Does Financial Constraints Impede Growth Convergence? Evidence From ECOWAS

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DOES FINANCIAL CONSTRAINTS IMPEDE GROWTH CONVERGENCE: EVIDENCE FROM ECOWAS?

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ABSTRACT

The paper examines the hypothesis that financial constraints can impede convergence in growth rates. Using a Schumperetian growth model that incorporates innovations and financial constraints, the paper was able to put forward plausible effects of financial constraints on growth convergence in ECOWAS member countries. Employing a panel regression, the paper found that financial constraints which are present in countries with a less developed financial sector can impede growth convergence. This finding is robust when policy control variables – government size, inflation, trade openness - were included in the model.

KEYWORDS: Growth, Conditional Convergence, Financial Development, Innovations.

1. INTRODUCTION

Economic growth – the annual rate of increase in a country's gross domestic product (GDP) – is what determines the material well – being of people within a society. It is the process of accelerating growth that has allowed for a better style of living for majority of people as compared to the standards of living of say, 100 years ago. Though there has been an increased clamor by economists and policy makers for a broader perspective to economic growth – to include poverty alleviation, reduce inequality and propagate structural changes – in order to induce economic development, economic growth is an important proponent for achieving the purpose of development.

From economic literature that emphasizes on explaining the growth process, the concept of converging incomes has generated a continually heated debate. Based on the postulates of the neoclassical growth theory (see: Jones and Manuelli (2005); Caselli and Ventura (2000); Mankiw, Romer and Weil (1992) and Solow(1956), poor countries are expected to eventually catch up with richer countries as long as they share the same level of technology and fundamental determinants of capital accumulation (savings, population growth rates, and depreciation rate). This kind of convergence is referred to as conditional convergence. Convergence can also exist in its weaker form – Absolute convergence: where poorer countries grow faster than richer countries irrespective of their specific fundamental determinants.

The history of cross country income differences exhibits mixed patterns of convergence and divergence. Of paramount interest is the varying distance and proximity between the average growth rates of countries to the world productive frontier. The most striking pattern over the long run for this relationship, estimates that the proportional gap in living standards – measured by country individual incomes – between the richest and poorest countries grew more than fivefold between 1870 to 2000 (Aghion et al, 2005). More recent evidences point to convergence; evidence from (see Aghion and Howitt, 2009) seem to imply that most countries are converging to parallel growth paths. However, many poor countries (especially in Africa) are continuing to diverge; the proportional gap in per capita income between the richest and the poorest convergence groups grew by a factor of 2.6 between 1960 and 2000. It thus seems that there has been club convergence, with the rich and middle income countries belonging to the convergence club. This assertion is

counter-factual as many poor countries have been excluded from the club and have strictly lower long-run growth rates (Deaton and Dreze, 2002).

The interesting point about converging economies is that though there is, from empirical studies, a tendency for poorer countries with lower growth rates to catch up with richer countries, the very poorest of these countries also tend to grow more slowly than the rest (Quah, 1996). For these very poor countries, there seems to be a divergence from the world frontier and thus creating a "club convergence". In particular, there seems to be a "club convergence" for countries like South Korea, India and China that brings their growth rates closer to the world productive frontier and a different kind of "club convergence" that deviates the growth rates from the world productive frontier for the very poor countries especially in Sub – Sahara Africa.

The Economic Community of West African States (ECOWAS) is a regional group comprising 15 West African countries with the mission to promote and accelerate economic integration within its member states. This regional group which was founded in 1975 is saddled with the overall goal of promoting integration, with a view of establishing an economic and monetary union as a means for stimulating growth. ECOWAS as a regional group is committed to the attainment of growth and development for its member states especially in the core areas of Industrialization, Transport, Commerce, Agriculture, social infrastructure and Telecommunications.

Given the goal of attaining regional growth of member states of a regional group like ECOWAS and the inherent controversies in the theoretical and empirical understanding of growth convergence, the paper explores the hypothesis that financial constraints can explain possible growth convergence between ECOWAS member countries. The paper follows the a Schumpeterian growth theory with technological transfers that implies that countries above some level of financial development will converge to the same long run growth rates (Aghion et al, 2004).

As noted by Aghion et al, (2004), there are three important aspects to this theory. The first aspect of the theory relates to the absorptive capacity of a country (Nelson and Phelps 1966). This refers to the capacity of a country to make use of an imported technology. Technology and innovations are usually very country specific, thus countries importing these technologies have to

invest resources to master these technologies and adapt them to their own environment. These necessary actions by countries importing foreign technologies play the same role as research and development in the model.

The second key component of the model, as used by Aghion et al (2004), is the assumption that as the global technological frontier advances, the amount of investment needed in order to keep innovating at the same rate as before rises in proportion. This implies that it will be increasingly difficult, as new and more complex innovations come out, for countries who import these technologies to master them and make them relevant in their environment. Unlike in the Aghion et al (2004) model where the United States of America was used by as the global frontier, this paper uses Nigeria as a representative of the global frontier for the set of ECOWAS member countries.

The third key component of the model postulates that the further behind a country is to the global frontier (in this case Nigeria) the less the country's innovators will be able to invest relative to what is required in order to keep innovating at a given rate (Aghion et al, 2004). This implies that the lower the level of financial development within a country the greater will be its inability to innovate.

This paper will explore the possibility of explaining any evidence of growth convergence or divergence in growth rates for ECOWAS member countries by employing a Schumpeterian growth model that accommodates financial constraints. The rest of the paper is organized as follows: section 2 gives a detailed literature review on growth convergence. In section 3 and 4, a simple Schumpeterian growth model is detailed and financial constraints are introduced respectively. In section 5 the model is estimated and in section 6 the regression results are discussed. The paper draws its conclusions in section 7.

2. LITERATURE REVIEW

Growth convergence has been used to evaluate the fundamental question of the possibility of poor countries catching up with the richer countries in terms of incomes, productivity and overall standard of living. Typical empirical studies on convergence start with the notion of a

steady state, assumptions of homogeneity in technological progress and homogeneity in the speed of convergence – determined by the elasticity of capital – within the frameworks of cross sectional study and time series / Panel analysis a (Barro and Sala – i – Martain, 1992; Mankiw et al, 1992; Evans, 1996; Quah, 1996). Unfortunately espousing growth convergence using econometric techniques of time series analysis and panel cointegration techniques have not been adequate in eliciting convergence (Phillips and Sul, 2003). They instead search for long run relationships and invariable assume that the data is already around its steady state. Panel tests, such as used in this paper are more reliable because they militate against any form of convergence bias by averaging the effects of different countries in different stages of transmission and convergence (Phillips and Sul, 2002; Moon and Perron, 2002).

In analyzing the effects of convergence on the world distribution of income, Pritchett (1997) have shown a large increase in the proportional gap between rich and poor countries between 1870 and 1990. Whereas Sala – i – Martin (2006) used a relatively more recent time period (1970 to 2000) and arrived at an overall reduction in inequality of incomes between rich and poor countries. In a neoclassical framework, several studies have tried to estimate the speed of convergence using panel data techniques with cross country data such as Islam (1995) and Caselli et al (1996).

Apart from appropriate method of study used in eliciting cross country convergence, in understanding the emergence of club convergence, there is still a heated debate between theorists. Akin to the postulates of different growth theories in the literature, explaining the emergence of club convergence depends on the assumptions and structure of these conceptually different theories. For the neoclassical theory of growth, club convergence poses a problem, for it predicts absolute convergence across countries. This simply implies all countries should be members of the same club. Evidence to support this form of absolute convergence include the works of; Barro and Sala – i – Martin (1992), Mankiw et al (1992). The endogenous growth models on the other hand have been able to explain the emergence of club convergence. Apart from the *AK* model – which implied independent growth rates and thus no club convergence at all - , the Schumpeterian model was able to account for club convergence by taking into account "Technological Transfers" and the related idea of "distance to the frontier" (Gerschenkron, 1962). The intuition behind the idea of "distance to the frontier"[1]:Technological transfer will stabilize the gap in living standards and

[1] See Evenson and Westphal (1995)

productivity between the poor countries and the rich countries, as long as the poor countries devote resources to technological innovations – both horizontal and vertical innovation – (Aghion and Howitt, 2009).

The role of technology in explaining convergence as well as club convergence among countries is paramount in the growth process according to proponents of endogenous growth. At the risk of repetition, it must be stated that this phenomenon of club convergence cannot be explained within the framework of the neoclassical growth theory. Gerschenkron (1962) observed that there was an advantage to backwardness for countries who were far below the world technological frontier (he assumed to be the United States) by adopting – either by imitating or innovating – the technologies already used in advanced economies. Howitt and Mayer – Foulkes (2005) concluded that when the benefits of innovation (monopoly profits of an innovator) is larger than the costs of innovation (not assuming financial constraints), there will be a speed up in the global frontier and thus creating divergence in cross country productivity distribution. Aghion and Howitt (2006) also showed how Europe was catching up with the United States after the 1980s with a speed up to the frontier[2].

With regards to the role of financial constraints in inducing economic growth and convergence, there is a wide divide in both the literature and theoretical postulates. On the one hand, the literature on economic growth and convergence shows that there is a positive relationship between a measure of private domestic credit and liquid liabilities on per capita GDP growth (Aghion and Howitt, 2006). This can be taken as evidence for the growth inducing effect of financial development (e.g., King and Levine, 1993; Levine et al, 2000). On the other hand, the literature on currency crisis finds that monetary aggregates, such as domestic credit, are among the best predictors for crises (e.g., Demirguc-Kunt and Detragiache, 1998 and 2000; Gourinchas et al, 1999; Kaminsky and Reinhart, 1999). Given that banking crises are usually associated with some form of economic downturn, an expansion of domestic credit would then be associated with growth slowdowns (; Levine et al , 2000).

[2]This speed up in the frontier can be attributed to acceleration in productivity and the revolution in productivity in the United States after the 1980s.

From a theoretical perspective; the endogenous growth models maintain that financial deepening will bring about an efficient allocation of savings to productive investment projects (see Greenwood and Jovanovic, 1990; Bencivenga and Smith, 1991). On the other hand, the financial crisis literature points to the undermining effect of financial liberalization which leads to an unjustifiably huge increase in credit. According to Norman and Romain (2004), over lending would take place through a blend of channels, including a restricted monitoring capability of regulatory agencies, the failure of banks to discriminate good projects throughout investment booms, and the existence of an explicit or implicit insurance against banking failures (Schneider and Tornell, 2004; Aghion, Bacchetta and Banerjee, 2003). The divide that exists between these theoretical differences has also lead to categories of policy implications. Thus, researchers that emphasize the findings of the endogenous growth literature advocate financial liberalization and deepening (e.g., Roubini and Sala-i-Martin, 1992), while those that concentrate on crises caution against "excessive" financial liberalization (e.g., Balino and Sundararajan, 1991; Hausman and Gavin, 1996).

3. A BASIC SCHUMPETERIAN MODEL OF CONVERGENCE

The paper employs a Schumpeterian growth model in a discrete time framework. The proponents of this model Acemoglu et al, (2002) laid some basic assumptions for the model:

- There are *m* countries who do not exchange goods or factors of production but use each other's technological ideas
- Each country has a fixed population *P*, which is normalized to unity, implying aggregate and per capita quantities are equal
- Individuals live for one period and have linear preferences in consumption
- There is one final good that is produced by labor and intermediate products
- Final good is produced under perfect competition

In this model, the final good is represented by a production function of the form

$$Y_t=\int_0^1 L^{1-\alpha}A_{it}^{1-\alpha}x_{it}^{\alpha}\,di, \quad 0<\alpha<1 \qquad 1$$

where $x_t(i)$ is the input of the latest version of intermediate good i and $A_t(i)$ is the productivity parameter associated with it and measures the quality of the intermediate good. The final good is produced under perfect competition, so the price of each intermediate good equals its marginal product:

$$P_{it}=\alpha A_{it}^{1-\alpha} x_{it}^{\alpha-1} \qquad 2$$

each intermediate good i is produced one for one by an innovator seeking monopolist profits. This monopolist innovator uses the final good as an input – the final good in one industry can serve as an intermediate good for another industry – and chooses x_{it} to maximize his profits.

$$\pi_{it} = p_{it}\, x_{it} - x_{it} = \alpha A_{it}^{1-\alpha} x^{\alpha}_{it} - x_{it} \qquad 3$$

Which gives an equilibrium quantity

$$x_{it}=\alpha^{2/1-\alpha} A_{it} \qquad 4$$

and profits

$$\pi_{it}=\pi A_{it}^{*} \qquad 5$$

where $\pi = (1-\alpha)\alpha^{\frac{1+\alpha}{1-\alpha}}$

The intermediate product is produced by a monopolist each period, using the final good as all input, one for one. That is, for each unit of intermediate product, the monopolist must use one unit of final good as input. Final output that is not used for intermediate production is available for consumption and research, and it constitutes the economy's gross domestic product (GDP)

$$GDP_t = Y_t - x_t \qquad 6$$

Which can be written as

$$GDP_t = \alpha^{1-\alpha}(1-\alpha^2)\, A_t L \qquad 7$$

The rate of economic growth is the proportional growth rate of per capita GDP (GDP_t/L), which is also the proportional growth rate of the productivity parameter A_t.

In each period the entrepreneur has an opportunity to attempt an innovation. If he succeeds with probability δ, the innovation will create a new version of the intermediate product, which is more productive than previous versions. Thus, the productivity of the intermediate good A_{t-1} will change to $A_t = \lambda A_{t-1}$, where λ represents the size of innovations and $\lambda > 1$. If he fails with probability $1-\delta$, then there will be no innovation at t and the intermediate product will be the same one that was used in $t-1$, so $A_t = A_{t-1}$. The average across all sectors will be

$$At = \delta\, \gamma At{-}1 + (1-\delta) At{-}1 \qquad 8$$

Implying that the growth rate of average productivity will be

$$g_t = (A_t - A_{t-1}) / A_{t-1} = \delta\,(\gamma - 1) \qquad 9$$

The probability of success for any innovator is δ and it is an increasing function $\varphi(n)$ of the innovator's productivity adjusted research expenditure $n = R_\delta / A_{it}^*$ where R_δ is the innovator's research and development expenditure and A_{it}^* is the targeted productivity level. The innovator chooses the probability δ to maximize his expected payoff

$$\delta\pi_{it} - R_{it} = [\delta\, \pi - \tilde{n}(\delta)]/A_{it} \qquad 10$$

where $\tilde{n}(\delta)$ is her productivity-adjusted R&D cost—the value of n such that $\varphi(n) = \delta$.

For the model to explain convergence, we have to allow for a simplifying assumption in the model. The assumption allows the possibility of some countries to carry out no form of research at all while others do. To capture this assumption in the model, the function of innovation cost $\tilde{n}(\delta)$ will be of the form that its marginal cost $\tilde{n}'(\delta)$ will not equal 0. Thus with this assumption, the model will present two cases for analysis;

- When rewards to innovations are large enough that entrepreneurs within a country will innovate at a positive rate i.e when $\pi > \tilde{n}$
- When rewards for innovation are so unfavorable that entrepreneurs within a country will not innovate i.e when $\pi < \tilde{n}$

Assume a world technological frontier[3] with the productivity parameter $\overline{At}$ and a successful entrepreneur gets to innovate with productivity equal to the frontier productivity. This Implies that each productivity parameter A_{it} will evolve according to:

$A_{it} = \overline{At}$ with probability δ

$A_{it} = A_{i\ t-1}$ with probability $1-\delta$

Thus this world frontier provides a measure of each country's proximity to the world frontier. The closer a country to this frontier, the more evidence we have for convergence and vice versa. For the purpose of this paper, Nigeria will serve as the world frontier for the ECOWAS member countries. The use of Nigeria as a world frontier is justified by its volume of trade and the fact that it has the biggest economy. Hence, the closer other countries are to Nigeria, then we can claim some form of convergence.

For each country, its average productivity parameter will be:

$$A_t = \delta \overline{At} + (1-\delta) A_{t-1} \qquad 11$$

That is, in the fraction δ of sectors that innovate productivity is $\overline{At}$, whereas in the remaining fraction productivity is the same as in period $t-1$. The implication of this is that;

- When $\pi > \tilde{n}$, all countries that innovate at a positive rate will converge to the same growth rate. The reason for this convergence result is that, because of technology transfer, the further behind the frontier a country is initially, the bigger the average size of its innovations.

[3]This technological frontier is used to explain endogenous growth. In this paper, a trade frontier will be used. However, in remaining consistent to the theoretical model, it will be referred to as the technological frontier.

- When $\pi < \tilde{n}$, That is, countries with poor macroeconomic conditions, legal environment, education system, or credit markets will not innovate in equilibrium, and therefore they will not benefit from technology transfer, but will instead stagnate

4. INTRODUCING CREDIT CONSTRAINTS

Assuming that research aimed at making an innovation in t must be done at period $t-1$. If perfectly functioning financial markets are assumed, then nothing happens to the model as described. However, when credit markets are imperfect, an entrepreneur may face a borrowing constraint that limits her investment to a fixed multiple of her accumulated net wealth. This credit constriant comes from the possibility that the entrepreneur might defraud her creditor. The multiplier will be bigger in countries where it is more costly to get away with fraud. Suppose now that what makes it difficult to borrow is that the borrower might default. A bank will monitor the borrower, thereby making it costly for the borrower to default, but not impossible. Specifically, by bearing some cost, the entrepreneur can hide the result of a successful innovation and thereby avoid repaying the loan. The cost is an indicator of the bank's effectiveness in monitoring; a well-functioning bank makes fraud very difficult. The cost also reflects the effectiveness of legal institutions in protecting creditors' rights; in a country where courts rarely enforce loan contracts, it is relatively easy to avoid repaying.

Given that the entrepreneur must pay the hiding cost at the beginning of the period when she decides whether or not to be dishonest, he will be dishonest when it is in her self-interest. This is when the expected savings from being dishonest exceeds the cost. Thus creditors may withhold financing research when there is a high possibility of default which is a frequent occurrence in countries with lower financial deepening.

To illustrate this, assume each entrepreneur at time t has a wage income w_{t-1}. Thus to invest R_t in an R&D project, the entrepreneur must borrow $M = R_t - w_{t-1}$, where M is strictly positive. If a cost of borrowing is introduced (following the intuition of King and Levine 1993b) where there is a possibility if having projects that are not feasible as well as projects that are. The feasibility of a project, in this sense, refers to the ability of the project to pay back the borrowed funds used in

R&D. The lender – bank – will incur a cost to screen these projects in order to differentiate between feasible and non feasible projects.

Let Ω be the probability that an entrepreneur has a feasible project and $1-\Omega$ be the probability that an entrepreneur has a project that is not feasible and will yield no pay – off to the lender. The bank will pay a cost fR_t to determine whether or not to borrow to a given project, where f represents the fraction that is spent on screening the projects. Thus for each feasible project, there will be a repayment of fR_t / Ω for the lender to break even. The combined pay offs for the entrepreneur and the lender becomes:

$$\delta\pi_{it} A^*_t - R_{it} - fR_t / \Omega \qquad 12$$

This shows that the combined pay off to the entrepreneur and the lender is the expected profit of a successful innovation minus the cost of R&D and the screening cost. From equation 10, the cost of R&D can be expressed as $R_{it} = \check{n}(\delta)A_{it}$

Inputting this into equation 12 gives the following expression

$$\delta\pi_{it} A^*_t - \check{n}(\delta)A_{it} - f(\check{n}(\delta)A_{it}) / \Omega \qquad 13$$

Maximizing this combined pay off results in an equilibrium probability of innovation equal to

$$\delta = \frac{\pi}{1 + f / \Omega} \qquad 14$$

From equation 13 and equation and equation 9, the corresponding equilibrium growth rate becomes:

$$g = \frac{\pi}{1 + f / \Omega} (\gamma - 1) \qquad 15$$

Therefore, it follows from equation 15 that higher screening cost of feasible projects f, the lower will be the frequency of innovations and the lower will be the equilibrium growth rate. Thus, countries with more efficient banks (consequently, more financially developed) should have a lower f and hence a higher growth rate.

5. MODEL ESTIMATION

Remaining consistent with the basic model specification of Aghion et al (2005), where the effects of financial development on convergence was tested by running a cross country panel regression of the form:

$$g_i - g_n = \beta_0 + \beta_f F_i + \beta_y Y_i + \beta_{fy} F_i (Y_i - Y_n) + \beta x X_i + \varepsilon_i \qquad 16$$

Where *gi* denotes the growth rate of per-capita GDP in country i, *F* the level of financial development – for robustness, the paper uses two measures of financial development: domestic credit to private sector as a fraction of GDP and money supply (M3- liquid liabilities, which is currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries) as a fraction of GDP, Y_i the log of per-capita GDP in country i, X_i a set of other regressors that represent policy controls; in this paper these regressors are inflation and government size and ε_i a disturbance term with mean zero. Country *n* is the technology leader, which we take to be the Nigeria. A country can converge to the frontier growth rate if and only if the growth rate of its relative per-capita GDP depends negatively on the value of Y_i, that is if and only if the convergence parameter βy is negative. Thus the likelihood of convergence will increase with financial development if and only if the interaction term β_{fy} is negative. The main objective in estimating the model will be to see whether or not the estimated interaction coefficient β_{fy} is indeed significantly negative.

The data used for estimating the model will be gotten from the World Bank's Data Bank. The sample year of study is 1993 to 2013 was chosen because of inadequate data set for all the member countries. The initial plan was to collect data corresponding to the year ECOWAS was established – 1975. Panel OLS will be used to estimate the model. The choice of econometric method is consistent with the literature on growth economics (Aghion and Howitt, 2006 and Levine et al, 2000)

6. REGRESSION RESULT

Due to limited data for the country set in focus, the paper employs a panel regression to estimate the model. As expected from economic literature, a negative coefficient of β_y will indicate convergence between ECOWAS member countries. The paper's main proposition is to

explain the contribution of financial development – the importance of financial channels in ensuring this convergence. From the model, a negative coefficient for β_{fy} will indicate that financial development can aid countries with catching up in growth rates.

The main results are presented in the first column of Table I, which reports the slope coefficient estimates for the case where there are no other regressors *X*. These results show that financial development interaction with relative output has a non significant positive effect when both measures of financial development are used: $\beta_{fy} = 0.177625 > 0$ with domestic credit as a fraction of GDP and $\beta_{fy} = 0.180313 > 0$ with M3 as a fraction of GDP, which is in stark contrast with the implications of the theory.

Table 1. Growth and Financial Development

Financial development (F)	Credit to private sector	Liquid liabilities
Coefficient estimates		
β_y	-2.742483	-5.667551
	(0.3214)	(0.1979)
β_f	-1.032848	0.422118
	(0.0296)**	(0.1208)
β_{fy}	0.177625	0.180313
	(0.2672)	(0.2121)
Adjusted R-squared	0.795244	0.802927

Estimation of equation: $g_i - g_n = \beta_0 + \beta_f F_i + \beta_y Y_i + \beta_{fy} F_i (Y_i - Y_n) + \varepsilon_i$
*The dependent variable gi-gn is the growth rate of per-capita real GDP of each ECOWAS member country relative to Nigeria, 1993-2013. F is a measure of financial development which is measured by domestic credit to private sector as a fraction of GDP and liquid liabilities, which is currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries as a fraction of GDP from 1993 – 1960. Yi - Yn is the log of per-capita GDP relative to Nigeria. Estimation is done by Panel OLS with fixed effects on both cross section and time effects. Significance at 1%, 5% and 10% levels are denoted by ***,**,* respectively.*

The findings for convergence are not significant statistically as the coefficient β_y is negative with both measures of financial development which is consistent with the theory for convergence but it is not statistically significant. The coefficient β_{fy} from Apriori expectations should be negative and statistically significant. From table 1, it is obvious that there is no evidence from the data to support financial channels in ensuring convergence between ECOWAS member

countries. However this does not mean that financial channels do not contribute to the occurrence of growth convergence. By introducing a new trade variable into the model with the interaction term $(Y_i - Y_n)$, the role of financial development in ensuring growth convergence becomes clearer. The choice of including other variables is premised on the intuition that financial development and the combination of other institutions may provide a better understanding of convergence given that institutions play a significant role in the economies of ECOWAS member countries. Recall that the Schumpeterian model used placed emphasis on innovations and financial deepening. These factors may not tell the entire story for very poor countries that do not innovate and have weak financial channels. In order to incorporate trade in the analysis, the paper estimated the following model:

$$g_i - g_n = \beta_0 + \beta_f F_i + \beta_y Y_i + \beta_{fy} F_i (Y_i - Y_n) + \beta_{ty} T_i (Y_i - Y_n) + \beta x X_i + \varepsilon_i$$

Where all the variables remain the same as with the initial model with Ti representing the level of trade openness within each country. Trade openness is measured as the sum of exports and imports of goods and services as a share of GDP. The expectation is that if coefficient β_{ty} for the trade interaction variable $T_i (Y_i - Y_n)$ is negative and statistically significant, it will indicate that inadequate trade openness keeps ECOWAS member countries from converging.

Table II. Growth, Financial Development and Trade Openness

Financial development (F)	Credit to private sector	Liquid liabilities
Coefficient estimates		
β_y	-26.17728	-20.52009
	(0.0000)***	(0.0000)***
β_f	-0.113415	0.797395
	(0.7444)	(0.0000)***
β_{fy}	-0.272107	-0.475826
	(0.0262)**	(0.0000)***
β_{ty}	0.436235	0.487544
	(0.0000)***	(0.0000)***
Adjusted R-squared	0.894121	0.909156

Estimation of equation: $g_i - g_n = \beta_0 + \beta_f F_i + \beta_y Y_i + \beta_{fy} F_i (Y_i - Y_n) + \beta_{ty} T_i (Y_i - Y_n) + \varepsilon_i$
The dependent variable gi-gn is the growth rate of per-capita real GDP of each ECOWAS member country relative to Nigeria, 1993-2013. F is a measure of financial development which is measured by domestic credit to private sector as a fraction of GDP and liquid liabilities, which is currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries as a fraction of GDP from 1993 – 1960. Yi - Yn is the log of per-capita GDP relative to Nigeria. Ti represents the level of trade openness for each ECOWAS member country and is measured as the sum of exports and imports of goods and services as a share

*of GDP. Estimation is done by Panel OLS with fixed effects on both cross section and time effects. Significance at 1%, 5% and 10% levels are denoted by ***,**,* respectively.*

The results from table *II* show that the interaction term for the trade variable β_{ty} is positive and statistically significant for our two measures of financial development. This indicates that trade openness actually encourages convergence between ECOWAS member countries. Also of interest, the coefficients β_y and β_{fy} become statistically significant and have the expected signs. This implies that introducing trade into the model has made the model better with an R^2 of at least 89% with both measures of financial development. When trade variable is introduced into the model, lack of financial development, with a negative interaction term β_{fy}, is what keeps ECOWAS member countries from converging. To check the consistency of these result estimates, the paper estimated the model using a set of policy control variable. These policy control variables act as a conditioning set for the robustness of our estimates. These variables that will be used are; inflation – as measured by the consumer price index, Government size – as measured by general government final consumption expenditure as a share of GDP, and poverty. For poverty, the square of relative output $(Y_i - Y_n)^2$ will be used. If this term were to have a significant negative coefficient $\beta_{yy,}$ it may indicate that what keeps poor countries from being members of the convergence club is just being poor in the first place or something other than finance but correlated with being poor.

Table III. Growth, Financial Development, Trade Openness and Policy control Variables

Financial development (F)	Credit to private sector	Liquid liabilities
Coefficient estimates		
β_y	-	-
	-	-
β_f	-0.050315	0.811878
	(0.8860)	(0.0000)***
β_{fy}	-0.289989	-0.520819
	(0.0190)**	(0.0000)***
β_{ty}	0.434217	0.493494
	(0.0000)***	(0.0000)***
β_{yy}	-12.16590	-8.699516
	(0.0000)***	(0.0000)***
Inflation	0.032379	0.110601
	(0.7728)	(0.3284)

Government Size	-0.723208	-1.050225
	(0.1874)	(0.0581)*
Adjusted R-squared	0.894083	0.911253

Estimation of equation: $g_i - g_n = \beta_0 + \beta_f F_i + \beta_y Y_i + \beta_{fy} F_i (Y_i - Y_n) + \beta_{ty} T_i (Y_i - Y_n) + \beta_x X_i + \beta_{yy}(Y_i - Y_n)^2 + \varepsilon_i$
The dependent variable gi-gn is the growth rate of per-capita real GDP of each ECOWAS member country relative to Nigeria, 1993-2013. F is a measure of financial development which is measured by domestic credit to private sector as a fraction of GDP and liquid liabilities, which is currency plus demand and interest-bearing liabilities of banks and non-bank financial intermediaries as a fraction of GDP from 1993 – 1960. Yi - Yn is the log of per-capita GDP relative to Nigeria. T_i *represents the level of trade openness for each ECOWAS member country and is measured as the sum of exports and imports of goods and services as a share of GDP. Xi captures policy control variables: inflation and government size. The term* $(Yi - Yn)^2$ *captures poverty's effect in the model. Estimation is done by Panel OLS with fixed effects on both cross section and time effects. Significance at 1%, 5% and 10% levels are denoted by ***,**,* respectively. Note: estimates for* β_y *are not reported because including them into the equation will cause multicollinearity due to* $(Yi - Yn)^2$.

From table *III*, the coefficient is still negative and statistically significant with the inclusion of the policy conditioning variable set and for the different measures of financial development. If the main results were fragile – if growth convergence was occurring through other channels than financial development – inclusion of the policy control variable will destroy the explanatory power of the coefficient β_{fy} in the growth model. However, the results in table 3 show otherwise. With the inclusion of all the policy control variables, the coefficient β_{fy} remained negative and statistically significant. The coefficient for capturing poverty's role in mitigating convergence β_{yy} was negative and statistically significant. This indicates that, growth convergence between ECOWAS member countries is not limited to the incidence of inadequate financial deepening but also that these countries are poor.

7. CONCLUSIONS

Growth convergence theory postulates that poor countries, given some conditioning sets, will eventually catch up with the rich countries. The paper has tested this proposition by abstracting from a Schumpeterian growth model that includes financial constraints. The model postulates that the incidence of financial constraints – mainly due to asymmetric information problems (moral hazard) – can restrict countries from catching up with richer countries in growth rates. These implications were tested using a cross country panel regression with an interaction term for financial development of a country relative to output. A sample of ECOWAS member countries was used with Nigeria representing the world frontier.

The empirical result suggests that financial development remains an important reason why some countries fail to converge in growth rates. This position also holds true when poverty level, inflation, the government size and trade is taken into consideration. However, this does not tell the whole story about growth convergence. For example, it is important to see the role of education, geographical variables, health policies and socio – political variables in encouraging convergence. Also another important aspect borders on method of study and scope. Further studies can be carried out using a panel regression with instrumental variables for financial development. The reason for this is the possibility of feedback problems between finance and growth. For the model we used this problem did not exist. The scope of research could also be increased to capture Sub-Sahara Africa or Africa in total.

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