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EQUITY, SAVINGS, AND GROWTH

by

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I: INTRODUCTION

The conventional wisdom, first set out by Kuznets (1955), holds that the first stage of high economic growth in initially low-income countries is likely to generate growing income inequality, as workers shift from low-productivity sectors such as agriculture, to high productivity sectors. But the evidence of what happened in East Asia is altogether different. From 1960-90, GDP growth of seven East Asian economies averaged almost 6 percent annually, yet income inequality did not deteriorate and may even have improved.[1] Moreover, income growth throughout the period was not confined to one group of workers, nor to workers and their households outside of agriculture. Agricultural productivity itself increased substantially, and in a sign of broad-based income growth, the number of people below the poverty line declined dramatically.[2]

One explanation for this process of equitable (as opposed to disequalizing) growth in East Asia is those countries' initially low levels of income inequality. It is true that countries with relatively low inequality in 1960 have grown faster over the subsequent three decades than countries in which the distribution of income was more skewed.[3] Why should low initial inequality foster growth? Some explanations focus on the political implications of a highly skewed distribution of income: Higher inequality may alienate the poor, leading to greater political and economic instability. Potential political instability may discourage investment, thereby lowering growth. Even in a stable democracy, high inequality may increase populist demands for taxes on capital, thereby discouraging investment and lowering growth.[4] Other, non-political explanations rely on imperfect capital markets: high inequality and implied high proportions of the poor mean many households are liquidity-constrained and cannot afford such high return

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[1] World Bank, 1993 and Birdsall, Ross and Sabot, 1995 (especially Figure 1) provide the growth rates along with evidence that income inequality did not deteriorate and may have improved in these economies.

[2] Agricultural productivity grew much faster than in other developing countries; see Turnham 1993 as cited in World Bank 1993. Poverty fell everywhere, in Indonesia from 58 to 17 percent of the population in one decade, even while agriculture remained dominant.

[3] See Birdsall, Ross and Sabot, 1995; Clarke, 1995, Deininger and Squire, 1998, for estimates of growth rate functions which include inequality as an explanatory variable.

[4] See for example Alesina and Perotti, 1994; Alesina and Rodrik, 1994; Perotti, 1996; Persson and Tabellini, 1994.

investments as education, ultimately limiting the economy's overall growth.[5] That explanation is consistent with recent evidence that it is not the distribution of income per se that affects growth, but the distribution of such critical assets as education and land,[6] and that a more equal distribution of these assets is associated not only with higher average growth rates but with higher income growth of the bottom 20 percent of households ranked by income.[7]

In this paper, we develop a model of the micro-economic behavior of poor households that accounts for the episodes of equitable, poverty-reducing growth from low initial income levels in East Asia and for selected periods in other settings. The account does not depend on any impact of initial low inequality, or on the political process; while it does assume that poor households are liquidity constrained, this is not a constraint to their investing in the face of certain conditions. The model instead relies on a savings and investment boom among the poor that raises their income while contributing to overall economic growth. The boom is triggered by the emergence of new investment opportunities for the poor accompanied by strong demand for their relatively unskilled labor. These are factors which do tend to be associated with low income inequality and with a healthy distribution of productive assets, but they rely as much or more on reforms in economic and social conditions – especially those which create new investment opportunities for the poor and reduce labor market distortions -- as on good initial conditions.[8]

The model focuses on investment as a motivation for savings and determines labor supply jointly with savings. An increase in returns to investments open to credit-constrained households increases saving, financed by increases in labor supply and current income, and by declines in consumption. The increment to savings will actually be more than 100 percent of the increment to income. The model also shows that,

[5] Benabou, 1996; and Birdsall, Ross and Sabot, 1995.
[6] Deininger and Squire (1998) include the distribution of land in their estimations; Birdsall and Londono (1997) find that both the distribution of education and of land affect growth, and their inclusion dominates the distribution of income, which loses statistical significance; Lopez, Thomas and Wang, 1998, find that the distribution of education affects growth and its inclusion makes education stock itself also significant.
[7] Birdsall and Londono, 1997; Deininger and Squire, 1998.
[8] Stallings, Birdsall and Clugage (1999) contrast different policy regimes in East Asia and Latin America to explain why in Latin America in contrast to East Asia, growth has not been equalizing.

given high returns to investment, an increase in the returns to labor will increase savings, financed again by increases in labor supply and current income, but not by decreases in consumption.[9] The increase in savings can be a substantial percentage of the increase in income.

The increased savings by the poor in response to higher returns to investment and to labor, can, in turn, contribute substantially to domestic savings. It is likely, therefore, to increase overall growth. By rapidly raising the incomes of the poor the process is also likely to minimize and even offset the increase in inequality about which Kuznets theorized.[10]

Section II develops the model. In Section III we assess the magnitude of the predicted effects of the model through simulations, and we discuss the realism of the crucial assumption that poor households are credit constrained. Section IV briefly considers four cases in which the model appears to have explanatory power. Section V concludes.

II: SAVINGS AND INVESTMENT BY THE POOR

Why do poor households in low-income countries save? The permanent income and life-cycle models commonly employed to analyze savings in high income countries assume that households save in productive years in order to provide income for unproductive years in the future. A typical household first accumulates and then decumulates assets.[11] In low income countries, where households tend to be multi-generational (Deaton 1990), today's adults have little need for retirement savings. They expect their

[9] By "increases in labor supply" we mean both increased time devoted to work and increased effort during that time. Thus this model is related to "efficiency wage" models that postulate a positive link between incentives and labor productivity. See Dasgupta & Ray (1986) for a formal development of an efficiency wage model. Furthermore, unlike the labor surplus models that follow Lewis (1954), we assume that marginal returns to labor are greater than zero.

[10] The model turns on its head the idea of Kaldor (1978), and more specifically of Galenson and Leibenstein (1955) that high inequality encourages rapid growth because the greater concentration of income results in higher savings in the aggregate, since the rich have a higher propensity to save than the poor.

[11] Savings behavior in high-income countries, however, does not typically follow the predictions made by life-cycle and permanent income models (Deaton 1992a, Carroll 1994). Precautionary motives and liquidity constraints are gaining more prominence as explanations.

children to support them, as they themselves are supporting their parents. Life cycle models of savings behavior have little relevance.

The motivation for savings in poor countries is either to provide a buffer against stochastic decreases in income,[12] or to finance investment. Deaton (1990, 1992b) develops a model of the precautionary savings behavior of credit-constrained, low-income, multi-generational households.[13] Since precautionary savings must be liquid, they may be held in non-productive assets such as jewelry and precious metals. But in addition to the precautionary motive, poor households have an investment motive to save. If the return to investment is high enough, they may save to invest in such illiquid but productive assets as their own businesses or farms, or the education of their children. Since investment cannot exceed savings for credit-constrained households, in order to invest more the household must save more. This implies that the expected returns to investment will influence the savings rate; an increase in returns will increase the incentives to save.[14]

The poor may have high rates of time preference, given that there are few luxuries to cut out of consumption bundles that are already scanty. Nevertheless, by definition an investment with a rate of return higher than their rate of time preference will be attractive. Improved opportunities for investment -- such as might arise from the development of a new agricultural technology, more favorable agricultural price policies, the introduction of a new crop, an improvement in the quality of local schools, or an increase in the demand for educated labor -- can raise returns to investment above the rate of time preference. Given their inability to borrow, households which previously saved only for precautionary reasons will then search for funds to invest.

[12] Much recent research has investigated the saving and dissaving response of rural households to income shocks. See, for example, Townsend (1995) and Paxson (1992).
[13] "At least for some households, borrowing restrictions are real and necessary to explain what we observe." (Deaton 1990).
[14] See McKinnon (1973). Schultz (1964) saw the absence of profitable agricultural investment opportunities as the explanation for low observed savings rates in poor rural areas.

The additional savings may be financed by decreasing consumption, or by increasing work effort and thus current income. While current income is generally considered an exogenous determinant of savings, we view current income as endogenous, as a function of the perceived return to savings (investment).[15] In effect, an increase in the rate of return to investment increases the marginal utility of money in the initial period for a credit-constrained household. This induces the household to accept a lower level of consumption and a lower level of leisure initially, to allow the investment to take place.[16] The household trades off a loss in utility in the initial period for a larger gain in utility in the future.

A simple, two-period model of a credit-constrained household with utility separable across time periods produces these effects. The household's utility in each time period is a separable function of leisure (R) and consumption (C); marginal utility declines with each additional increment of R or C. Utility is maximized over two periods, the present and the future, with future utility discounted by the rate of time preference (d):

$$U(C_1,C_2,R_1,R_2) = U1(C_1,R_1) + (1+d)^{-1}U1(C_2,R_2) \quad (1)$$

where U is the multiperiod utility function, and U1 is its single period component.

The household generates output Y in both periods by applying labor:

$$Y_i = Y(L_i) \text{ for } i = 1,2 \quad (2)$$

We will assume the marginal productivity of labor is constant or decreasing in both periods:

$$\partial^2 Y / \partial L^2 \leq 0 \quad (3)$$

The household allocates total time T in each period between leisure and labor:

$$L_i = T_i - R_i \text{ for } i = 1,2 \quad (4)$$

[15] A household that has accumulated precautionary savings in non-productive resources has the additional option of using those resources to finance the investment. Since precautionary models show household dissaving as often as they save, however, this form of financing is not sustainable.

[16] There is no "income effect" of the increase in investment returns on consumption in the first period; with a binding credit constraint, the positive impact on consumption of that increase in returns is realized only in the second period. In each period, the marginal utility of leisure must equal the marginal utility of consumption times the marginal productivity of labor. An increase in the returns to investment induces more work and *reduced*

In the first period, income is either consumed or saved (and invested):

$$C_1 = Y_1 - S \tag{5}$$

Savings (and investment) yield a return of r percent in the second period, so that consumption in the second period equals income in the second period plus the amount saved (invested) and its return.[17] The return to investment is modeled explicitly rather than via an improvement in returns to labor in the future so as to allow for the assessment of the impact of improvements in r on savings and investment.

$$C_2 = Y_2 + (1+r)S \tag{6}$$

A key assumption: the household has to cope with a capital market imperfection; there is no opportunity to exchange income produced in the future for present consumption, at any interest rate.[18] This implies:

$$S \geq 0 \tag{7}$$

Constrained maximization of the utility function yields the following first order conditions after algebraic manipulation:

$$\frac{\partial U1 / \partial C_1}{\partial U1 / \partial C_2} = \frac{1+r}{1+d} \tag{8}$$

$$\frac{\partial U1 / \partial R_1}{\partial U1 / \partial R_2} = \frac{1+r}{1+d} \cdot \frac{\partial Y / \partial L_1}{\partial Y / \partial L_2} \tag{9}$$

Consider the implications of these first order conditions under alternative assumptions regarding the relationship between the returns to investment and the discount rate. When r < d, Equations 8 and 9 imply that $C_1 > C_2$ and $R_1 > R_2$; these can both hold only if S < 0 (the household borrows). But borrowing

consumption in period one to finance the investment; labor supply increases and consumption decreases in such a way to maintain the equality.

[17] As in all two-period models of this type, assets are consumed in the second period; there is no motivation for further saving. Since this is a non-stochastic model, there is no incentive for precautionary saving in period 1. Thus, consumption in period 2 is limited by income in period 2 plus the amount invested and its return.

[18] We assess whether or not this assumption holds for poor households in Section 3.

is ruled out by assumption (Equation 7). Thus, in this case the first order conditions in Equations 8 and 9 do not apply; for the household there is no alternative to S = 0, implying that $C_1 = Y_1$ and $C_2 = Y_2$; furthermore, $R_1 = R_2$ and $L_1 = L_2$. When r = d, Equation 8 implies that $C_1 = C_2$. Again, the problem collapses to two one-period problems. The household neither invests nor borrows; $R_1 = R_2$ and $L_1 = L_2$. Thus, given the capital market constraint, r < d and r = d produce identical solutions.

When the rate of return to investment exceeds the discount rate (r > d), results differ. Equation 8 now implies that $C_1 < C_2$, which, together with Equation 9, implies that $L_1 > L_2$ and, therefore, S > 0. Consider first the situation in which the marginal product of labor is constant. In this case, the right hand side of Equation 9 simplifies to (1+r)/(1+d); since this is greater than one, R_1 must be less than R_2, and thus $L_1 > L_2$. If the marginal product of labor is decreasing, Equation 8 and the time constraint (Equation 4) imply that the ratio of the marginal products of labor is less than one and the ratio of the marginal utilities of leisure is greater than one. This, in turn, implies that $R_1 < R_2$ and $L_1 > L_2$, as when the marginal product of labor is constant.[19] Thus, in Case 3 the household increases labor supply and decreases consumption in the first period in order to save; labor supply decreases and consumption increases in the second period as the household reaps the benefit of its investment. The larger the ratio (1+r)/(1+d), the greater will be the difference between the two periods in labor supply and consumption. In this case, the ratio of the increase in savings to the increase in income will be greater than one. When investment opportunities improve, all of the increase in income that results from increased labor supply is added to savings; in addition, savings increase by the amount that consumption decreases.

The increments to savings triggered by an increase in returns to investment will be larger where the demand for labor is strong, and thus marginal returns to labor decline slowly. As shown by Equation 9, when returns to labor decline rapidly, the household chooses to increase labor supply only slightly. Labor supply increases the most in response to improved investment opportunities when marginal returns to labor

[19] The combination of $R_1 > R_2$ and $L_1 < L_2$, while consistent with the time constraint (Equation 3), is not consistent with Equation 8 because it would make the left hand side less than one and the right hand side greater than one.

are constant. High demand for labor, therefore, leads to more investment in the presence of profitable investment opportunities.

When triggered, the mechanisms on which we focus clearly improve the welfare of the poor; they are also likely to spur equitable growth. Many of the investment opportunities available to the poor enhance the productivity of assets owned by poor households: human capital, small farms, and informal sector enterprises, for example. Since human capital cannot be transferred and, hence, does not serve well as collateral, rich, creditworthy households are not able to profit by investing in the human capital of the poor. Similarly, rich households face high transactions and monitoring costs that limit their investments in small farms and informal sector businesses owned by the poor.[20] Therefore, if the poor are unable to finance the investments themselves, the potential proceeds are lost to the economy.

Moreover, at the margin investments available to the poor are likely to have higher returns than investments available to the rich. Rich, creditworthy households are likely to drive down the marginal returns of their investments to their borrowing rate for formal sector investments. By contrast, poor households with very low marginal returns to labor may have an array of high-payoff investments that they are unable to finance because of their high rates of time preference and rapid increases in the marginal utility of present consumption as consumption declines.[21]

Thus, a change in the policy environment that raises the rate of return to investment in the assets of the poor while simultaneously increasing marginal returns to their labor spurs growth by increasing savings and investment in the aggregate and by inducing investments with particularly high rates of return. The incomes of the poor are likely to rise faster than the incomes of the rich, both because of the higher marginal propensity to save of the poor and because of higher returns on the investments they make.

[20] Sharecropping is a rare example of an institution that reduces such costs.

[21] Bevan, Collier, and Gunning (1989) verify the presence of high-payoff investments for poor households in Kenya and show that windfall proceeds from the coffee boom allowed households to make these investments. The recent literature on the Grameen Bank of Bangladesh and other microcredit programs finds positive impacts on income, production and employment, suggesting that investments by the poor often yield very high returns (indeed

Furthermore, over a period of years, the rate of time preference of the poor may decline as their income increases.[22] This results in a higher 1 + r/1 + d ratio in Equations 7 and 8, generating yet more labor supply and investment.[23] The labor- and skill-demanding, agricultural-based, and export-oriented development strategies of countries in East Asia over the last three decades may be examples of this phenomenon: high and rising returns to both investment and labor triggered savings and investments of poor households, which fueled growth, lowered poverty, and, eventually, lowered the rate of time preference of the poor.[24]

III: ASSESSING THE MODEL

How big are the increases in savings by poor credit constrained households in response to increases in returns to investment and/or labor? We use the model to conduct simulations, applying plausible parameters. Assume that output is solely a function of the amount of labor applied, with no diminishing returns (Y=L; this is relaxed below), and the rate of time preference is 0.3. With a simple, separable utility function,[25] when r < d, the household works half of the time, producing 0.5 income and consuming all of it. If the rate of return to investment increases to 0.4, above the rate of time preference, then labor and income

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given that microcredit programs often charge quite high real interest rates, the investment returns have to be high to warrant participation). See, for example, Khandker, Samad and Khan (1998) and Pitt and Khandker (1998).

[22] Few studies have tested whether or not the rate of time preference changes with income. Lawrance (1991) estimates rates of time preference three to five percentage points higher for relatively poor US households compared to the relatively rich. Osaki and Atkeson (1997), working with Indian data, find the intertemporal elasticity of substitution higher for the rich, but do not reject the hypothesis that the rate of time preference is constant across income.

[23] In addition, over time an improvement in returns to investment by the poor could have a greater impact on income of the poor than the change in marginal conditions suggests by inducing search for yet more profitable investments. See Bruton (1985).

[24] See Birdsall, Ross and Sabot (1995) and Timmer (1993a, 1995). Timmer argues that the link between agricultural growth and improvements in national total factor productivity results, in part, from the increased work effort and investments made by the rural poor in response to improved incentives to the agricultural sector.

[25] $U1(R,C) = R^{0.5} + C^{0.5}$. Many unemployment and retirement models employ utility functions in which leisure and consumption are additive. See for example Gustman and Steinmeier (1986), Shi and Wen (1997), and Gali (1999). The key effect of this form of the utility function as opposed to a Cobb-Douglas form is to make the marginal utility of leisure independent of the level of consumption. If, instead, we use a utility function in which the marginal utility of leisure is a decreasing function of consumption, our results strengthen. Matheny (1998) argues this is a more plausible relationship.

increase by 6.25 percent, consumption declines by 6.25 percent, and savings equal 12.5 percent of initial income. The increase in savings is thus twice the increase in income. While this particular ratio of the increment in savings to the increment in income is a function of the parameters of the utility function, the model yields a ratio greater than 100 percent under all possible parameters.

The model yields similar results when returns to labor are decreasing. For example, increasing the rate of return to investment from below the 0.3 rate of time preference to 0.4 with a production function exhibiting decreasing returns to labor[26] results in a 6.2 percent increase in labor, a 4.9 percent increase in income, a 6.2 percent decrease in consumption, and savings equal to 11.1 percent of old income. The increase in savings is more than twice the increase in income. The declining marginal productivity of labor induces the household to finance a greater proportion of the increase in savings from decreases in consumption.

Consider the consequences for savings of improving marginal returns to labor when the rate of return on investment exceeds the rate of time preference. If the rate of return on investment is 0.4, an improvement in the marginal returns to labor of 12 percent results in a 13.9 percent increase in labor supplied, a 12.4 percent increase in income, an 11.5 percent increase in consumption, and savings equal to 11.3 percent of income (compared to 10.6 percent prior to the increase in returns to labor).[27] The increase in savings is 17.5 percent of the increment in income. In actuality, a change in policy or technology that raises the rate of return to investments is also likely to increase the marginal productivity of labor. Raising the rate of return on investment from below the 0.3 rate of time preference to 0.4, and simultaneously increasing marginal returns to labor by 12 percent results in a 21 percent increase in labor and an 18 percent increase in income. Consumption increases 4.6 percent, and savings equals 13 percent of initial income. The ratio of the increase in savings to the increase in income is 74%.

[26] The production function used is $Y=0.8L^{0.8}$, whereas in the first simulation the production function was $Y=L$.
[27] The new production function is $Y=0.875L^{0.9}$. The parameters of this function were chosen so that marginal returns to labor are higher but average returns to labor are identical to those of $Y=0.8L^{0.8}$ at the former equilibrium value of L.

Of course, if households are able to borrow at an interest rate less than or equal to the discount rate, they will finance high return investments by borrowing rather than by decreasing consumption or leisure.[28] A household that can borrow will respond to an increase in the rate of return to investment not by working harder and cutting consumption, but by borrowing more, consuming more, and increasing leisure in the first period.[29] Are poor households credit-constrained?

Poor households do participate in credit markets. Credit constraints are binding, however, for multi-year investments. Deaton (1992b) reports that 25 to 40 percent of rural households surveyed in the Ivory Coast and Ghana had outstanding loans. In Nigeria, Pakistan, Kenya, and Tanzania surveys indicate that 65 to 90 percent of households borrowed at some point during a twelve-month period (Udry 1993, Alderman and Garcia 1993, Kimuyu 1994). But according to these same household surveys, the vast majority of loans to the poor are for one cropping season or less.

In East Africa, for example, expected proceeds from the present year's coffee harvest are used as collateral for short term loans; less than one percent of surveyed households borrowed for more than a season (Kimuyu 1995). Rotating savings and credit schemes similarly provide financing for at most the length of the rotation -- typically less than 6 months. Kimuyu concludes: "Sources of multi-year financing are sorely lacking. This must act as a hindrance on long-term investments in the community, and thus on productivity in the long run." (Kimuyu 1995)[30] Borrowing to finance multi-year investments, such as

[28] Furthermore, with returns on investment exhibiting no diminishing returns in this model, a household that does not face borrowing constraints or increasing interest rates could become infinitely wealthy. In the absence of borrowing constraints one must assume either diminishing returns to investment, increasing interest rates with borrowing, or both.

[29] This is the classical permanent income effect. See Shibli (1991) for a discussion of other implications of the borrowing response by households to improved investment opportunities.

[30] Stiglitz and Weiss (1981) provide theoretical justification for binding credit constraints for some borrowers even in much better functioning financial markets than those found in less developed countries. Bayoumi (1993) for the United Kingdom and Gavin et al (1997) for Latin America argue that financial deregulation has reduced savings by eliminating credit constraints. Behrman, Foster, and Rosenzweig (1997) provide evidence that the poor in rural Pakistan are credit-constrained even in the short period between planting and harvesting. See also Bhalla (1978), Jacoby (1994), and Rosenzweig and Wolpin (1993) for indirect evidence of the importance of borrowing constraints in developing countries. On the macro level, liquidity constraints are being used increasingly to explain savings behavior even in rich countries (Deaton 1992a).

planting of permanent crops and improving human capital, is simply not feasible for most poor households without collateral.[31]

IV: FOUR APPLICATIONS

This model offers alternative explanations for important economic phenomena. In Korea, for example, rural savings rates increased from a range of 11 to 15 percent in the mid-sixties to a range of 25 to 34 percent in the period from 1971 to 1976. Hyun, Adams, and Hushak (1979) use cross-sectional data to argue that this increase in savings is the result of the combination of an increase in transitory income and the higher propensity to save from transitory rather than permanent income. In their specification, however, any income generated by increased work effort to finance investment would be called "transitory income."

Our model suggests a different explanation. From the mid-sixties to mid-seventies, the real domestic price of rice in Korea nearly doubled, improving agricultural investment opportunities (Timmer 1993b), and there were increases in the demand for labor, improving marginal returns to labor outside of agriculture (Birdsall et al 1999, World Bank 1993). Credit constrained households would respond by increasing labor supply, lowering consumption, and using the marked increase in savings to finance investment.

A second example comes from Taiwan.[32] During the period 1976 to 1990, per capita income and household savings were both rising rapidly. Households at all income levels faced greater opportunities for

[31] Income and credit constrain investment in human capital only when expected returns to schooling are high. If these returns are low, an increase in the income of the poor may have little or no impact on investment in schooling. Thus, empirically estimated income elasticities of demand for schooling, as conventionally measured, are of little relevance to assessing the model's assumptions. To test our model the demand equations need to include controls for expected returns to investment. Rosenzweig (1995) does this for India, showing that differential increases in school enrollment are associated with differential increases in returns to schooling that occurred with the introduction of high-yielding seed varieties.

[32] Angus Deaton graciously provided us with annual survey data on household savings in Taiwan from 1976 to 1990, reported in each year by quintiles of income and of expenditure per capita. Savings rates are measured as a

investment and higher returns to labor, but the poorest households faced the greatest constraints on credit. Consistent with the predictions of our model, savings rates for the poorest income quintile show the largest proportionate increase, doubling from 11 percent to 22 percent over the period. Savings for the richest quintile increase by 50 percent, from 32 percent to 48 percent. When households are ranked by per capita expenditure instead of per capita income, savings rates doubled for the poorest quintile, increasing from 19 percent to 39 percent, while for the richest quintile they increase from 23 percent to 31 percent.[33]

East Africa provides a third example. African farmers in Kenya's Central Province were forbidden from planting coffee until the late fifties. The lifting of this restriction (along with the simultaneous development of coffee processing and marketing infrastructure) markedly raised returns to on-farm investment. In response, in some villages poor farmers planted as much as half of their land in coffee (Pinckney and Kimuyu 1995). The government partially subsidized the direct costs of planting coffee, but the opportunity cost of the land during the five years of coffee maturation was borne by rural households.

Long-term borrowing to finance these opportunity costs -- in excess of 20 percent of income annually -- was not possible. Nor is it plausible to assume that these poor farmers decreased consumption by this magnitude. There were, however, increases in the marginal returns to labor off-farm at this time (Collier and Lal 1986).[34] Farmers could finance the investment in coffee by a combination of some decrease in consumption and by greater work effort, on the remaining agricultural land and off-farm, which increased income.

The difference between human capital investments in Latin America and East Asia provides a fourth example (Birdsall et al 1999). Korea's secondary enrollment rates are considerably higher than

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residual (reported income minus reported consumption expenditure), so that investments on the farm or in small enterprises are classified as savings (but education expenditure is classified as consumption).

[33] Measurement error in these data -- in which savings are not measured directly -- suggests that the results should be interpreted with caution. Because savings are calculated as a residual, measured savings are positively correlated with the income measurement error and negatively correlated with the expenditure measurement error. Savings for the lowest income quintile, therefore, are likely underestimates**,** while savings for the highest income quintile are likely overestimates. The net result: the relationship between income and savings is biased upward. The opposite relationship holds for savings by expenditure quintile.

predicted by comparison with other countries at similar levels of income, while Brazil's are considerably lower. The difference is particularly large for the poor. The conventional explanation for the difference is the greater public commitment to supplying schooling in Korea, which in turn results from a greater cultural affinity for education. Higher spending on basic education per eligible child in Korea did occur, financed in the 1970's and 1980's by higher per capita growth (brought about, in part, by declining fertility). This is part of the explanation; higher spending per child meant that in Korea, the quality of primary and secondary schooling improved, while in Brazil expansion of enrollment without proportionate increases in spending led to declining quality, especially for the poor. As a result, the return to schooling for the poor (and hence the incentive for the poor to save and invest) was much higher in Korea than in Brazil.

But an additional explanation is based on the marked difference between the countries in the demand for educated workers. Korea's export oriented, labor-demanding growth strategy raised the returns at the margin for the labor of the poor, making it attractive to increase time allocated to work in order to finance high return investments in education. Moreover, the labor demanding growth path contributed to high expected rates of return to schooling, hence to strong household demand for education, by becoming increasingly skill-intensive over time. Poor Korean parents were confident that their children would be much better off if they were educated. By contrast, in Brazil the inward-looking growth strategy was not labor demanding and so, for the poor, the returns to additional labor time allocated to work were quite low. This made financing investments in education difficult. Because educated workers were scarce, average returns to investment in schooling were high, despite lack of dynamism in the demand for labor and skill. But, for the poor, who attended low quality schools, returns to investment in schooling were below average. Parents thus had little incentive to engage in the types of sacrifices implied by our model.

[34] For example, wages for unskilled laborers employed by agricultural estates increased by 80 percent in real terms between 1954 and 1965 (Collier and Lal 1986).

In sum: in Korea public policy -- which contributed to high quality schooling, strong demand for labor, and low income inequality -- generated powerful incentives for the poor to invest in their children and to work more to finance that investment. In Brazil public policy -- which contributed to low quality schooling, weak demand for labor and high income inequality -- created incentives for low levels of saving and investment among the poor and high levels of leisure. As a consequence, in Korea there was much more investment in human capital and much more "growth from below" than in Brazil.

V: CONCLUSIONS

We have developed a model of savings, in the presence of credit constraints, which endogenizes labor supply. The model suggests that improvements in investment opportunities and returns to labor, features of a labor demanding growth strategy, can lead to exceptionally high savings by the poor. Reductions in poverty and equitable growth may result, in part due to the relatively high rates of return available to investments in assets of the poor. The model also helps explain why low inequality and its corollaries -- higher absolute incomes of the poor and higher returns to the poor's labor and investment -- can result in higher aggregate savings rates and faster growth. Our model, therefore, suggests an explanation for the growth with equity achieved in East Asia that does not rely upon interactions with politics.

Research is needed both to expand the theoretical foundations of the model and to test for its importance empirically. Logical extensions include a shift from a two-period to a multi-period model, thereby allowing savings in more than one period, and changing the production function so that investment improves returns to labor in subsequent periods. Finally, incorporating precautionary motives for savings, as in Deaton (1990 and 1992b), via the introduction of income shocks should be a high priority. Empirically, historical case studies may prove to be a fruitful means of testing the model. A more rigorous approach would require detailed micro data on a cross-section of communities facing different investment opportunities and returns to labor.

Nevertheless, our simulations and examples of relevant cases suggest that improvements in investment opportunities can result in substantial increases in labor supply and savings for poor, credit-constrained households. These increases in savings are larger yet when investment and employment opportunities both expand. The implications of this model are therefore potentially far-reaching: ensuring that the poor face incentives to invest and to work more can result not only in higher incomes for the poor, but also in large increases in savings and investment and hence in growth. The poor then become not only beneficiaries of the growth process; they become an engine of growth as well.

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