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The Relative Importance of Institutions and Foreign Direct Investment to Economic Growth and Convergence

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ABSTRACT

Theoretical models used to form the basis of statistical tests for economic growth convergence are often modeled without regard to international flows of capital. Recent developments have led to the inclusion of foreign direct investment into these models. This paper extends those models by also including political and economic institutions.

KEYWORDS: International Markets, Market Structure, Property Rights, Macroeconomic Analyses of Economic Development, and Models with Panel Data

INTRODUCTION

Over the last several decades, worldwide foreign direct investment (FDI) has fluctuated wildly as a share of all economic activity. As most multinationals engage in the issuance of stocks, FDI is defined here as any additional investment once a 10% share of equity in a foreign firm has been achieved. Thus, the nature of measuring FDI with a stock portfolio could explain the volatility. On the other hand, this wide variation has followed a clear and significant long-run upward growth trend. FDI outflows as a percent of worldwide GDP have doubled since 1996, and now represent 2.4% of all global economic activity (World Bank Group, 2016). This is down from a peak of 5.4% in 2007. Some of this variability is simply due to measurement: FDI is typically defined as 10% or more of an equity share in a foreign firm (Lane and Milesi-Ferretti, 2007). Flows of capital become more dispersed when the world faces a riskier international investment environment. Diversification becomes more important during this turmoil, thus the FDI measure is affected as fewer financial interests will see much benefit in concentrating their wealth into FDI. However, outside of these global business cycle effects, the rise in FDI over the long run is remarkable given that it represents an annual flow of international ownership, not the level. That is, the rate of change in international ownership is increasing. Along with this increasing level of economic integration has been the rise in decentralized political systems, and a democratization and liberalization of markets. This paper sets out to detect these factor's impacts on growth convergence. Is foreign investment the main driver in economic growth convergence? Or are economic institutions more important? To answer these questions a comparison of different estimations of the speed at which global income are converging is used. When measures of foreign investment are included in estimations of international income convergence, the speed of convergence may be greater. This would be an indication that the differences in foreign investment were leading to differences in global incomes. Likewise, if differences in the quality of political and economic institutions leads to differences in national incomes, then controlling for those differences will give a faster measure of convergence, as this is what economies would be doing on their own, without these differences. A panel data set of 4-year averages is used to smooth out the business cycle effects which we see featuring so prominently in international financial data.

Recently, models which can statistically test for economic convergence, or the “catch-up” effect in the economic growth of countries have been modified to include sources of foreign direct investment (FDI) into the statistical estimations. For instance, Neto and Veiga (2013) incorporate FDI into the growth model developed by Barro et al. (1995) in order to show how FDI is associated with technology diffusion. The Barro-type models explicitly define a variable which represents technological growth. Thus, a direct way to make these types of closed economic models into open, international versions is to specify a process of technological innovation which is directly related to levels of foreign investment. The idea is that higher levels of global integration will facilitate technology diffusion, i.e. the exchange of information. Conceptually, managers from all over the world will become more engaged with international owners and new ideas will more easily spread. He and Sun (2013) use a Solow-Swan version of the neoclassical growth model to achieve the same goal: make the model open to the global economy by specifying technology as a function of FDI. The goal of this work current work is to incorporate measures of political and economic institutions into these types of models. The method to do so has been laid out in DelVecchio (2015). If technology is seen in its broadest sense, which is a way of doing things, then we can incorporate foreign investment, and economics and political institutions into its description.

The role of political and economic institutions in economic growth has been a very active area of research over the last decade ever since Daron Acemoglu’s seminal work published in the Journal of Political Economy (Acemoglu and Johnson, 2005). The objective of this present work, is to merge the growth and convergence literature involving FDI and cited above with the work which has followed Acemoglu’s. The specification follows directly from that which I have conducted before. Additionally, the methods developed in (DelVecchio, 2015) would allow for the computation of the “total factor productivity” component of economic growth, inclusive of the impact of foreign investment.

With increasing rates of foreign investment, it’s expected that the impact on convergence in national-level incomes would be to speed up that rate at which less developed economies are catching up to developed economies. With economic and political institutions, it’s also expected that we would see faster rates of convergence. In the study of growth convergence, there are two types which can occur when looking at how quickly countries catch up to each other. As Danny Quah (1997) and Mankiw, Romer, and Weil (1992) discuss in their path-breaking research, convergence which involves a catch-up effect shows that the variance of cross-country income distributions must be falling. This is different from convergence in which an individual economy is approaching its long-run steady state. However, the relationship is such that as an economy approaches its long-run steady state from a lower level of capital, its rate of growth will slow. This is due to the diminishing impact that capital investment has upon growth. And it’s this type of convergence which then leads to cross-country income convergence as the less developed economies are further from their long run steady states and thus have a higher marginal product of capital and a resultant faster rate of growth.

The method used to test for convergence in this current work is of the same form that is in Mankiw, Romer, and Weil (1992). On its own, this method has a problem when trying to infer that there is a catch-up effect after successfully identifying that, in general, economies are converging to their own long-run steady state. The problem comes from the fact that some economies may be over capitalized and be converging from a level of capital which is unsustainable given current levels of technology. This sort of thing can happen when there is an investment “bubble” which has emerged from speculation and has burst upon this realization. Governments in planned economies may also cause too much investment in physical capital to occur. To understand this effect, this current work extends the traditional results by computing the actual estimated initial steady state levels of income for each economy and determining if they are above or below their long-run path. If they are above, this this may indicate divergence of incomes, not convergence. That is some countries may be disinvesting and shrinking on their way to their steady long-run growth paths, not catching up.

LITERATURE REVIEW

The theory of economic convergence predicts that countries that have lower levels of development and lower levels of physical capital will catch up to the more developed countries with higher levels of physical capital. Given the importance of physical capital to production, this is fundamentally a question of whether global incomes are becoming more equal or not. It thus has a long history, but one of the first to write extensively on the subject was Alexander Gerschenkron (1952) who spoke about the “advantages of backwardness.” This phrase did well at capturing the main theoretically underpinnings of growth convergence: that at lower national levels of capital investment, there were higher returns, whereas at higher levels of investment, the economy is saturated with capital and there are lower returns. Robert Solow formulated theoretical model which predicts convergence Solow (1956) by using a production function containing these diminishing marginal product features. Another model which became a modern workhorse emerged from the work of Ramsey (1928), Cass (1965), Koopmans (1965), which is often cited in textbooks as the RCK model. Statistical work on testing these predictions then began with Baumol (1986) and reached its peak of activity in the 90s through research first using the Solow-Swan model in Mankiw et al. (1992) and the RCK model with Barro and Sala-i-Martin (1992). The work in the 90s was particularly important as it provided a test for convergence between cross-country incomes. For the most part, these results were positive and have led to the current state of macroeconomic growth models which are centered around the assumption of diminishing returns to capital.

The question of whether countries are becoming more or less equal in income is, in all likelihood, one that will always be of interest. Presently, variants of the standard statistical models that have found themselves in prominent journals are often used to test for specific sectors of convergence. For instance, a pair of recent publications in the American Economic Review, Ravallion (2012) and Rodrik (2013) look at convergence of the lowest incomes and convergence in the manufacturing sector, respectively, using similar methods to those which will be used herein.

Neto and Veiga (2013) and He and Sun (2013) give examples as to how FDI, and international financial investment in general, can be incorporated in some of the standard growth models. He and Sun use a theoretical model to explain production technology, which they describe as a “technology diffusion and absorption model.” It is borrowed from Acemoglu (2009) and takes the following form:

$$\dot{A_{it}} = \sigma_{it}(A_t^w \cdot FDI_{it} - A_{it}) + \gamma_i A_{it} \qquad \textbf{1)}$$

Here, $\dot{A_{it}}$ is the growth rate total factor productivity (TFP) for country i in time t. TFP is a measure of the effectiveness of labor and capital in the production process. Total factor productivity will multiply the amount of economic output due to labor and capital. In the He and Sun model, the diffusion of technology occurs through foreign investment. A_t^w is a measure of world-wide technology. It is multiplied by FDI_{it}, the country's inflows of foreign direct investment. Thus, the term $\sigma_{it} \cdot A_t^w \cdot FDI_{it}$ determines the inflows of technology as a function of foreign investment. The model used herein is a simple version of this basic idea.

Literature Review of the Estimation Methods

Estimation of the model poses several problems. The first is that of a dynamic panel model with a lagged dependent variable, which is lagged real GDP in this case. As with any panel, it is important to control for the cross-sectional effects by incorporating the unobserved heterogeneity through the use of what amounts to a dummy variable for each country. However, this fixed effect modeling in the presence of a lagged dependent variable will result in biased coefficient estimates (Nickel, 1981) as the fixed effect will be correlated with the lagged dependent variable. In most circumstances, the inclusion of a lagged dependent variable is handled with a form of GMM estimation which uses all available lags of both the dependent and independent variables (Arellano and Bover, 1995; Blundell and Bond, 1998). Such models require additional assumptions about the relationship of the independent variables to the unobserved (cross-sectional) effect.

However, in this present work, the data is characterized with more cross-sections than time series, with the cross sections being 138 worldwide economies. Thus, in order to ensure unbiased estimation of the coefficients, this paper uses quasi-maximum likelihood following the work of Bhargava and Sargan (1983) and Hsiao, Pesaran, and Tahmiscioglu (2002). The estimation of the dynamic panel is implemented using the recent work of Sebastian Kripfganz (2015), who has made his programs publicly available. In this way, the issue of dynamic panel bias, or Nickel bias, is addressed and the model is considered to be identified (excluding other possible sources of endogeneity).

THEORETICAL JUSTIFICATION FOR THE EMPIRCAL MODEL

The basis for the theoretical model comes from Mankiw, Romer and Weil (1992) and builds on their model of total factor productivity in a very simple manner. The level of TFP is given by:

$$A_{it} = \bar{A}_i e^{gt+\rho z} \qquad \textbf{2)}$$

where $\bar{A}_i$ is an initial level of TFP for country i. This is multiplied by an exponential term being raised to $gt + \rho z$ where gt is a term describing the deterministic growth of technology in which TFP grows at rate g given time t. The term ρz is a vector of shift parameters which can be foreign investment, political institutions, and economic institutions. This is the main addition to the model of technology. It allows for a simple empirical estimation. Once the above specification is entered into the standard Solow-Swan growth model, and the resulting differential equation is solved out, the resulting theoretical model is given by:

$$\begin{aligned} \ln y(t) = gt + \ & e^{-\lambda t} \ln y(0) + \left(1 - e^{-\lambda t}\right) \ln \bar{A} + \left(1 - e^{-\lambda t}\right) \rho z \\ & + \left(1 - e^{-\lambda t}\right) \frac{\alpha}{1 - \alpha - \beta} \ln s_k + \left(1 - e^{-\lambda t}\right) \frac{\beta}{1 - \alpha - \beta} \ln s_h \\ & + \left(1 - e^{-\lambda t}\right) \frac{\alpha + \beta}{1 - \alpha - \beta} \ln(n + g + \delta) \end{aligned} \qquad \textbf{3)}$$

The parameter of λ is the speed of adjustment coefficient to be discussed later. Here, the variables in the terms are as follows:

$y(t)$	Real GDP at time t
$y(0)$	Real GDP in an initial time period
$\bar{A}$	The initial level of technology
ρz	A vector of institutional, foreign investment, and natural capital measures
s_k	Domestic investment into physical capital
s_h	Human capital
$(n+g+\delta)$	Break-even level of investment where n is population growth, g is the deterministic growth rate of capital and δ is the depreciation rate of physical capital

This theoretical model is then put into discrete form and estimated with the following empirical model:

$$y_{it} = \gamma y_{i,t-n} + \sum_{j=1}^{3} \beta_j X_{it}^{j} + \eta t + \mu_i + \nu_{i,t} \tag{3)}$$

Where,

$$y_{it} = \ln y_t, \quad y_{i,t-n} = \ln y_{t-n}, \quad \gamma = e^{-\lambda t},$$

$$\beta_1 = (1 - e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta}, \quad \beta_2 = (1 - e^{-\lambda t})\frac{\beta}{1-\alpha-\beta}, \quad \beta_3 = (1 - e^{-\lambda t})\frac{\alpha+\beta}{1-\alpha-\beta}$$

$$X_{it}^{1} = s_k, \quad X_{it}^{2} = s_h, \quad X_{it}^{3} = (n+g+\delta)$$

$$\eta = g, \quad \mu_i = \left(1 - e^{-\lambda t}\right)\ln \bar{A}$$

So, the parameters to be estimated are γ, β_1, β_2, β_3, η, and μ_i, the country fixed effect. By deriving the results from a theoretical model, the long-run growth path can be computed. This way, we can compare where an economy is relative to where it will be after it is done converging. Some economies are above where they should be given their long-run trends and others are below where they should be, given their long-run trends.

As mentioned before, there is likely a bias which will emerge when this empirical model is estimated using regression methods. The fixed effect, $\mu_i = \left(1 - e^{-\lambda t}\right)\ln \bar{A}$ will be present in both the dependent variable, $y_{it} = \ln y_t$, and the lagged dependent variable on the right-hand side of the regression equation. Quasi maximum likelihood estimation methods are used to account for the types of biases that emerge from the use of a dynamic model in a panel data setting.

DATA AND RESULTS

The data were assembled from various sources and represent 138 worldwide countries over the period of 1970-2003. The core data come from the Penn World Tables (Feenstra et al, 2015). The measure for the dependent (and lagged dependent) variable is the output side real GDP adjusted for purchasing power parity found. The measure of domestic investment is the investment as a share of real GDP, and the measure of human capital investment comes from the Barro-Lee human capital index found in the Penn World Tables.

The most restrictive component of the data comes from The External Wealth of Nations Mark II dataset by Lane and Milesi-Ferretti (2007) and is only available up to 2004. However, this dataset has become a standard in the examination of foreign investment. There are variety of international investment measures, but not all of them perform well in the convergence setting. Many are related to time trends and the significance disappears once a trend is included in the model. Measures of inward and outward flows of FDI is an example of this. One of the most robust measures is the External Wealth of Nation's measure of a country's net external position. This is a very comprehensive measure, which includes FDI along with net portfolio investments. The net external position is defined as the value of a country's foreign assets minus its foreign liabilities. While liabilities represent an inflow of finance at some point in the past, they will not offer any income. Moreover, for our purposes, this measure gives insight into which direction technology will flow. If a country's net external position is positive, this indicates that they own more, and manage more foreign assets than foreigners own in their domestic economy. If the coefficient on this is positive, it's an indication that managers take information home with them. If the coefficient is negative, then economies with more foreign owners of capital will see higher rates of growth. This is consistent with the notion that managers would bring technology with them (as opposed to taking it home). While this is clearly a very indirect way at getting this type of evidence, the results are robust and lead to important policy implications which are not discussed in the literature.

The measures of political and economic institutions come from the PolityIV dataset (Marshall et al., 2011) and the Economic Freedom of the World report (Gwartney et al., 2015). The PolityIV data set gives several indicators of regulation of the executive in power. These indicators, which in sum vary on a scale of 0-10 are used to compute a principal component index. The first principal component of the following measures is computed: Competitiveness of Executive Recruitment, Openness of Executive Recruitment, Constraint on Chief Executive, and Competitiveness of Political Participation. The principal component is then normalized to cover a range of 0-1. The Economic Freedom Index is another comprehensive measure of various factors which measure the business climate of a country. While the correlation and therefore inclusion of some components may be in question (such as the size of a government which scores lower while well-defined and enforced property rights score higher), the cumulative index does perform well in growth regressions. In sum, the index measures the size of government, legal systems, property rights, sound money, freedom to trade internationally, and regulation. It too is normalized to a scale of 0-1.

A measure of natural capital is also used due to its importance in explaining the economies of the developing world. This was shown clearly in Caselli and Feyrer (2007) as they used measures of reproducible capital in the form of land and natural resources. Data comes from the World Banks (2011) Changing Wealth of Nations dataset. It is included as an important source of wealth and is expressed as a percent of real GDP.

As has become common in the panel data growth estimations, the economic and political indicators, domestic investment and human capital are all averaged over 5 years. This is one way of addressing the short run business cycle fluctuations. Years are then chosen in which the lagged dependent variable does not appear as an independent variable in any of the other cross-sections. This way there are no “overlapping” cross sections. The result is a smaller dataset containing averages over 5 years along with the beginning and ending values of real GDP.

EMPIRICAL RESULTS

The regressions are run stepwise in order to determine whether what the speed of convergence is in each of the cases. Table 1 on the following page reports the results of six regression models, all estimated with the quasi-maximum likelihood method. This method accounts for country specific effects and ensures that dynamic panel bias does not exist. Because some variables are restrictive to the data availability, the most comprehensive model contains the least amount of observations, with 442 cross sectional observations from 138 countries. The countries have a maximum of 7 time periods (of 5-year averages), with some having fewer in an unbalanced dataset.

Interestingly, in the first regression, all the variables are included and the traditional Solow-Swan variables of domestic investment, human capital, and the measure of deprecation are all insignificant. The importance of net external position, economics freedom, and executive regulation all outweigh and interact with the traditional Solow variables. The natural capital variable is consistently negative. This is in line with the notion of the “curse of natural resources” and some economies may become overinvested into natural resource infrastructure and then neglect the other diverse forms of capital, leading to slower growth and more volatility in the macroeconomy. Like in all of the regressions, there is a significant amount of convergence. The coefficient on the lagged dependent variable can be used to recover λ, the speed of adjustment coefficient in the model. From there, the half-life, or time it takes to reach half-way to the long-run level of output, can then be computed. These measures are computed using the method introduced in Barro and Sala-i-Martin (1992). In the full model, we have $\lambda = 0.0597$. This variable is statistically significant with a t-stat of 4.43 which is computed using the recovered standard error of λ. This speed of adjustment parameter is equivalent to a half-life of 11.6 years, the fastest rate of convergence out of all the models. Although we can now examine the variables piece-wise to see which one is driving the result.

In model 2, the measure of political institutions is omitted. Natural capital is still negatively and significantly related to output. The economy’s relationship to net external position and economic institutions seems unaffected by the omission of the measure of political institutions. The speed of convergence is also unaffected. In the full model, we have $\lambda = 0.0573$. This variable is statistically significant with a t-stat of 4.30. This speed of adjustment parameter is equivalent to a half-life of 12.1 years, the second fastest rate of convergence out of all the models. One of the variables is driving this speed of convergence and it’s not political institutions.

Table 1.

	(1) Full b/se	(2) FDI & Econ Ins b/se	(3) FDI & Poli Ins b/se	(4) Just Econ b/se	(5) Just FDI b/se	(6) Just Poli b/se
GDP_{t-n}	0.742***	0.751***	0.827***	0.795***	0.844***	0.852***
	(0.05)	(0.05)	(0.04)	(0.06)	(0.05)	(0.05)
Domestic Investment	0.013	0.004	0.124***	0.024	0.118***	0.110***
	(0.05)	(0.05)	(0.04)	(0.06)	(0.04)	(0.03)
Education	-0.103	-0.135	-0.242	-0.218	-0.229	-0.144
	(0.21)	(0.22)	(0.18)	(0.23)	(0.19)	(0.17)
$(n + \delta + g)$	-0.230	-0.228	-0.268	-0.238	-0.279	-0.204
	(0.20)	(0.19)	(0.18)	(0.18)	(0.18)	(0.14)
*Natural Capi*tal	-0.034***	-0.034***	-0.042***	-0.045***	-0.039***	-0.044***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Net External Position	0.114***	0.116***	0.021		0.025	
	(0.04)	(0.04)	(0.06)		(0.06)	
Econ Freedom	0.755***	0.787***		0.844***		
	(0.17)	(0.17)		(0.16)		
Exec Constraints	0.181**		0.173***			0.175***
	(0.07)		(0.06)			(0.06)
Time Trend	0.002	0.001	0.006***	-0.000	0.005**	0.005**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.841	0.831	0.346	0.253	0.309	0.344
	(0.66)	(0.67)	(0.60)	(0.71)	(0.61)	(0.52)
N	442	442	511	450	511	531
aic	-237.014	-230.558	-176.035	-211.264	-172.413	-185.579
bic	-196.101	-193.736	-137.908	-178.390	-138.522	-151.381

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

In model 3, the measure of economic institutions is omitted and we see what is driving the convergence result. The speed of adjustment parameter drops to $\lambda = 0.0380$ which gives a half life of 18.2 years. The same can be seen in models 5 and 6 when the measure of economic institutions is omitted. In model 4, with only economic institutions the speed of adjustment parameter increases back to $\lambda = 0.0459$ which gives a much shorter half-life of 15.1 years. This isn't as quick as in the full model, but is still faster than the others.

Convergence Results

In this section, a brief graphical representation of the "steady state" level of national income is presented. The steady state is the long-run level of real GDP per worker (or per effective worker when controlling for technology), which an economy will gravitate toward. It exists because of the property of diminishing marginal product of capital. At low levels of capital per worker, there is a larger additional increase in output per additional unit of capital. This explains why developing economies can catch up to the developed economies. The theory of growth convergence depends on the existence of a steady state, or fixed point toward which an economy will converge.

The following two graphs look at the world's economies at two different points in the dataset. To illustrate where an economy is relative to its long-run steady state, the graphs show the (log) estimated steady states in the x-axis which come from the results and are derived using the methods illustrated in DelVecchio (2015). In the y-axis is the log of the real GDP in the actual data. The black line indicates the 45-degree position where the two values would be equal. If an economy is to the right (or below) this line, it is an indication that the economy's actual real GDP is less than its steady state. This is not necessarily a bad thing as it indicates that there should be above average growth occurring as the economy converges to its steady state. If an economy is to the left or above the black line, then it is above its steady state and must face slower than average growth before reaching its steady state. This is an interesting outcome as it indicates that an economy has too much capital, a very counter-intuitive idea. Although, now that there is the inclusion of foreign investment and natural capital, there could be some valid explanations. The natural resources may be a reserve of capital that cannot be maintained in the less developed economies. Also, foreign investment may lead to bubbles and sudden stops of investment inflows once those bubbles pop. This can also leave economies in the lurch and above their steady states. As we see in Figure 2, this was much more likely the case for many of the world economies. The period of the late 80s and early 90s was a questionable one for growth convergence. The period following 2000 was very beneficial to the leveling of worldwide incomes and has led to the period in which we now reside: one in which global incomes are reaching unprecedented levels of equality, albeit with a great distance still to be made up between the developed and developing economies.

Figure 1. Year 2000 Output Gaps

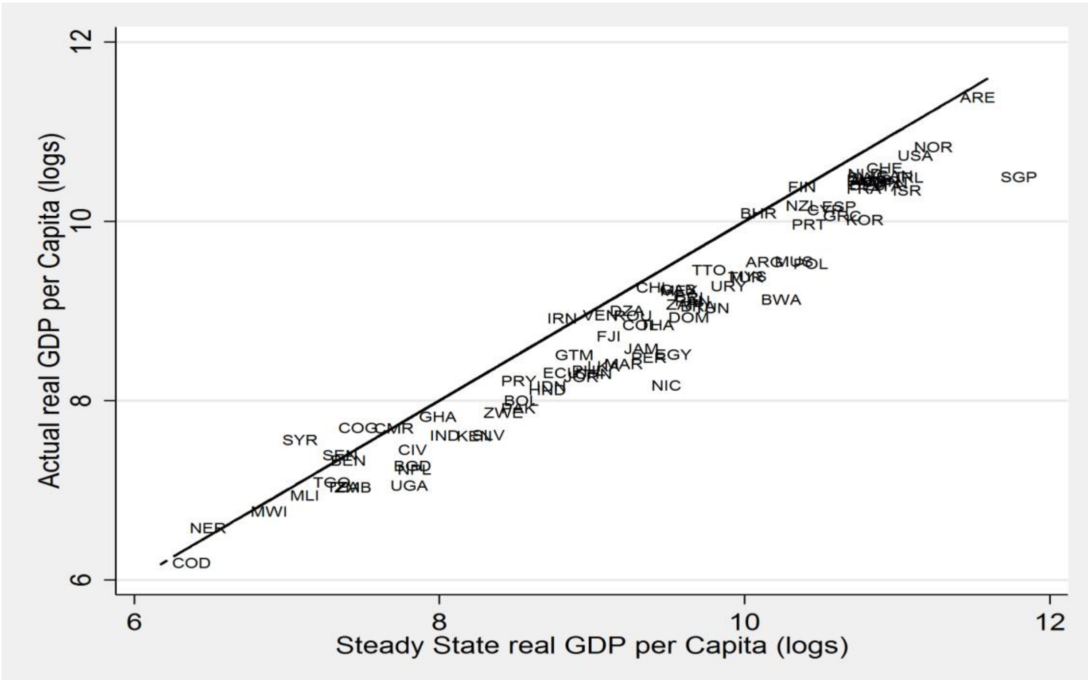
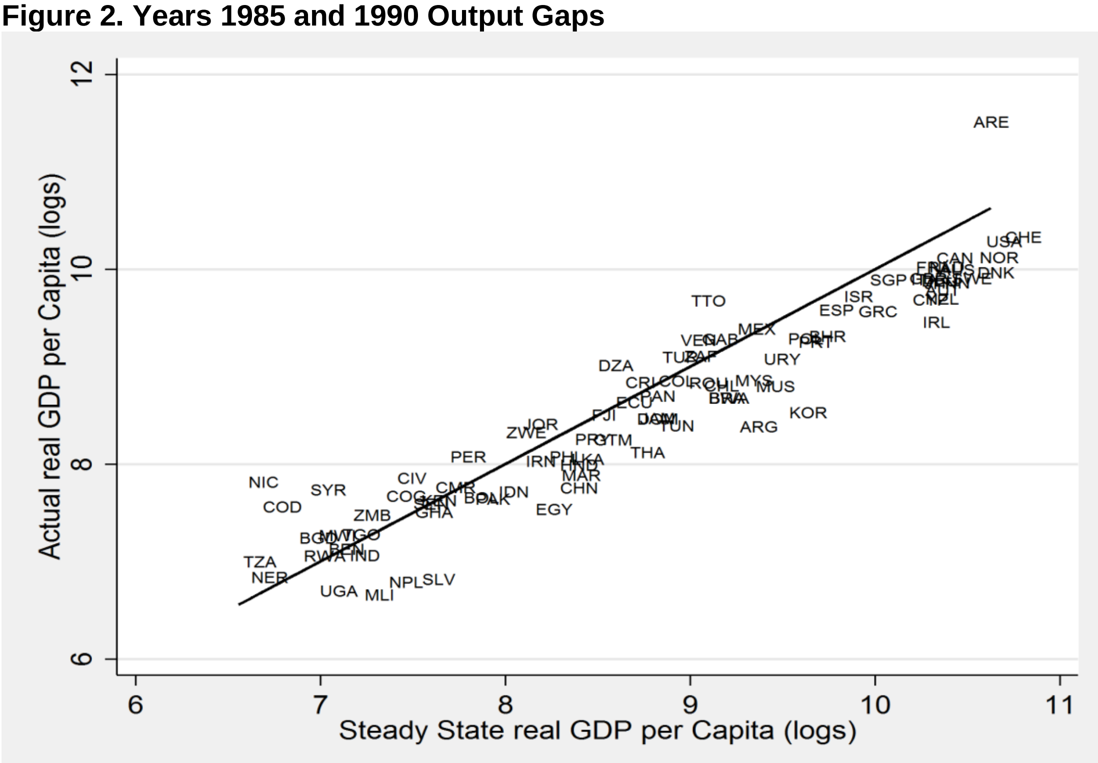


Figure 2. Years 1985 and 1990 Output Gaps



CONCLUSION

The inclusion of all of the “new” growth variables into the standard Solow-Swan model present us with some perspectives on growth convergences which haven’t been seen. Firstly, natural capital seems to be robust and negative in all of the specifications. It’s likely due to the large share that this value takes on in the less developed economies. It’s also an indication that there could be a natural resource curse. In the dynamic setting, this may even represent a sort of poverty trap as economies become reliant on natural resource wealth, leaving other sectors underdeveloped. On the other hand, it could be simply that all they have are natural resource at hand and haven’t accumulated the other forms of capital. The policy implication is that economies, especially those undergoing development, should make sure they are more diverse and avoid becoming dependent on a single natural resource, in spite of its short-run advantages.

The comparison of the regressions is interesting in themselves, as we see which variable causes the gaps in incomes and prevents convergence. When there are differences in the quality of economic institutions, there can be a slower rate of growth convergence. Once these differences are controlled for by including the measures of economic institutions in the model, then the speed of convergence picks back up. None of the other variables of interest, political institutions and foreign investment positions, have this same effect.

The inclusion of foreign investment and natural capital do well at offering explanations of country’s positions relative to their steady states, especially when they are found above their steady states. The resulting estimations of steady states in these models seems to be in line with the story of the last two decades. We first began with much inequality between global incomes, and little growth toward income equalities, and then after the 2000s, we had reached an era which held much potential for equalization of worldwide incomes. Whether or not this trend continues may depend on the level of international economic integration that we maintain and the quality of economic institutions that people in the developing economies are afforded.

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