ECONOMIC GROWTH IN SUBSISTENCE ECONOMY: AN ALTERNATIVE VIEW

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Abstract

In conventional growth models, deferring current consumption and saving part of current income plays an important role in explaining the process of economic growth. In the case of subsistence economies, however, taking such economic action is hardly possible, (Myrdal, 1971). This leads, based on the models, one to conclude the impossibility of endogenously driven growth in these economies, which amounts to the notion that the poor tend to remain poor unless their economies are stimulated exogenously. After discussing this problem in detail, this paper attempts to develop a framework that relies, on one of its sides, on effects of factors of market failure and proposes the possibility of growth in subsistence economies as far as they have the capacity to manage and exploit factors of market failures. Empirical evidence obtained from panel data analysis supports this argument.

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1. INTRODUCTION

The horizon of economic knowledge has been widening since antiquity, but it seems that it has not reached its limit, yet. The presence of some puzzles in Growth Economics, puzzles like productivity slowdown in advanced economies, the "Africa Dummy", and the process of economic growth in indigent economies, is a good reason to state that way. In this regard, some writers argue that growth theorists are still unable to claim that they can explain the mysterious driving force behind economic growth (see, for example, Snooks, 1998; Kenny and Williams, 2001).

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Attempts made, during the last half century, to explain some of these puzzles are usually grouped into three categories. The first category, stimulated by the work of Harrod [1939, 1948] and Domar [1946, 1947], attempted to study long-run growth with the help of tools of Keynesian economics. The output of this category seemed to confirm the widely held view, especially among development economists, that rapid growth is derived by sustained rise in rate of saving and investment. Moreover, it provided a rationale for interventions designed to raise savings rates and encourage investment, [Rattan 1998].

The second category including, but not necessarily limited to, the works of Solow [1956] and Swan [1956] and most often referred to as neoclassical growth model, was motivated by skepticism that a sustained rise in the savings rate is the key to the transition from a slow to a fast growth path and shifted the focus from saving rate to technological progress. The surprising finding of this category is that a very substantial component of growth remained unexplained by growth of the traditional inputs–labor and capital. Solow estimated the unexplained component to be about four fifth in US economy during 1909-1949, and he named it the residuals, which others prefer to name it total factor productivity or technical change. The determinant of this residual was considered to be exogenous to the society and perceived it as a public good, where the radicals perceived technological opportunity to be the same throughout the world [see, for example, Mankiw [1995]]. Regarding policy, the neoclassical growth model assumed implicitly that public policy could affect the level of aggregate output but not its growth. The insightful analysis of the conclusion of this group led to stating the hypothesis of what is often referred to as global growth convergence.

The third group includes, but again not limited to, Romer [1986] and Lucas [1988]. This group, most often identified as endogenous growth model, was motivated by inconsistencies observed between some implications of neoclassical model and actual growth patterns like global growth convergence, on the one hand, and lack of evidence even among the developed economies, on the other hand.

Certainly, the endogenous growth model, like the neoclassical growth economics has advanced our understanding of the process of economic growth in industrial economies characterized by reasonable stability of expectations regarding factor and product markets, legal institutions and civic culture. However, as Solow [1997] argued, it is not much about the problems facing the poor economies of the world, particularly, economies characterized by subsistence life and severe market failures. Such economies need to have more alternatives to growth and development than what the current models inform based on competitive market structure. Apparently, the search for some alternative tool to endogenous growth models, for poor economies, is a superfluous task, but it is possible to understand that the suitability of endogenous growth models for advanced economies themselves is not yet a settled point. Some economists are not yet fully convinced whether the theoretical insights of

the endogenous growth models have succeeded in providing a better guide to explaining actual growth experience than the neoclassical model. Pack [1994], for example considers the success to be doubtful. Griliches [1994] also notes the inadequacy of the model in explaining the mechanisms that produce growth. Hence, at least from this aspect understanding the search for alternatives becomes a basic and a justifiable task.

2. THE POOR AND THE MARKET

In general, the process by which wealth accumulates depends on two basic conditions: first, the degree to which competitive equilibrium is ensured at any instant of time, this deals with the nature of goods and factor prices; second, the degree to which the equilibrium established at one moment will influence the rate at which assets are accumulated for the next moment: this deals with the style of decision made by the agents on deferring consumption by saving more. In growth studies we observe, most often, the first condition to be less emphasized as a result of the frequently imposed assumption of competitive equilibrium and the second being well stressed. Romer [1986] and Lucas [1988][1] that start from the conjecture of competitive equilibrium and assume away imperfect competition are good examples of this point. As Romer [1994] argues both models fail to be grounded on imperfect competition though they manage to include the endogenously provided technology[2]. This condition, it is believed here, has limited the comprehensiveness of the conventional model and inadvertently has contributed in hampering human economic achievements. By comprehensiveness it is intended to mean the degree to which the models explain growth process of the past and the present without exclusion of any type economy and point of time.

On the other side, the growth models rely heavily on the outcome of the decision made by the agents in choosing appropriate consumption time path. Perhaps, the first paper to set forth the view of alternative time path of consumption clearly was that of Ramsey [1928] that analyzed the problem of a society choosing at any moment of time between consumption and physical capital accumulation and thereby affecting its future production possibilities. In line with this view, Romer [1986] model starts by considering that agents divide their current income between current consumption and investment in research technology that produces knowledge from forgone current consumption. Slightly differently, Lucas [1988] human capital model starts by considering that agents allocate their non-leisure time between current production and human capital accumulation. In short, both pioneering endogenous growth models are based on attitude of agents' intertemporal utility optimization, more explicitly, on agents' attitudes that involve sacrifice of current utility for the sake of improved future welfare. In this approach, we understand that should the agents fail to save and to invest in physical capital accumulation or in human capital accumulation or in discovering new knowledges for some reasons, the consequence

will be facing freezing growth. Thus, in the models, we observe that the agents' forward-looking behavior, manifested through their decision on deferring current consumption, plays central role in triggering and sustaining growth. However, the central question here is whether these frameworks are suitable in explaining growth problems and process of poor economies, especially those living at about subsistence level.

This problem can be spelt out as follows. Consider the decision style of poor agents who live below or about subsistence level, and who are supposed to make decision on their resources. It is believed that all human beings, whether rich or poor, share a common behavior of optimizing utility of their resources. The alternative decisions ahead of such poor agents is then, on the one hand, to undertake investing in physical capital accumulation or schooling or research by forgoing current income or consumption with the expectation of greater future earnings, which actually entails risk of passing away before attaining the foreseen greater earnings and, on the other hand, to sustain their life by consuming the currently available income and forgo the foreseen greater future income to be available from the investments. So what type of decision do we expect from our rational, but poor, agents? In principle, as far as we regard these agents to be rational decision makers, they pursue investing in the indicated areas up to the point where the marginal rate of return from the investment equals the opportunity cost of the resource. The opportunity cost of the investment resource for our poor agents may be as high as their own life, as deferring current consumption risks their life. Do we expect them to think the returns to be as great value as their own life from such investments and decide to invest? If such expectations are there somehow, don't they think like 'what is the point of being rich corpse' or don't they consider the 'cure' worse than the 'disease'? Indeed, the latter alternative is a reasonably expected outcome of their decision. If that is the case, what other factor can be expected to drive the economic growth of such poor agents?

In fact, growth history provides us a good reason for disagreeing with the predictions. In growth history, we have a large number of growth experiences that started from far below subsistence level, passed through it and have come to the level well above subsistence level. Such empirical growth evidences lead us to imagine the possibility of other source of growth besides the decision making style of economic agents. This, in turn, will dictate us to focus on the first mechanism of wealth accumulation mentioned at the beginning of this section. Putting it differently, solving growth problem of poor economies requires economists to move a bit beyond considering deferred current consumption as a sole source of growth, which is not actually equally applicable to poor and rich economies.

In line with this argument the following section, by invoking factors of market failure, attempts to propose a tool that serves in describing growth process in poor economies, where deferring current consumption is hardly possible.

3. THE FRAMEWORK

The progression of capturing factors of market failure will start by stressing implication of an objective function (welfare maximizing function) of subsistence economy, and pass to highlighting the implication of usual assumption of complete and perfectly competitive market. Next, it moves to incorporating the effects of market incompleteness and imperfection of competition into the production function, and finishes off with expressing per capita income level and its growth as a function of exogenously determined factor level - labor and endogenously[3] determined effects of factors of market failure.

However, before starting capturing factors of market failure in the framework, we need to make the phrase "factors of market failure" a bit clearer. By assuming out perfect competition we mean inclusion of factors of market failures. These factors in their broader forms include market incompleteness and imperfection of competition. In explicit terms, market incompleteness includes unpaid factors that constitute factors that can be used by recipient without causing depletion to the benefactor (e.g. knowledge, information, unilateral production externalities), or factors that can be used mutually by the benefactor and recipient (e.g. bilateral production externalities) or factors that are valueless to the benefactor but useful to the recipient (e.g. information). Likewise, by imperfection of competition it is implied selling products above its cost or buying factors below value of their marginal product.

To start with the progression, we need an objective function specified in such a way that it embraces effects of market failure. Under unfailing market assumption, the source of utility, $C(t)$, is confined to market transaction alone, and the objective function, $J[C(t)]$, corresponding to this case is given as

$$J[C(t)] = \int_0^{\infty} e^{-\rho t} \frac{(C(t)-\bar{C})}{(1-\sigma)(C(t)-\bar{C})^{\sigma}} L(t)dt \qquad [1]$$

where $L(t)$, $C(t)$, $\bar{C}$, σ, ρ, are number of economic agents in the economy, consumption time path selected by the agent, a positive constant representing a lower bound of acceptable marketable consumption levels, marginal effects of factors of market failure, reciprocal of intertemporal elasticity of substitution, and rate of discount, respectively. However, when market failure is introduced in the system, sources of actual utility, $C(t)'$, will be both from market transaction, $C(t)$, and non-market mechanisms, $i(t)$, particularly, factors of market failure. Here, it is worth stressing the fact that we are dealing with intertemporal substitution for the objective of utility maximization, which is carried out by postponing current consumption

through saving. The savings influence part of the agents' utility through purchases of goods and services made from the markets. Accordingly, the objective function under this case, $J[C(t), i(t)]$, will be

$$J[C(t), i(t)] = \int_0^{\infty} e^{-\rho t} \frac{(C(t)' - \bar{C})}{(1-\sigma)(C(t)' - \bar{C})^{\sigma}} L(t)dt$$

which can be rewritten as,

$$J[C(t), i(t)] = \int_0^{\infty} e^{-\rho t} \frac{(C(t) - \bar{C}) + i(t)}{(1-\sigma)(C(t) + i(t) - \bar{C})^{\sigma}} L(t)dt \qquad [2]$$

by setting $C(t)' = C(t) + i(t)$, where $i(t)$, effects of factors of market failure.

What makes the objective function [2] different from that used in conventional growth models i.e. [1] is that the latter suggests that the long-run welfare of the society depends on consumption time path selected by the agents alone as they presume perfect competitions, ($i(t) = 0$), whereas [2] suggests that the welfare depends both on the selection of consumption time path as well as degree and directions of effects of factors of market failure. Here it is worth noting that σ and ρ are constant number different from zero so far as the agents have some thing to save for the sake of utility maximization.

In the case of our idealized poor economy, where agents have no consumption to be deferred to tomorrow, consumption at time t will be equal to the lower level necessary for sustaining life, $C(t) = \bar{C}$, that dictates us to modify the objective function according to this information. In this circumstance the agents are not taking part in the intertemporal business by deferring current consumption. Consequently, we have $\sigma = 0, \quad \rho = 0$, which reduces the objective function to

$$J[i(t)] = \int_0^{\infty} [i(t)L(t)]dt \qquad [3]$$

[3] indicates that long-run welfare of agents in subsistence economy is dependent on the degree and direction of effects of market failure and on the labor size. Moreover, it suggests that any action that increases $i(t)$ at any instant of time will have an increasing effect on $J[i(t)]$, implying the fact that the society can improve its welfare by managing properly the factors of market failure in such a way that they have a positive impact on welfare. Furthermore, it informs us that the aggregate production function of this economy is a function of an exogenous factor-labor and an

endogenous factor-effect of factors of market failure. Finally it is important to note that once this economy has managed to extract sufficient gains from managing factors of market failure, $C(t)=\overline{C}$ cannot hold, which makes the objective function of the economy to follow [2].

To develop a production function as implied by the objective function [3] for our idealized poor, we start from a general production function given as $Y(t)=f(L(t),X(t))$. Where $Y(t),L(t)$ *and* $X(t)$ are net output, labor size and a row vector of factors of production that accumulates as a result of deferred current consumption, at point of time t. By taking the total derivative, we get $dY(t)=f_L dL(t)+f_x dX(t)$ and by assumption of no saving we get $dX(t)=0$ and, hence

$$dY(t)=f_L dL(t) \qquad [4]$$

To see the effects of the assumption of unfailing market on growth in this economy, let's rewrite $dY(t)=f_L dL(t)$ in a growth estimating form, as $\frac{dY(t)}{Y(t)}=\frac{f_L Y(t)}{Y(t)}\frac{dL(t)}{L(t)}$ Sraffa [1926] has demonstrated[4] that the fact that only constant returns is compatible with the assumption of unfailing market, which suggest that $\frac{f_L L(t)}{Y(t)}=1$. From this result we have $\frac{dY(t)}{Y(t)}=\frac{dL(t)}{L(t)}$, which in turn suggests per capita income growth, $\left(\frac{dy(t)}{y(t)}\right)$, to be $\frac{dy(t)}{y(t)}=\frac{dY(t)}{Y(t)}-\frac{dL(t)}{L(t)}=0$. This is the prediction of a model that assumes unfailing market in subsistence economy regarding per capita income growth. That is, if agents cannot defer current consumption and fail to save, the economy remains poor. But this is not always true in the realm of reality. As stated in the introduction, at least history of economic growth can be a good reason to decline this prediction. The inconsistency between the prediction and the reality arose from over simplifying assumption of competitive market structure, which hides some of the economic realities.

Next, let's try to drop this assumption and try to see what happens to per capita income growth of the subsistence economy. Reconsider equation [4] and introduce factors of market failure. Under the presence of factors of market failure, we understand that marginal products of labor to be equal to its level under unfailing market plus effects of the factors, as

$$dY(t)=(f_L+\varepsilon+\lambda)dL(t) \qquad [5]$$

where ε, λ are marginal effects of market incompleteness and imperfection in competition, respectively. By rewriting [5] in growth estimating form, we get $\frac{dY(t)}{Y(t)} = \frac{(f_L + \varepsilon + \lambda)L(t)}{Y(t)} \frac{dL(t)}{L(t)} = \frac{(f_L + \varepsilon + \lambda)}{Y(t)/L(t)} \frac{dL(t)}{L(t)}$, which can be written, without affecting the equality, as $\frac{dY(t)}{Y(t)} = \left[\frac{Y(t)/L(t) + (f_L + \varepsilon + \lambda) - Y(t)/L(t)}{Y(t)/L(t)}\right] \frac{dL(t)}{L(t)}$

$$\frac{dY(t)}{Y(t)} = \left[1 + \frac{(\{f_L - Y(t)/L(t)\} + \varepsilon + \lambda)}{Y(t)/L(t)}\right] \frac{dL(t)}{L(t)} \qquad [6]$$

In [6], the item in the curly bracket is the difference between marginal product and average product of labor. As we have extracted out all effects of factors of market failure, the quantity in the curly bracket becomes zero, and hence we have $\frac{dY(t)}{Y(t)} = \left[1 + \frac{(\varepsilon + \lambda)}{Y(t)/L(t)}\right] \frac{dL(t)}{L(t)}$. Let $\theta \equiv \frac{(\varepsilon + \lambda)}{Y(t)/L(t)}$, the quantity that measures the degree and direction of relative effects of factors of market failure. Then, we can have net output growth as

$$\frac{dY(t)}{Y(t)} = (1 + \theta) \frac{dL(t)}{L(t)} \qquad [7]$$

[7] informs how growth of net national output takes place depending on exogenously determined labor growth and degree and direction of relative effects of factors of market failure. Taking the indefinite integral of both sides of [7], we get an explicit production function of the economy under consideration as

$$Y(t) = AL(t)^{(1+\theta)} \qquad [8]$$

Solving for per capita income growth, we get $\frac{dy(t)}{y(t)} = \frac{dY(t)}{Y(t)} - \frac{dL(t)}{L(t)} = \theta \frac{dL(t)}{L(t)}$, or

$$\frac{dy(t)}{y(t)} = \theta \frac{dL(t)}{L(t)} \qquad [9]$$

[9] suggests that per capita growth to be determined by effects of factors of market failure and labor growth. Taking the indefinite integral of [9], we find an explicit

function associating effects of factors of market failure and labor to per capita income level as

$$y(t) = AL(t)^{\theta} \qquad [10]$$

Where A stands for real wage rate per year under unfailing market condition.

Before leaving for the messages to be drawn from this framework, one point regarding returns to scale of this framework is worth mentioning. By definition a return to scale of a production function containing n factors of production, is the sum of all elasticities of output with respect to all the inputs, and given as $\mu(x) = \sum_{j=1}^{n} \mu_j(x)$, where $\mu_j(x)$ is given as $\mu_j(x) = f_j(x)\frac{x_j}{f(x)}$. Under our case, we have only one factor, labor. Hence the returns to scale $[\mu(l)]$ will take the form $\mu(l) \equiv \frac{dY}{dL}\cdot\frac{L}{Y} = \frac{A(\theta+1)L^{(\theta+1)}}{L}\cdot\frac{L}{Y} = \frac{(\theta+1)Y}{L}\frac{L}{Y} = (\theta+1)$. Thus we find that the returns to scale of the economy under consideration to be $(\theta+1)$ and determined by relative effects of factors of market failure. Should the net effects of factors of market failure be positive, the economy is going to have increasing returns to scale and if, on the contrary, the economy's adverse factors of market failure outweigh the favorable ones, i.e. the net effect of factors of market failure is negative, the economy exhibits diminishing returns to scale. If, on the other hand, the effects of the adverse and favorable types of factors of market failure are balancing each other, the economy will have constant returns to scale.

If that is the case, one pertinent question may be how it could be possible to influence the size of positive market imperfection favorably. One possible mechanism could be through developing institutions that protect property right. Knack and Keefer (1995) stress the fact that institutions that protect property right are crucial to economic growth and investment. There is no doubt that well protected property right improves the allocative efficiency of individuals, and hence of the entire economy, as far as they are rational, well informed, and factors are perfectly mobile. In our case, it sounds that given more chance of resource allocation, rational agents allocate their resources toward goods that contain or generate more positive effects of market failure. This activity leads to higher θ value. Here, it is worth noting that this approach presumes that agents have full information, factors are perfectly mobile and the agents decide rationally. However, the reality of poor economies may not be consistent with the presumption, particularly, when seen from perspectives of full information and perfect mobility of factors. In this circumstance, a complementary mechanism could be setting an objective incentive system that may encourage positive factors and discourage the adverse ones for the aim of allocative efficiency.

What messages can be drawn from growth estimating equation [10] in general? We observe here, as noted in section 2, that the major endogenous source of growth and determinant of level of per capita income for the economy under study to be factors of market failure as labor is exogenous. For a given poor economy if growth-favoring factors of market failure outweigh the adverse ones we expect to have some positive values for θ. The larger the θ for a given labor growth rate, the faster will be the growth and the larger will be the level of per capita income. Similarly, if adverse factors in market failure outweigh the favorable ones, we expect some negative values of θ that entail deterioration of per capita income over time. At the outset, we have seen that market incompleteness is one cause of market failure. It includes external economies and diseconomies, public goods and 'Bads'. In this dimension of factors of market failure, keeping other factors unchanging, the higher positive net effect of incompleteness, the larger the parameter will be. This implication is in line with Griliches [1992] argument that says unless there are significant externalities, spillovers or other source of increasing returns, it is unlikely that economic growth can proceed at constant undiminishing rate in the future. Moreover, from dimension of imperfection, the framework informs us that well-managed market imperfection can also contribute, favorably, to faster growth through the parameter. Bardhan [1995] notes that temporary monopoly power acts as a motivating force for private innovations.

Moreover, the equation has some information for the puzzle of how growth has taken place in the past in today's advanced economies. The currently developed nations have managed to pass the point of subsistence level, not by deferring the then current consumption and investing it in physical capital, schooling and research and development, which actually contradicts the rationality of human behavior, but through properly managing and exploiting possible factors of market failure. Once they passed that point, the arguments of deferring consumption for accumulation of physical capital, human capital and for searching new knowledge can go with the growth process that has prevailed.

Furthermore, the equation has special message for poor economies like African economies. Those economies below or close to subsistence level have to aim at managing and exploiting possible factors of market failures rather than undermining them or considering them as given. Relatively lesser attention has to be given to the recommendations that are actually beyond their capacities. The explicit information from the equation is that these economies have to search for means of promoting activities and encouraging agents availing positive externalities and discouraging those availing negative externalities. Moreover, market imperfections have to be looked into, and have to be geared towards contributing to growth rather than considering them as given. Still further, from the framework, we can drive some information about the long-run growth for other economies, as well. By considering the prescription here at together with the prescriptions of conventional growth models, there is a possibility of keeping growth of economies from petering out.

4. EMPIRICAL EVIDENCE

Before providing the empirical evidence, it is worth stressing about the meaning of θ estimate as well as the type of evidence to be sought. The usual meaning that can be attached to this parameter in equation [9] or [10] is that it measures relative marginal effect of labor on per capita income. In addition to this meaning, from its setting i.e. from [6], we observe that the parameter represents the relative effects of factors of market failure involved in the production system. Should the production system involve higher positive externalities and favorable imperfection of competition, we have larger difference between marginal product and average product of labor, which makes the parameter relatively larger. In the absence of the effects of these factors, marginal product and average product will be identical, which makes the estimate nil. Thus we understand that the estimate of θ measures the extent to which the economy under consideration has exploited effects of factors of market failure. On this ground we need to see if poor economies with higher magnitude of θ, have performed better than those with relatively lesser θ. To this effect, first, attempt is made to find a group of poor economies. Average daily earnings below one dollar a day was considered as a filtering mechanism. Second, the group is further divided into two sub-groups, those which remained in the same status after some time and those which managed to improve the status of their income. Then, after the proposed growth estimating equation is estimated for both sub-groups separately, estimates of parameter θ in each sub-group will be compared for its size, sign and significance, and seen if the results are compatible with the arguments i.e. higher θ is observed for the second sub-group relative to θ of the first group.

The statistical data used for this purpose was taken from World Bank [2001]. The data set contains total labor force and gross domestic product per capita for 40 years (1960 – 1999) for a number of countries. From this data set, a total of 23 countries, earning an average GNP per capita below 370 (for this demarcation, see World Bank [1990]) in 1960s (1960-1969) were selected on the ground of data completeness. From this group of economies, countries which remained in the same status in subsequent decades up to 1999, were grouped under sub-group one[5], and those which managed to go above the stated line in the following decades were grouped under sub-group two[6]. A brief description of the performances of the two sub-groups is given in Table 1.

Table 1 reports the average GDP per capita and its growth in both sub-groups for the base period 1960s as well as for the subsequent decades. In the 1960s both groups were earning, on average, below one dollar a day. Thereafter, the first group has remained in the same per capita income status. On the other hand, the second group, earning an average income below a dollar a day in the 1960s, managed to come gradually to a level above the stated line in the following three decades. Similarly, the table reports that the GDP per capita growth of both groups were at a similar level in

the 1960s, but followed dissimilar path thereafter. Using the data set used for this description, the parameter θ in [10] is estimated for both groups using panel data analytic approach. In forming the panel, the time series data of each country was averaged over five years and a total of eight periods were formed for each country in each sub-group.

Table 1: Income Status of the Sample Countries

Indicator	Group	1960-1969	1970-1979	1980-1989	1990-1999	1970-1999
Average Income*	Group-1	239.86	265.69	269.30	265.67	266.89
	Group-2	229.26	287.61	377.55	526.88	397.35
Average Growth**	Group-1	1.41	0.90	0.47	-0.41	0.32
	Group-2	1.42	3.46	2.42	3.10	2.99

* GDP per capita (constant 1995 US$) ** GDP per capita Growth

In the analysis, after taking natural logarism of [10], it was specified as one-way and two-way error component model. The superior specification was selected on the ground of suitable statistical test-F-statistics. Moreover, under each specification, estimates from the restricted or OLS (RM), the Fixed effect (FE), and Random Effect or GLS (RE) estimators were obtained. Here again the superior estimator was chosen based on appropriate statistical tests. The results were given in Table 2.1-3.2.

Table 2.1: Parameter 'θ' Estimation for Sub-Group One One-Way Error Component Regression Model

Estimators	Parameters	Estimate of the parameter	St. error of the parameter	T-ratio	p-value
Restricted Model OLS	$\ln A$	5.2588	0.4086	12.8694	0.0000
	θ	0.0160	0.0264	0.6053	0.5461
Fixed Effect Model	$\ln A$				
	θ	0.1269	0.0792	1.6022	0.1118
Random Effect Model	$\ln A$	4.3917	0.7221	6.0815	0.0000
	θ	0.0721	0.0465	1.5511	0.1209

Lagrange Multiplier test of RM vs. FE/RE $\chi^2_{(2)} = 177.26,\ p = 0.0000$

Hausman test of FE vs. RE; $\chi^2_{(1)} = 0.00,\ p = 0.9965$

Table 2.2: Parameter 'θ' Estimation for Sub-Group One Two-Way Error Component Regression Model

Estimators	Parameters	Estimate of the parameter	St. error of the parameter	T-ratio	p-value
Fixed Effect Model	$ln\ A$	-3.0359	5.0024	-0.6069	0.5451
	θ	0.5531	0.3239	1.7075	0.0904
Random Effect Model	$ln\ A$	4.4621	0.7659	5.8256	0.0000
	θ	0.0676	0.0493	1.3693	0.1709

F-test of One-Way vs. Two-Way $F(7,97)=1.38$, $p=0.2215$

Lagrange Multiplier test of RM vs. FE/RE $\chi^2_{(2)}=178.69$, $p=0.0000$

Hausman test of FE vs. RE; $\chi^2_{(1)}=2.3$, $p=0.1294$

For the first group, to choose from One-Way and Two-Way specification F-statistics was used. The statistics test the significance of any time specific effect that is not included in One-Way regression specification. The test result is given at the bottom of table 2.2- and suggests that One-Way error component regression model is superior to Two-Way, $p=0.2215$. The next step will be selecting appropriate estimator from the three given estimators. To start with, first pullability hypothesis, i.e. the appropriateness of constrained model or OLS estimator has to be tested. In other words, the hypothesis of absence of country specific effects has to be examined. With N=15 T= 8 and k = 2, a Lagrange-multiplier test for significance of country specific effects yields a χ^2-value of 177.26 ,$(p=0.0000)$. This is distributed as $\chi^2_{(2)}$ under the null hypothesis of zero country specific effects. The null is soundly rejected, and the within or the random effect model is preferred to OLS estimator. That is the test does not support the pullability of the data set, as there is strong country specific effect. Next, for a choice between random effects (GLS estimator) and within effect estimator a Hausman-test is performed. The basic assumption associated with random effect is that there is no correlation between the regressor and country specific effects. If such assumption is violated, then the GLS estimator will be biased and inconsistent. The test gave a χ^2 value equal to 0.00, $(p=0.9965)$. This is distributed as $\chi^2_{(1)}$ under the null hypothesis of absence of the indicated correlation. The test accepted strongly the null hypothesis of no correlation between the country specific effect and the regressor, which in turn imply that the GLS estimator in this case is unbiased and consistent. As a result, the preferable estimate of the parameter θ for the sub-group one becomes $\hat{\theta}=0.0721$. This estimate was found to be insignificant at standard levels of significance, $p=0.1209$, implying for the group the effects of factors of market failure is not significantly different from zero during the covered period of study.

Next, let's try to estimate the parameter, θ, for sub-group two. Applying the same procedure applied to sub-group one to the data set of sub-group two, the results obtained are given in table 3.1 and 3.2. Following the same procedure of selecting superior estimator conducted for sub-group one, One-Way specification and Random Effect model were found to give preferable estimate of the parameter θ, which estimates the parameter as $\hat{\theta} = 0.1320$. Unlike that of the former group this estimate is significant at standard levels, $(p = 0.0071)$. Next, let's move on to the information reported by the two sets of estimation. As indicated above, sub-group one is formed from a set of countries that were poor in the 1960s and remained in the same status thereafter. Sub-group two, on the other hand, has been poor in the 1960s just like sub-group one, but managed to improve its economic status thereafter.

Table 3.1: Parameter 'θ' Estimation for Sub Group Two
One-Way Error Component Regression Model

Estimators	Parameters	Estimate of the parameter	St. error of the parameter	T-ratio	p-value
Restricted Model OLS	$\ln A$	7.2325	0.3848	18.7971	0.0000
	θ	-0.0842	0.0240	-3.5084	0.0008
Fixed Effect Model	$\ln A$				
	θ	1.0525	0.1373	7.6636	0.0000
Random Effect Model	$\ln A$	3.8222	0.7893	4.8427	0.0000
	θ	0.1320	0.0490	2.6918	0.0071

Lagrange Multiplier test of RM vs. FE/RE $\chi^2_{(2)} = 41.6,\ p = 0.0000$

Hausman test of FE vs. RE; $\chi^2_{(1)} = 0.02,\ p = 0.8994$

Table 3.2: Parameter 'θ' Estimation for Sub Group Two
Two-Way Error Component Regression Model

Estimators	Parameters	Estimate of the parameter	St. error of the parameter	T-ratio	p-value
Fixed Effect Model	$\ln A$	22.9713	9.9419	2.3106	0.0242
	θ	1.0818	0.6302	1.7167	0.0910
Random Effect Model	$\ln A$	8.0673	4.6333	1.7412	0.0817
	θ	0.1371	0.2863	0.4788	0.6321

F-test of One-Way vs. Two-Way $F[7,48] = 1.703,\ p = 0.1309$

Lagrange Multiplier test of RM vs. FE/RE $\chi^2_{(2)} = 57.03,\ p = 0.0000$

Hausman test of FE vs. RE; $\chi^2_{(1)} = 2.83,\ p = 0.0924$

The econometric analysis suggests that effect of factors of market failure was not significantly different from zero for the former group and significantly different from zero for the latter group. Moreover, the magnitude of the parameter estimate in the latter group is about two fold of that of the former group, confirming the hypothesis that effects of factors of market failure are higher in the latter case, which have brought the difference in growths of the two sub-groups. That is, be it knowingly or unknowingly, the latter group has managed to get significant gain from factors of market failure that brought them to a level above poverty line. Furthermore, we observe that the latter group has attained some statistically significant rate of per capita income growth, even though it is apparently small in magnitude, about 13% of their labor force growth, which disagrees with the prediction of conventional growth model under the assumption of unfailing market. Still further, the significance of the result, indirectly, informs us the inappropriateness of the assumption in describing economic growth process as well as in solving problems there from at least in subsistence economies.

5. CONCLUDING REMARKS

A growth process of subsistence economies was examined by using somewhat different spectacle. The framework used to analyze the problem was designed by taking into consideration the problem faced by poor agents in saving part of their income. Moreover, the framework has tried to relax the common assumption of competitive equilibrium. It suggests that poor economies can exhibit per capita growth, by properly managing and exploiting factors of market failure. They remain poor only if they fail to do so. The explicit information from the framework is that these economies have to search for means of promoting activities availing positive externalities and discouraging those availing negative externalities. Moreover, market imperfection has to be looked into and has to be geared towards contributing to growth, rather than considering them as given. In addition to that, the framework suggests the possibility of perpetual growth as far as agents are willing and determined to promote favorable factors of market failure and nullify the contraries.

Furthermore, the proposed framework gives some information on how growth took place in currently developed nations, when they were at the stage of subsistence. It suggests that the currently developed nations have managed to go beyond the level of subsistence, not by deferring the then current consumption and investing it in accumulation of physical capital, schooling and research, which is not compatible with rational human behavior, but through exploiting possible factors of market failure.

Finally, it is felt here, that the candidate of "mining site" for source of growth is suggested. Excavating the "ore" and separating the elements therein and ranking them according to their values will be the remaining job behind the paper.

Endnotes

[1] *Most often the two papers are considered to press growth study forward after neoclassical growth approach.*

[2] *Indeed, Romer (1990) managed to bring into play both monopoly power (one form of market imperfection) and spillovers (one form of market incompleteness) in his model. But the problem is not as such confined to imperfection due to monopoly.*

[3] *The effects of factors of market failure are endogenous to the economy though they are exogenous to the markets. An economy can influence the degree and directions of the effects though its social institutions (law, moral institutions and the market place itself). The institutions can promote or discourage external economies and diseconomies (one form of market incompleteness); can maintain or destroy the public goods; can permit or abandon advantageous market structure.*

[4] *Alternatively, we can show this result very briefly as follows. Under unfailing market condition we have marginal product of a factor equaling average product of a factor. i.e.*

$$f_L = \frac{Y(t)}{L(t)} \Rightarrow f_L L(t) = Y(t) \Rightarrow \frac{f_L L(t)}{Y(t)} = 1$$

[5] *Sub-Group one includes Bangladesh, Benin, Burkina Faso, Burundi, Chad, Congo- Dem. Rep., Kenya, Madagascar, Malawi, Nepal, Nigeria, Pakistan, Rwanda, Sierra Leone and Togo*

[6] *Sub-Group two includes China, Gambia-The, India, Indonesia, Lesotho, Mali, Sri Lanka and Swaziland.*

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