trinidad and Tobago and Manufacturing Firms in an Increasingly Liberalised Trading Environment," *Journal of Eastern Caribbean Studies*, vol. 30(2), pp. 41-71.

Barro, R.J. and Sala-i-Martin, X. (2004) *Economic Growth*, MIT Press, Cambridge, MA.

Berman, E.M., (1990) "R&D Consortia: Impact on Competitiveness," *The Journal of Technology Transfer*, vol. 15 (3), pp. 5-11.

Berndt, E.R. and J.C. Morrison (19950, "High-tech Capital Formation ans Economic Performance in U.S. Manufacturing Industries: An Exploratory Analysis." *Journal of Econometrics,* vol. 65, pp 4-43.

Bhavani, T., "The Impact of Technology on the Competitiveness of the Indian Small Manufacturing Sector," *WIDER* Discussion Paper no. 76, World Institute for Development Economics Research, United Nations University.

Coase, R., (1998) "The New Institutional Economics," *The American Economic Review*, vol. 88 (2), pp. 72-74.

Dahlman, C., (2007) "Technology, Globalisation and International Competitiveness: Challenges for Developing Countries," Georgetown University.

Ezeala-Harrison, F., (1995) "Canada's Global Competitiveness Challenge: Trade Performance versus Total Factor Productivity Measures," *American Journal of Economics and Sociology,* vol. 54 (1), pp. 57-78.

Ezeala-Harrison, F.,(2005) "On the Competing Notions of International Competitiveness," *Advances in Competitive Research*, vol. 13 (1), pp. 80-87.

Fabio, M., and R. Francesco (2005) "The Impact of Technology and Structural Change on Export Performance on Nine Developing Countries," *World Development*, vol. 33(4), pp. 527-547.

Fagerberg, J., (1988) "International Competitiveness," *The Economic Journal*, no. 391, pp. 355-374.

Fagerberg, J., M. Knell and M. Srholec (2004) "The Competitiveness of Nations: Economic Growth in the ECE Region," Prepared for UNECE Spring Seminar, Geneva.

Fagerberg, J., M. Knell and M. Srholec (2007) "The Competitiveness of Nations: Why Some Countries Prosper While Others Fall Behind," *World Development,* vol. 35 (10), pp. 1595-1620.

Gouvea, R., (2002) "The Effect of Technology on International Competitiveness and Export Portfolio Diversification," *Global Competitiveness.*

Kaufmann, D., Kraay, A. and M. Mastruzzi (2007) "Governance Matters VI: Governance Indicators for 1996-2006," *World Bank Policy Research Working Paper* No. 4280, Washington, DC.

Landesmann, M., and M. Pfaffermayr (1997) "Technological Competition and Trade Performance," *Applied Econometrics*, vol. 29 (2), pp. 179-196.

Laursen, K., (1996) "The Impact of Technological Opportunity on the Dynamics of Trade Performance," *DRUID Working Papers*, No 12, Danish Research Unit for Industrial Dynamics, Denmark.

Markusen, J.R., (1992) "Productivity, Competitiveness, Trade Performance and Real Income: The Nexus between Four Concepts," Economic Council of Canada for Minister of Supply and Services Canada.

Martin, R, and P. Sunley (2003) "Deconstructing Clusters: Chaotic Concept or Policy Panacea?" *Journal of Economic Geography*, vol. 3, pp. 5-35.

Porter, M.E., (1990) "The Competitive Advantage of Nations," *Harvard Business Review*, no. 2, pp. 73-93.

Porter, M.E., and C. Ketels (2003, "U.K. Competitiveness: Moving to the Next Stage," *DTI Economics Paper* no. 3, Department of Industry and Trade, London.

Porter, M.E. (2004) "Building the Microeconomic Foundations of Prosperity: Findings from the Business Competitiveness Index," Sala-i-Martin, X. (ed.), *The Global Competitiveness Report 2003-2004*, Oxford University Press, New York.

Rajarman, V., and S.A. Zahra (2000) "Competitiveness in the 21st Century: Reflections on the Growing Debate about Globalisation," *Advances in Competitive Research*, vol. 8 (1), pp. 14-32.

Rustagi, N.,K., (1994) " Competitive Strategies for Newly Democratized Countries," *International Journal of Commerce and Management*, vol. 4(3), pp. 5-24.

Sigel, E., (2006) "International Competitiveness and Comparative Advantage: A Survey and a Proposal for Measurement," *Journal of Industry Competition and Trade*, vol. 6 (2), pp. 137-159.

The World Economic Forum Global Competitiveness Index, 2006-2007.

Waheeduzzaman, A., N.M., (2002) "Competitiveness, Human Development and Inequality: A Cross-National Comparative Inquiry, *Competitiveness Revie*w, vol. 12 (2), pp. 13 -29.

Wickham, P. (1987) "A Revised Weighting Scheme for Indicators of Effective Exchange Rates," *IMF Working Paper*, 87/87, International Monetary Fund, Washington, DC.

Wint, A.G. (1998) "The Role of Government in Enhancing the Competitiveness of Developing Economies: Selective Functional Intervention in the Caribbean," *International Journal of Public Sector Management*, vol. 11(4): 281-292.

Appendix

Table 1: Technological Development Indicators

Country	Research & Development (% of GDP)			Patent Applications (Per capita)			Scientific & Technical Articles Published (#)		
	1990	1999	2004	1 990	1 999	2 004	1 990	1999	2 004
CARICOM									
Antigua & Barbuda	0.093	0.088	0.129	0	0	0	0	0	n.a
Bahamas	0.093	0.088	0.129	0	0	0	1	1	n.a
Barbados	0.093	0.088	0.129	0	3.76	18.4 8	15	15	n.a
Belize	0.093	0.088	0.129	0	0	0	0	4	n.a
Dominica	0.093	0.088	0.129	0	0	0	0	1	n.a
Grenada	0.093	0.088	0.129	0	0	0	0	1	n.a
Guyana	0.093	0.088	0.129	0	0	0	5	4	n.a
Jamaica	0.093	0.088	0.129	4.60	4.30	3.78	56	44	n.a
St Kitts & Nevis	0.093	0.088	0.129	0	0	0	0	1	n.a
St Lucia	0.093	0.088	0.129	0	0	0	0	1	n.a
St. Vincent & Grenadines	0.053	0.053	0.154	0	0	0	0	0	n.a
Suriname	0.093	0.088	0.129	0	0	0	2	3	n.a
Trinidad & Tobago	0.132	0.123	0.104	3.95	0.00	3.66	45	37	n.a
Non-CARICOM, South &Latin America									
Argentina	0.417	0.453	0.413	25.5 2	25.3 0	24.4 5	1 627	2 705	n.a
Bolivia	0.326	0.298	0.280	2.55	2.08	1.93	17	33	n.a
Brazil	0.775	0.874	1.040	18.3 3	11.6 5	36.9 3	2 374	5 950	n.a
Chile	0.583	0.507	0.542	11.6 6	10.1 7	9.68	830	1 062	n.a

Colombia	0.299	0.199	0.101	1.89	1.64	1.49	122	254	n.a
Costa Rica	0.298	0.332	0.387	0	0	0	61	76	n.a
Dominican Republic	0.093	0.088	0.129	0	0	0	11	6	n.a
Ecuador	0.088	0.078	0.078	0.68	1.23	0.54	20	20	n.a
El Salvador	0.009	0.009	0.009	0.59	0.49	0.46	6	0	n.a
Guatemala	0.268	0.273	0.290	0.69	0.63	0.49	20	14	0
Honduras	0.054	0.054	0.054	1.44	1.27	1.00	6	11	n.a
Mexico	0.309	0.429	0.394	4.67	4.85	6.13	1 038	2 925	n.a
Nicaragua	0.084	0.084	0.084	2.75	1.82	1.92	5	8	n.a
Panama	0.328	0.328	0.328	7.92	6.76	6.37	44	37	n.a
Paraguay	0.083	0.083	0.083	0	0	0	7	4	n.a
Peru	0.082	0.096	0.103	2.23	1.88	1.77	77	60	n.a
Uruguay	0.265	0.257	0.238	9.98	8.17	9.17	57	159	n.a
Venezuela	0.289	0.330	0.438	7.41	6.13	5.70	314	523	n.a

Source: World Bank Development Indicators 2005
‘n.a.’ means not available
Where data were missing, group mean substitution was used

Table 2: Technological Diffusion Indicators

Country	Gross Capital Formation (Per Capita)			Information Telecommunication Expenditure (% of GDP)		
	1990	1999	2004	1990	1999	2004
CARICOM						
Antigua & Barbuda	2471.319	2766.869	2724.69	5.858	5.858	6.616
Bahamas	3640.735	5194.94	5211.838	5.858	5.858	6.616
Barbados	1413.802	1878.107	1594.241	5.858	5.858	6.616
Belize	673.658	746.3788	824.1054	5.858	5.858	6.616
Dominica	1277.636	944.9852	496.3932	5.858	5.858	6.616
Grenada	1159.685	1514.176	1544.54	5.858	5.858	6.616
Guyana	130.8218	223.6928	193.5611	5.858	5.858	6.616
Jamaica	904.3597	754.2753	947.297	10.416	10.416	11.455
St Kitts & Nevis	2900.676	2666.358	3557.729	5.858	5.858	6.616
St Lucia	763.8854	1106.798	881.4828	5.858	5.858	6.616
St. Vincent & Grenadines	765.24	1025.091	1099.676	5.858	5.858	6.616
Suriname	215.3901	328.9677	675.7493	5.858	5.858	6.616
Trinidad & Tobago	546.1084	1261.547	1355.79	5.858	5.858	6.616
Non-CARICOM, South &Latin America						
Argentina	662.5772	1389.777	926.8179	4.320	4.320	5.678
Bolivia	110.3055	199.0728	111.3038	4.383	4.383	5.809
Brazil	634.4171	701.5181	663.6084	5.552	5.552	6.910
Chile	602.8214	959.9888	1007.265	6.046	6.046	6.671
Colombia	293.7787	245.4953	342.2066	8.486	8.486	9.004
Costa	624.01	738.0672	929.2228	6.851	6.851	7.491

Rica						
Dominican Republic	280.3407	537.92	393.9496	5.858	5.858	6.616
Ecuador	345.645	203.1566	411.4323	2.904	2.904	3.656
El Salvador	199.1512	353.854	366.8067	5.858	5.858	6.616
Guatemala	183.7146	297.3214	289.7422	5.858	5.858	6.616
Honduras	181.7879	303.6005	279.5494	4.227	4.227	4.539
Mexico	934.1692	1283.306	1181.272	3.142	3.142	3.121
Nicaragua	122.5195	278.6783	273.3956	5.858	5.858	6.616
Panama	395.0774	1119.02	1066.804	8.980	8.980	9.152
Paraguay	478.0858	401.1785	285.908	5.858	5.858	6.616
Peru	292.9768	433.778	395.9381	6.948	6.948	6.869
Uruguay	489.545	975.4245	619.2606	6.157	6.157	7.070
Venezuela	482.1425	800.1663	275.83	3.604	3.604	5.194

Source: World Bank Development Indicators 2005
Where data were missing, group mean substitution was used

Table 3: Technological Infrastructure Indicators

Country	Personal Computers (Per 1000 Persons)			Telephone Mainlines (Per 1000 Persons)		
	1990	1999	2004	1990	1999	2004
CARICOM						
Antigua & Barbuda	8.25	64.12	84.94	252.58	488.62	487.77
Bahamas	5.59	49.05	69.61	273.91	368.96	415.27
Barbados	41.24	78.53	104.09	280.61	430.07	496.85
Belize	2.53	106.86	138.34	91.64	154.38	112.73
Dominica	0.13	65.36	89.74	163.83	278.85	303.95
Grenada	0.42	117.79	132.08	176.52	315.13	290.43
Guyana	16.69	24.56	27.30	20.13	74.89	91.51
Jamaica	0.69	43.00	53.86	44.61	190.51	169.73
St Kitts & Nevis	0.44	134.53	191.49	237.46	449.75	500.00
St Lucia	9.44	73.28	99.10	129.38	291.57	319.51
St. Vincent & Grenadines	9.44	73.28	99.10	124.01	208.82	233.53
Suriname	9.44	45.45	99.10	91.68	164.76	151.71
Trinidad & Tobago	4.22	54.16	79.52	141.02	215.79	249.75
Non-CARICOM, South &Latin America						
Argentina	7.22	59.19	81.97	93.05	207.35	218.84
Bolivia	2.22	12.28	22.78	27.57	61.72	72.30
Brazil	3.11	36.31	74.76	65.02	148.73	222.91
Chile	9.39	76.85	119.32	65.97	207.02	221.05
Colombia	8.79	33.66	49.27	69.05	160.27	179.29
Costa Rica	29.21	101.70	197.20	100.51	204.06	250.54

Dominican Republic	5.59	49.05	69.61	47.59	49.05	115.41
Ecuador	1.91	20.14	31.11	47.79	91.01	122.42
El Salvador	3.76	16.25	25.24	24.16	80.49	115.52
Guatemala	1.05	9.92	14.42	21.26	55.07	70.51
Honduras	0.01	9.50	13.59	17.23	44.21	48.15
Mexico	8.23	44.16	81.99	64.83	112.23	157.73
Nicaragua	5.15	20.25	27.93	12.60	30.43	37.39
Panama	7.25	31.96	38.26	92.74	164.25	121.98
Paraguay	2.74	11.20	34.59	26.65	50.03	46.07
Peru	4.62	35.67	42.97	26.15	66.91	67.07
Uruguay	1.51	99.60	110.09	134.26	270.69	279.63
Venezuela	10.26	42.18	60.94	76.29	107.60	110.62

Source: World Bank Development Indicators 2005

Table 4: External Competitiveness and Technology

Dependent Variable	Output Labour Ratio		Revealed Competitiveness Index	
	Homogeneous ECM Model	Heterogeneous ECM Model	Homogeneous ECM Model	Heterogeneous ECM Model
ecm_{t-1}	-0.350 (0.023)**	-0.339 (0.022)**	-0.510 (0.056)**	-0.504 (0.056)**
K/L	0.300 (0.012)**	0.301 (0.012)**	-0.029 (0.017)	-0.022 (0.017)
Human Capital	0.080 (0.015)**	0.106 (0.015)**	0.129 (0.057)*	0.167 (0.057)*
Tech Index	0.227 (0.034)**	0.215 (0.034)**	0.224 (0.059)**	0.204 (0.062)**
ICT Infrastructure	0.102 (0.011)**	0.088 (0.011)**	0.390 (0.030)**	0.381 (0.030)**
ICT Diffusion	0.026 (0.083)	-0.029 (0.083)	0.114 (0.103)	0.118 (0.103)
Rule of Law	0.046 (0.006)**	0.044 (0.006)**	0.073 (0.014)**	0.071 (0.013)**
Adjusted R-squared	0.524	0.518	0.305	0.299
S.E. Regression	0.029	0.029	0.057	0.058
LM Test for Autocorrelation	1.842 [3.840]	0.340 [3.840]	0.371 [3.840]	0.260 [3.840]
Observations	371	371	402	402

Note: *(1)** and * indicate significance at the 5 and 10 percent level of testing, respectively*

(2) Standard errors are in parenthesis

(2) *The maximum lag length for the first differences is set at 1*

(3) All variables, except the rule of law, are expressed in natural logarithms.

Table 5: Heterogeneous Error Correction Estimates for the Productivity Model

Country	*Coefficient Estimate*	*Standard Error*
Antigua and Barbuda	-0.313	0.020
Argentina	-0.310	0.020
Bahamas	-0.301	0.020
Barbados	-0.311	0.020
Belize	-0.338	0.023
Bolivia	-0.373	0.023
Brazil	-0.333	0.021
Chile	-0.323	0.021
Colombia	-0.350	0.022
Costa Rica	-0.326	0.022
Dominica	-0.340	0.022
Dominican Republic	-0.341	0.022
Ecuador	-0.369	0.024
El Salvador	-0.345	0.022
Grenada	-0.339	0.022
Guatemala	-0.354	0.022
Guyana	-0.383	0.024
Honduras	-0.384	0.025
Jamaica	-0.343	0.022
Mexico	-0.321	0.020
Nicaragua	-0.388	0.025
Panama	-0.330	0.021
Paraguay	-0.371	0.023
Peru	-0.349	0.022
St. Kitts-Nevis	-0.320	0.022
St. Lucia	-0.330	0.022
St. Vincent and the Grenadines	-0.340	0.023
Suriname	-0.340	0.022
Trinidad and Tobago	-0.313	0.021
Uruguay	-0.317	0.020
Venezuela	-0.325	0.021

Table 6: Annual Average Growth in Output Labour Ratio for Various Scenarios

	Tech Index grows at historical country average	Tech Index grows at region averag e	Both Tech and ICT Infrastructure grow at historical country average	Tech Index grows 5% higher than historical Average	ICT Infrastructur e grows 5% higher than historical Average	Both Tech Index and ICT Infrastructure growth are 5% higher than historical Average
Antigua and Barbuda	0.095	0.045	0.140	0.106	0.050	0.156
Argentina	0.103	0.046	0.149	0.114	0.051	0.165
Bahamas	0.108	0.045	0.153	0.119	0.050	0.169
Barbados	0.112	0.046	0.158	0.123	0.051	0.175
Belize	0.097	0.045	0.143	0.108	0.051	0.159
Bolivia	0.104	0.044	0.148	0.115	0.049	0.165
Brazil	0.099	0.045	0.144	0.111	0.050	0.160
Chile	0.102	0.046	0.148	0.114	0.051	0.164
Colombia	0.104	0.046	0.149	0.115	0.051	0.166
Costa Rica	0.094	0.045	0.139	0.105	0.050	0.155
Dominica	0.099	0.044	0.143	0.110	0.049	0.159
Dominican Republic	0.108	0.045	0.153	0.119	0.050	0.169
Ecuador	0.098	0.046	0.144	0.109	0.051	0.160
El Salvador	0.103	0.045	0.148	0.114	0.050	0.164
Grenada	0.096	0.044	0.140	0.107	0.049	0.157
Guatemala	0.102	0.044	0.146	0.113	0.049	0.162
Guyana	0.108	0.047	0.154	0.119	0.052	0.171
Honduras	0.104	0.043	0.148	0.116	0.048	0.164
Jamaica	0.105	0.045	0.150	0.117	0.050	0.167

	Tech Index grows at historical country average	Tech Index grows at region average	Both Tech and ICT Infrastructure grow at historical country average	Tech Index grows 5% higher than historical Average	ICT Infrastructure grows 5% higher than historical Average	Both Tech Index and ICT Infrastructure growth are 5% higher than historical Average
Mexico	0.104	0.046	0.150	0.116	0.051	0.166
Nicaragua	0.105	0.045	0.150	0.116	0.050	0.166
Panama	0.114	0.045	0.159	0.125	0.050	0.175
Paraguay	0.108	0.047	0.155	0.119	0.052	0.171
Peru	0.104	0.045	0.149	0.115	0.050	0.165
St. Kitts-Nevis	0.079	0.044	0.123	0.090	0.049	0.140
St. Lucia	0.098	0.044	0.142	0.109	0.050	0.159
St. Vincent and the Grenadines	0.099	0.044	0.144	0.111	0.050	0.160
Suriname	0.094	0.046	0.140	0.105	0.052	0.157
Trinidad and Tobago	0.098	0.045	0.143	0.109	0.050	0.159
Uruguay	0.102	0.045	0.147	0.113	0.050	0.163
Venezuela	0.115	0.047	0.162	0.126	0.052	0.179
Average	0.102	0.045	0.147	0.113	0.050	0.164

Source: Authors calculations

Figure 1

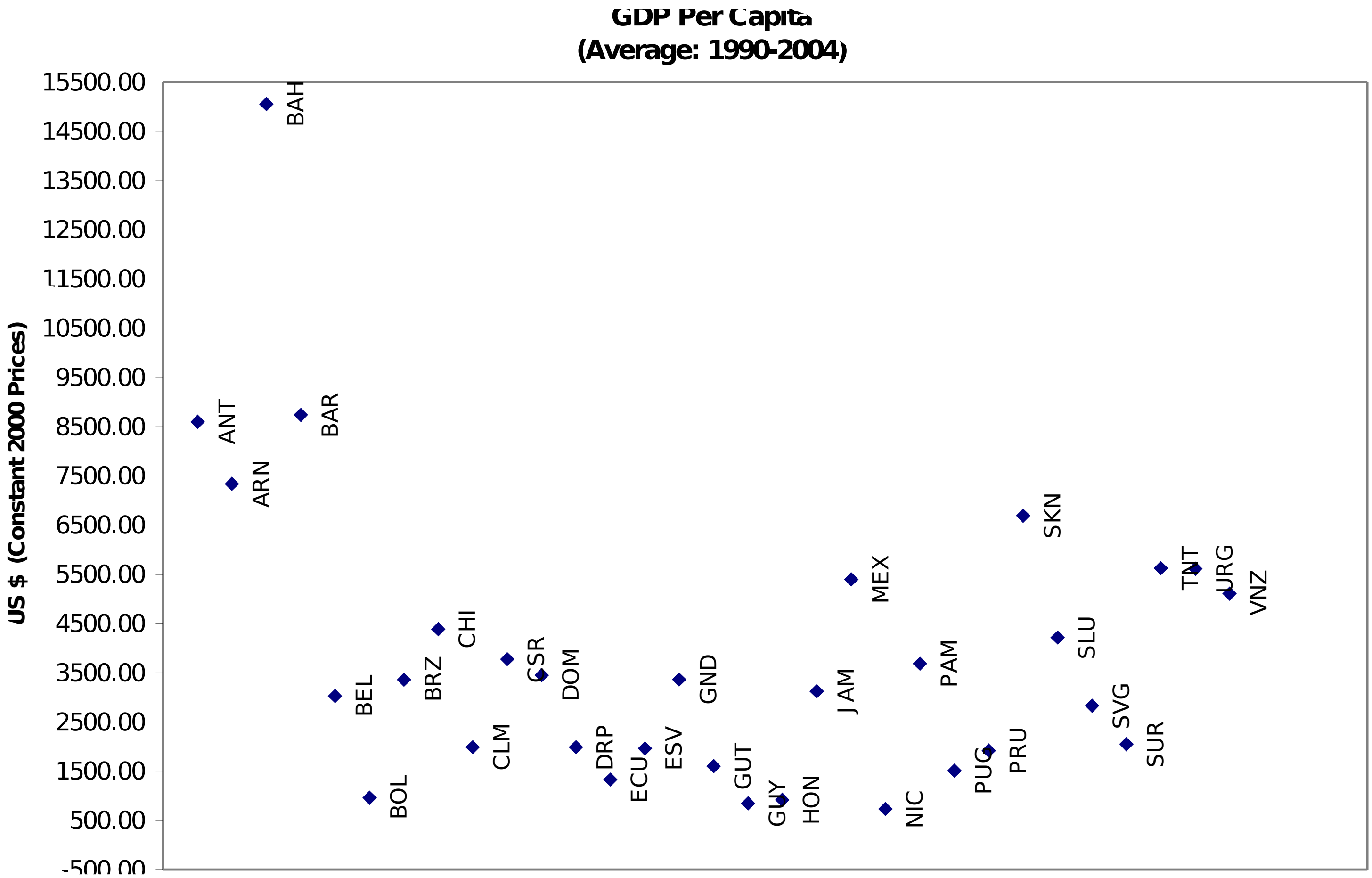
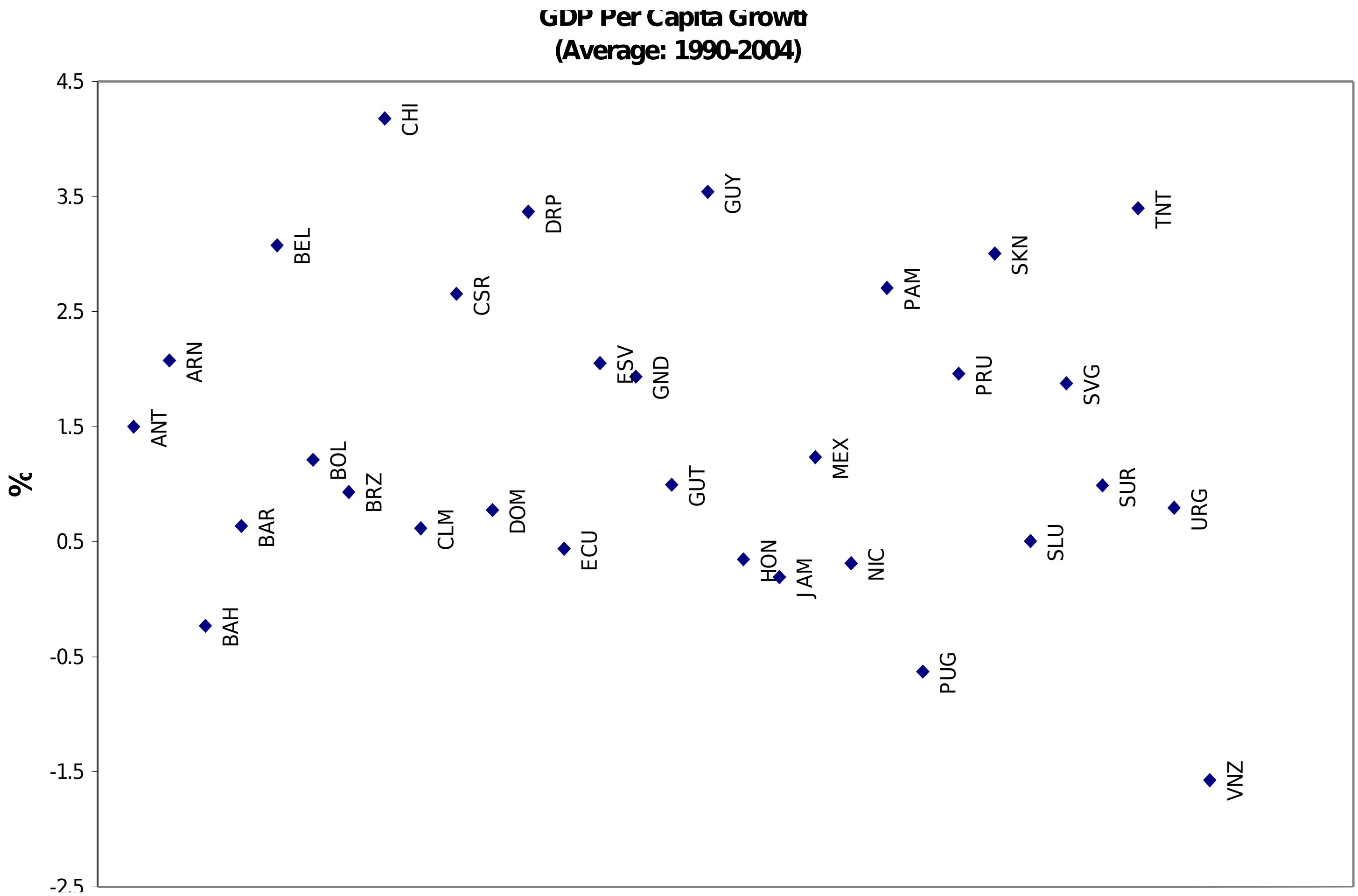

GDP Per Capita
(Average: 1990-2004)
US $ (Constant 2000 Prices)
15500.00
14500.00
13500.00
12500.00
11500.00
10500.00
9500.00
8500.00
7500.00
6500.00
5500.00
4500.00
3500.00
2500.00
1500.00
500.00
-500.00
BAH
ANT
BAR
ARN
SKN
TNT
URG
VNZ
MEX
CHI
SLU
CSR
PAM
BRZ
DOM
GND
BEL
JAM
SVG
CLM
DRP
ESV
SUR
PRU
PUG
GUT
ECU
BOL
HON
NIC
GUY

Figure 2


GDP Per Capita Growth
(Average: 1990-2004)
%
4.5
3.5
2.5
1.5
0.5
-0.5
-1.5
-2.5
CHI
GUY
DRP
TNT
BEL
SKN
CSR
PAM
ARN
ESV
GND
PRU
SVG
ANT
BOL
BRZ
MEX
GUT
SUR
URG
BAR
CLM
DOM
ECU
HON
JAM
NIC
SLU
BAH
PUG
VNZ

Country List

ANT	Antigua and Barbuda
ARN	Argentina
BAH	The Bahamas
BAR	Barbados
BEL	Belize
BOL	Bolivia
BRZ	Brazil
CHI	Chile
CLM	Colombia
CSR	Costa Rica
DOM	Dominica
DRP	Dominican Republic
ECU	Ecuador
ESV	El Salvador
GND	Grenada
GUT	Guatamala
GUY	Guyana
HON	Honduras
JAM	Jamaica
MEX	Mexico
NIC	Nicaragua
PAM	Panama
PRU	Peru
PUG	Paraguay
SKN	St Kitts and Nevis
SLU	St Lucia
SVG	St Vincent and the Grenadines
SUR	Suriname
TNT	Trinidad and Tobago
URG	Uruguay
VNZ	Venezuela