Social and Political Factors in a Model of Endogenous Economic Growth and Distribution: An Application to the Philippines

Prepared by Delano Villanueva

Authorised for distribution by B.R.H.S. Rajcoomar

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Abstract

This paper proposes a model of endogenous economic growth and distribution explicitly incorporating social extraction and political competition, with an application to the Philippine historical experience. The major objective is to explain developments in the distribution of national income and wealth and in the growth rate of per capita capacity output. When calibrated, the proposed model is found to be consistent with the broad contours of Philippine macroeconomic history.

JEL Classification:

N15, O11, O41, O53

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Summary

This paper analyzes the interrelations among social extraction, political competition, wealth distribution, capital accumulation, and long-term macroeconomic performance in the Philippine experience. It tests hypotheses about these interrelationships using institutional information and historical data to explain developments in the distribution of national income and wealth and in the growth rate of per capita capacity output. Sociological and political features of the economy are incorporated in an aggregative endogenous growth model. The paper concludes with several policy implications for a successful strategy of economic development.

Philippine society is divided into the elite (top quintile of income distribution) and the non-elite (the remainder). The elite owns vast tracts of land and most of the capital stock. The non-elite consists of laborers, self-employed professionals, and small-scale entrepreneurs. The extraction rate is defined as 1 minus the fraction of labor's marginal product paid out as wages. Political competition is defined as the ratio to group income of consumption spending on political activities.

Social equity argues for lowering the rate of social extraction and improving the distribution of wealth and income, which should be made explicit objectives of economic growth, because their attainment is essential to a broad-based, rapid increase in the growth rate of per capita capacity output. A less unequal distribution of wealth, a more progressive incidence of public finance (or at least a neutral net tax incidence) to provide the working population access to basic goods and infrastructure services, a more neutral (with respect to exports and import substitutes) trade and industrial policy, improved labor market policies to promote efficiency in resource allocation, and sound macroeconomic policies that achieve and maintain a low-inflation environment would imply a low value for the social extraction rate, much improved distribution of income and wealth, and a rapid growth rate of per capita capacity output.
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I. Introduction

This paper analyzes the interrelations among social extraction, political competition, wealth distribution, capital accumulation, and long-term macroeconomic performance. Hypotheses about these interrelationships are tested using institutional information and historical data on the Philippines. The major objective is to explain developments in the distribution of national income and wealth and in the growth rate of per capita capacity output. Sociological and political features of the economy are incorporated in an aggregative endogenous growth model, and their economic implications are drawn to shed light on the broad contours of Philippine macroeconomic history. Section II develops a theoretical framework for the analysis, which is used to explain the Philippine experience in Section III. Section IV concludes with several policy implications for a successful strategy of economic development.

II. The Theoretical Framework

1. The macroeconomy

The economy is organized as shown in Table 1. Philippine society is divided into two broad classes: the elite and the non-elite. The elite owns a very large capital stock, particularly vast tracts of land on which are based further accumulation and income generation. For this paper, the elite is defined as the top 20 percent of Philippine society. As such the elite, although representing only about a tenth of households, receives more than half of aggregate household income. Members of the elite comprise the following three land-owning classes: (i) a landlord class that evolved from the land-settlement policy at the beginning of Spanish rule in 1521--land consolidation by the Catholic Church that originated from bequests of Spanish settlers, including religious orders, who were granted property rights by the Spanish crown; (ii) a class of government servants who were awarded land for their services to the civil government of Spain, and who intermarried with Filipinos (whose descendants became the ruling elite); and (iii) a final class of landowners--the Chinese, who accumulated land through money-lending and commerce (Power, Sicat, and Hsing 1971).

The non-elite is defined as the bottom 80 percent of Philippine society. Although representing nearly 90 percent of total households, the non-elite receives less than half of total household income and owns a small stock of capital. This group consists of workers, self-employed professionals, and small- and medium-scale entrepreneurs. The non-elite

1/ About 54 percent on the average from 1961 through 1988 (Medalla et al., 1995).
2/ The Philippines was under Spanish rule from 1521 through 1898.
Table 1. Group Assets, Incomes, and Expenditures

<table>
<thead>
<tr>
<th>Asset</th>
<th>$K_e$</th>
<th>$K_{ne}, L$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>$Y_e = (1-r_e) r K_e$</td>
<td>$Y_{ne} = (1-r_{ne}) (r K_{ne} + w L)$</td>
</tr>
<tr>
<td>Consumption</td>
<td>$c_e Y_e$</td>
<td>$c_{ne} Y_{ne}$</td>
</tr>
<tr>
<td>Surplus</td>
<td>$(1-c_e) Y_e$</td>
<td>$(1-c_{ne}) Y_{ne}$</td>
</tr>
<tr>
<td>Investment in K</td>
<td>$i_e Y_e$</td>
<td>$i_{ne} Y_{ne}$</td>
</tr>
<tr>
<td>Investment in L</td>
<td>0</td>
<td>$\mu h Y_{ne}$</td>
</tr>
<tr>
<td>Political competition</td>
<td>$\gamma_e Y_e$</td>
<td>$\gamma_{ne} Y_{ne}$</td>
</tr>
</tbody>
</table>

Memorandum item:

Government budget identity: $r_e Y_e + r_{ne} Y_{ne} = 0$

---

1/ The aggregate production function is $Y = F(K, L) = L f(k)$ with the standard properties, where $Y$ is capacity GDP, $K$ is capital, $L$ is labor, and $k = K/L$. These properties, also known as the Inada (1963) conditions, are: \( \lim \frac{\partial F}{\partial K} = \infty \) as $K \to 0$; \( \lim \frac{\partial F}{\partial K} = 0 \) as $K \to \infty$; $f(0) \geq 0$; $f'(k) > 0$; and $f''(k) < 0$. A class of production functions satisfying these conditions is the Cobb-Douglas form, which is used to calibrate and simulate the growth model developed in this paper. The simple function used is $F(K, L) = L K^\alpha$.

$K$ includes land and the stock of entrepreneurial capital, in constant pesos; $L = EN$, where $E$ is an efficiency index that measures the quality of the labor force, and $N$ is the working population, $L$ is thus measured in efficiency units, in man-years; $K = K_e + K_{ne}$; $Y$'s are group disposable incomes, in constant pesos; $r$ and $w$ are profit and wage rates, respectively, equal to actual gross rental share $\rho$ multiplied by $Y/K$ and to actual gross wage share $\omega$ multiplied by $Y/L$, where $\rho = \alpha + \beta (1-\alpha)$, $\omega = (1-\beta) (1-\alpha)$, $\beta = 1-b$ is the extraction rate, and $b$ is the fraction of labor's marginal product paid out as wages; $r_e$ and $r_{ne}$ are net tax rates on elite and non-elite income (taxes paid net of benefits received), respectively; $c$'s and $i$'s are group consumption and investment rates; $h$ is the fraction of non-elite income devoted to raising the efficiency or quality of labor, such as spending on education, training, health, and nutrition; $\mu$ is a parameter that translates these expenditures into units of $L$; and $\gamma$'s are group rates of spending on political competition. A full discussion and derivation of these parameters are given in the following pages.
"owns" labor and augments it by increased spending on education, on-the-job training, health care, nutrition and other efficiency-enhancing expenditures. GDP, in this paper, refers to long-run capacity output. Since short-run deviations from capacity output, although important in practice, are not of primary concern in this paper, changes in factor utilization rates are not considered. An assumption of either full employment or a constant rate of unemployment is consistent with the long-run growth model developed in this paper. 1/ Given the potential supplies of capital and labor, real disposable incomes are determined by the distribution of productive assets, net tax-benefit rates, and marginal factor productivities. Gross elite real income is income from owning capital, which is equal to rKe, where r is the rate of profit and Ke is the elite-owned capital stock. Gross non-elite real income is the sum of incomes from employment, self-employment, and income from owning capital, equal to rKne + wL, where Kne is the capital stock owned by the non-elite, w is the wage rate, and L is employment. The net tax-benefit rates τe and τne are applied to these gross incomes to derive real disposable incomes, as shown in Table 1. The net tax rates τ's are ratios to group incomes of direct (property and income taxes) and indirect taxes (production and sales taxes) less benefits received (such as educational and health benefits to workers and subsidies and direct transfers to businesses). They include benefits received from the use of public capital assets such as schools, hospitals, roads, etc. and in the form of subsidies, transfers, and exemptions to boost capital income. 2/

Group income is consumed or invested. A portion of consumption is spent on political competition. 3/ Group surplus is defined as group income less consumption other than on political competition. 4/ Political competition and expenditures on physical and human capital are alternative uses of group surpluses. Although socially unproductive, political competition raises group income to the extent that it protects, supports, maintains, or enhances economic advantages, specifically the portion that is

1/ To the extent that the rate of unemployment increases with the rate of extraction, the conclusions of this paper are reinforced when variable rates of factor utilization are incorporated.

2/ The ratio of benefits to income by income class has been estimated by Tan (1976) based on allocators from surveys of households.

3/ The definition of political competition as a form of consumption excludes political activity that is directly or indirectly productive (generates or encourages private investment). For example, expenditures associated with a group's sponsorship of weddings or baptisms are a form of political competition, while lobbying costs associated with legislation to reduce official red tape are not. Political competition also excludes income transfers, which may be used for productive investment.

4/ This concept of surplus is thus broader than the standard concept of saving and includes not only expenditures on increasing K (the conventional concept of saving) but also expenditures on political competition and on increasing L.
extracted from labor's marginal product. The latter is achieved by effectively resisting policies leading to meaningful land reform and the strengthening of labor market institutions (particularly the wage-bargaining process on behalf of workers). Because it owns the major portion of the capital stock, the elite accounts for most expenditures on political competition to augment capital income through the extraction of a portion of labor's marginal product.

Expenditures on labor include current expenditures such as on nutrition (for example, caloric intakes), health care, tuition and teachers' salaries, and capital expenditures such as on hospitals, schools and student computers. 1/ In contrast to the elite, the non-elite spends negligible amounts on political competition because it owns a small stock of capital and reaps little economic favors from the ruling elite.

2. Asset distribution and social extraction

Real-world societies, including advanced industrial nations, have a positive rate of economic extraction, since imperfect labor and capital markets, unequal distribution of wealth and associated unequal distribution of political power exist in varying degree. A positive rate of extraction requires the presence of political lobbying groups that allocate a certain level of expenditures to influence the state in maintaining or even increasing the extraction rate.

a. Factor incomes and the rate of extraction

In a full-employment, perfectly competitive two-factor economy characterized by a Cobb-Douglas production function \( Y = Lk^\alpha \), where \( \alpha \) is the elasticity of \( Y \) with respect to \( K \), 2/ the ratio of factor income shares is equal to the ratio of the respective output elasticities:

\[
\frac{\rho}{\omega} = \frac{\alpha}{1-\alpha}
\]

(1)

where \( \rho \) is the gross rental (non-labor costs) on capital and \( \omega \) denotes wages, both as ratios to GDP. Philippine data on actual factor shares and empirical work on production functions by Kikuchi (1991) in the rice sector and Sicat (1968) on manufacturing indicate that \( \rho/\omega > \alpha/(1-\alpha) \). The

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1/ In this paper the term "investment" refers to physical investment. Investment in human capital will be termed "human investment."

2/ \( 1-\alpha \) is the elasticity of \( Y \) with respect to \( L \).
discrepancy is particularly large in Philippine manufacturing. 1/ Although Sicat (1968, Chapter 4, p. 54) attributes the deviations partly to measurement and regression biases, he acknowledges that "even if it is possible to take out the biases in measurements due to census accounting and regression bias, the divergence due to market imperfections must still be large."

Sicat suggests applying a factor $\lambda$ ($< 1$) that corrects for the ratio of actual factor shares,

$$\lambda(\rho/\omega) = \alpha/(1-\alpha).$$

Given data on actual $\rho$ and $\omega$ and the estimates of $\alpha$ from the empirical production functions, Sicat then provides estimates of $\lambda$ in eighteen two-digit (ISIC) Philippine industries. The estimates of $\lambda$ range from 0.125 for chemical products and 0.699 for leather products.

Equivalently a corrective factor "b" may be applied, representing the fraction of labor's marginal product actually paid out as wages and captured by $\omega$, and "1-b" is the remaining fraction appropriated by capital. 2/ In these circumstances, actual factor shares are:

$$\rho = \alpha + \beta(1-\alpha)$$

$$\omega = (1-\beta)(1-\alpha)$$

where $\beta = 1 - b$ is the rate of extraction, and their ratio is:

$$\rho/\omega = [\alpha + \beta(1-\alpha)]/[\beta(1-\alpha)]$$

---

1/ Increasing returns may be an alternative source of the discrepancy. However, Sicat's massive empirical study of eighteen industries, which involves estimating unrestricted output elasticities with respect to capital and labor, finds that in all those industries the sum of output elasticities is not statistically different from one. There is thus empirical support for the assumption of constant returns to scale in the Philippine manufacturing sector.

2/ The retention rate "b" reflects nominal and real adjustments. Let the nominal wage rate $w = (aP)[e(1-\alpha)k^{a}]$, where "a" is the fraction of the price of the domestic good produced by labor and capital and "e" is the fraction of the physical marginal product of labor retained as wages. The term "a" is the nominal or inflation adjustment factor, and "e" is the real adjustment factor. Thus, the term "b" in the present growth framework is the composite term "ae." If a = 1, the full price of the good is reflected in the nominal wage rate; if e = 1, the full physical marginal product of labor is paid out.
Noting that the elite and non-elite own $K_e$ and $K_{ne}$ of capital \( 1/ \) and substituting equations (3) and (4) in the definitions of group incomes shown in Table 1, group disposable incomes may be rewritten as:

\[
Y_e = (1-\tau_e)\rho(1-z)Y \\
Y_{ne} = (1-\tau_{ne})(\rho z+\omega)Y
\]

where \( Y = Lk^\alpha \) and \( z = K_{ne}/K \).

b. **The determinants of the rate of extraction**

The social extraction rate \( \beta \) is an institutionally determined parameter. \( 2/ \) It reflects the degree of market imperfections and the relative economic and political power of the two groups in the wage-setting process. \( 3/ \) Economic power rests on the asset distribution regime (summarized by \( z \), which is determined by its initial value and subsequent group investments) and institutional arrangements in the economy. \( 4/ \) The elite wields political and market power and is able to earn more than \( \alpha \) of GDP by extracting \( \beta(1-\alpha) \) of labor's marginal product.

From equation (5) the extraction rate \( \beta \) may be expressed in terms of the actual factor shares \( \rho \) and \( \omega \) and the estimated elasticity of output with respect to capital \( \alpha \), and related to Sicat's \( \lambda \) as follows:

\[
\beta = \alpha/[(\alpha+(\lambda/(1-\lambda))] \ 5/
\]

Under marginal productivity pricing, \( \lambda = 1 \). This means that \( \beta \) approaches zero: the ratio of actual factor shares reflect the ratio of the relative factor contributions to output. Sicat's estimates of \( \lambda \) are less than unity, which implies that the extraction rate \( \beta \) is positive and less

---

1/ $K = K_e + K_{ne}$.

2/ The parameter \( \beta \) nets out the extractive activities of members of each group against each other. See the Philippine study by McCoy (1993).

3/ For example, oligopsonistic labor markets involve some extraction of labor's marginal product, in addition to producing lower levels of employment. Land tenure arrangements, the extent of land ownership by farmers, and the strong bargaining position of the elite in other sectors of the economy determine the size of \( \beta \).

4/ The determinants of \( \beta \) are driven by elite policies (Jurado, 1974). In share-cropping arrangements if factor payment is made in the extracted output, workers may sell it either at market price \( P \) (in which case \( \beta \) tends toward zero) or at below \( P \) (for example, ceiling price of rice, in which case \( \beta > 0 \)). The other institutional determinant of \( \beta \) is the set of arrangements on the actual division of real output between owners of capital and laborers. If this division reflects marginal productivity factor pricing, then \( \beta = 0 \); otherwise, \( \beta > 0 \).

5/ Derived from Sicat's \( \rho/\omega = (1/\lambda)\alpha/(1-\alpha) \) and equation (5).
than unity. Two additional results are that $\beta$ declines with $\lambda$ and rises
with $\alpha$. 1/ For example, Sicat estimates that the leather products
industry has a higher $\lambda$ ($\sim 0.699$) and a higher $\alpha$ ($\sim 0.481$) than the chemical
products industry ($\lambda = 0.125$, $\alpha = 0.296$). This suggests that whether the
leather products industry has a lower extraction rate is theoretically
unclear and depends on the sizes of $\lambda$ and $\alpha$ in the respective industries.
However, for the range of Sicat's estimated values of $\alpha$ for different
industries, the negative effect of $\lambda$ dominates the positive effect of $\alpha$, so
that the extraction rate in the leather products industry appears to be less
than in the chemical products industry.

In the absence of a suitable empirical aggregate production function
for the Philippines the economy-wide retention rate $b$ may be approximated by
the function,

$$b = \text{SUM}([s_i/(1-\alpha_i)]\nu_i) \quad i = a, m, o$$

where $s_i$ is the actual share of wages (non-capital costs) in value added in
sector $i$, $\alpha_i$ is the estimated elasticity of output with respect to capital
in the production function for sector $i$, $\nu_i$ is the share of value added of
sector $i$ to aggregate value added (GDP), and $a$, $m$, and $o$ denote agriculture,
manufacturing, and other sectors. The actual wage shares $s_i$ and estimated
$\alpha_i$ for agriculture (at least for rice) and manufacturing, and the share of
value added $\nu_i$ in GDP are available for sectors $i = a, m, o$.

Factor payments and factor shares in rice production are illustrated by
Kikuchi (1991) on data collected from a study of a rice village during the
wet season in 1976 (Hayami and Kikuchi, 1981). Rice is produced by
combining land and capital (along with intermediate inputs such as
fertilizer and water) owned by the elite (landlords) with labor supplied by
the non-elite (farmers). The land tenure system is based on share-cropping
and lease-holding arrangements, in which $s_a = 0.418$ and $\alpha_a = 0.478$, which
implies a retention rate for farm labor of $b_a = 0.80$. 2/ If capital and
labor were paid their marginal physical products, gross real incomes of
landlords and farmers would represent $\alpha$ or 47.8 percent and $1-\alpha$ or 52.2
percent of farm output, respectively: (i) $Y_e = \alpha_a Y$; and $Y_{ne} = (1-\alpha_a) Y$.
However, the actual factor shares were 58.2 percent of farm output for
landlords and 41.8 percent for farmers: (ii) $Y_e = (1-s_a)Y$; and $Y_{ne} = s_a Y$.
From (i) and (ii), the fraction "$b$" of labor's marginal physical product
retained by farmers is equal to $s_a/(1-\alpha_a) = 0.80$, and gross real incomes of
farmers and landlords would be:

$$Y_e = [0.478 + 0.2(0.522)]Y = (0.478+0.1044)Y = 0.5824Y$$

$$Y_{ne} = [(1-0.2)(0.522)]Y = (0.8)(0.522)Y = 0.4176Y$$

1/ $\partial\beta/\partial\lambda = -[\alpha/(1-\lambda)]^2/[\alpha+\lambda/(1-\lambda)] < 0$; and
$\partial\beta/\partial\alpha = (1-\beta)/[\alpha+(\lambda/(1-\lambda))] > 0$.

2/ Capital includes farm equipment, irrigation, and land.
which are exactly the actual factor shares $l - s_a$, $s_a$. These shares are
determined by negotiated share-cropping and lease-holding arrangements and
by their compliance and enforcement, as well as by settlement of disputes.

For workers in the manufacturing sector Sicat (1968) reports the actual
share of wages in manufacturing value added of $s_m = 0.3$ and an estimate of
$a_m = 0.4$. Thus the retention rate $b_m$ is 0.5, 30 percentage points lower
than $b_a$. This may be explained by repeated government efforts at
strengthening the share-cropping and lease-holding arrangements and the
rights of farm tenants over the years. There have been little comparable
efforts on behalf of industrial workers. The actual factor share $s_m$ has
been determined primarily by wage-setting policies of the industrial elite.

Since the extraction rate $\beta$ is one minus the retention rate $b$, it
follows that $\beta$ also depends on the actual factor shares $s_1$. The higher the
actual $s_1$, the higher the rate of retention $b$, and the lower the extraction
rate $\beta$. Obviously when there is full marginal productivity pricing
($s_1 = 1 - \alpha_1$) there is full retention ($b = 1$) and no extraction ($\beta = 0$).

In general the wealth distribution variable $\zeta$ has exogenous and
endogenous components. The exogenous component may reflect a conscious
policy of land redistribution or a policy of requiring tightly-held family
corporations to go public and be subject to more competitive pressure. The
endogenous component arises from the fact that $\zeta$ reflects the behavior of
both elite and non-elite investments, which are determined by group income
levels and rates of return.

3. Politics of growth and growth of politics

As shown in Table 1, saving rates are the proportions $1 - c_e$ for the
elite and $1 - c_{ne}$ for the non-elite. Subsistence considerations suggest that
the saving behavior of the non-elite should be different from that of the
elite. Empirical research on low- and middle-income developing countries
strongly supports the proposition that the saving-income ratio is a rising
function of the level of real income (Ogaki, Ostry and Reinhart, 1996).
Since the extraction rate $\beta$ and net taxes $\tau_{ne}$ are significant determinants
of the level of disposable real income of the non-elite, it is hypothesized
that $c_{ne}$ is a positive function of $\beta + \tau_{ne}$ so that the saving rate $1 - c_{ne}$ is
a negative function of $\beta + \tau_{ne}$, that is, $c_{ne} = c_{ne} (\beta + \tau_{ne})$, with the property
$\partial c_{ne}/\partial \beta + \tau_{ne} > 0$ so that $\partial (1 - c_{ne})/\partial \beta + \tau_{ne} < 0$. As an increase in $\beta + \tau_{ne}$
reduces non-elite real income, the non-elite saving rate is expected to
fall. Conversely, as $\beta + \tau_{ne}$ declines, the level of non-elite real income
increases past the subsistence level, and the rate of saving rises.

In Table 1 group expenditures are assumed to be proportional to group
disposable incomes. On the allocation of group surpluses, one rational
long-run criterion is the maximization of the steady-state growth rate of

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real income by each group. 1/ On this basis the Appendix shows that the optimal proportions of group surpluses devoted to group activities would be set equal to the relative contributions of those activities to group incomes. Thus for the elite, \( \gamma_e = \beta(1-\alpha)(1-z)(1-c_e) \) and \( i_e = 1-c_e-\gamma_e \). For the non-elite \( \gamma_{ne} = \beta(1-\alpha)z(1-c_{ne}) \), \( h = (1-\beta)(1-\alpha)(1-c_{ne}) \), and \( i_{ne} = 1-c_{ne}-\gamma_{ne}-h \). Note that the allocation ratios, except for \( h \), are partly endogenously determined, since they depend on the asset distribution variable \( z \), which is an endogenous variable.

To provide a concrete illustration of the allocation of surplus incomes of the elite and the non-elite assume \( \alpha = 0.4273 \), \( \tau_e = -0.10562 \), \( \tau_{ne} = 0.124 \), \( c_e = 0.63 \), and \( c_{ne} = 0.80+(\beta+\tau_{ne})^{1.86} \). 2/ For purposes of the simulation, the economy-wide retention rate \( b \) is raised from its base value of 0.755268 by increments that are consistent with full retention rate (zero extraction rate) separately in the three economic sectors, followed by full retention rate jointly in all three sectors. Each iteration generates a pair of values for \( \beta \) and \( z \) and subsequent allocation rates of the group surpluses.

When \( b = 1 \) and economic extraction \( \beta \) is zero, the rate of spending on political competition is zero, while the rates of investment in both physical and human capital (ratios to group incomes) are highest. As \( \beta \) increases, the rate of return on political competition goes up, which raises

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1/ This long-run criterion is akin to the "golden rule" type of criterion introduced by Phelps (1961). The only difference is that Phelps' decision rule maximizes the growth rate of society's income, whereas the decision rule in the present paper maximizes the growth rate of each group's income, which may not necessarily lead to the maximum growth rate of society's income, a result akin to a Nash equilibrium.

2/ The economy-wide \( \alpha = 0.4273 \) is a weighted average of the \( \alpha_i \) of the agricultural, manufacturing and other sectors, weighted by their shares \( \nu_i \) in total value added (\( \alpha_a = 0.478; \alpha_m = \alpha_o = 0.4; \nu_a = 0.35; \nu_m = 0.20; \nu_o = 0.45 \)). This overall \( \alpha \) is close to the value of 0.45 suggested by Williamson (1969), which is a scaled-up value of the overall \( \alpha = 0.30 \) used by Lampman (1967). The sensitivity of the results to changes in the assumption about the overall \( \alpha \) is discussed in subsection 4.c. The estimates for the net tax rates are taken from Table 7.1 in Tan (1976), in which there are 7 income classes; \( \tau_e \) is the net tax-benefit ratio applied to the top 20 percent (the top income class) and \( \tau_{ne} \) is the average of the net tax-benefit rates applied to the next lowest 6 income classes, weighted by the income share of each class in total family income of the lowest 6 classes. These rates take into account Group I benefits, which are public expenditures that directly benefit families such as education and health, the distribution of which was estimated by allocators obtained from a survey of Philippine households. The value for \( \tau_e \) is adjusted for non-social expenditures, which generally benefit mostly the elite. The value for \( c_e \) and the parameters of the \( c_{ne} \)-function are explained in the discussion of the calibrated model in subsection 4.a.
the rate of political spending at the expense of the rate of investment (in terms of group incomes). 1/ From the point of view of enhancing growth prospects, minimizing the extraction rate is desirable because the rates of investments in K and L are maximized and resources wasted on political competition are used productively.

Because the rate of social extraction $\beta$ is institutionally determined and product and factor markets are imperfect, an even split of the group surplus rates between their respective components would require an extremely large value for $\beta$, which is not feasible in practice. This implies that relative rates of return would fail to be equalized.

4. The growth model 2/

From the definitions of group incomes and the allocation functions, the capital accumulation dynamics can be written as follows:

$$\frac{dK}{dt}/K = \mu k^{\alpha-1} - \delta$$  \hspace{1cm} (9)

where $i^* = i_e^* + i_{ne}^*$, $i_e^* = i_e(1-\tau_e)A$, $i_{ne}^* = i_{ne}(1-\tau_{ne})B$; $i_e = 1-c_e\gamma_e$; $\gamma_e = \beta(1-\alpha)(1-z)(1-c_e)$; $i_{ne} = 1-c_{ne}\gamma_{ne}h$; $\gamma_{ne} = \beta(1-\alpha)z(1-c_{ne})$; $h = (1-\beta)(1-\alpha)(1-c_{ne})$; $z = K_{ne}/K$; $A = \rho(1-z)$; $B = \rho z + \omega$; $\rho = \alpha + \beta(1-\alpha)$; $\omega = (1-\beta)(1-\alpha)$; $\beta = 1-b$; $b = \text{SUM}([s_i/(1-\alpha_i)]\nu_i)$ for $i = a, m, o$; $c_e$ is a constant parameter; $c_{ne}$ = constant$+ (\beta + \tau_{ne})$; $\delta$ is a uniform constant rate of depreciation that applies to K and its components, $K_e$ and $K_{ne}$; and $d(.)/dt$ denotes time differentiation.

The increase in the labor input is given by the definition of non-elite income and allocation function for h:

$$\frac{dL}{dt}/L = \mu h^*k^{\alpha} + n$$  \hspace{1cm} (10)

1/ In the modern-day world there is, of course, an upper limit to $\beta$. The maximum value of unity for $\beta$ is not feasible in practice simply because no workers and thus no elite can survive with this extraction rate.

2/ This model extends the basic endogenous growth model developed in Villanueva (1994) by incorporating the rate of extraction, endogenous political expenditures, differential propensities to save, and the distribution of national income and wealth.

3/ The constant intercept serves to establish a floor on the consumption ratio as $\beta + \tau_{ne}$ approaches zero.
where $h^* = h(1 - \tau_{ne})B$; and $h$, $\mu$, $c_{ne}$, and $B$ are as defined above and in Table 1. 1/

Time differentiating the capital-labor ratio $k = K/L$, its rate of change is given by equation (9) minus equation (10):

\[
\frac{dk}{dt}/k = i^*k^{\alpha - 1} - \mu h^*k^\alpha - (n+\delta) = \phi(k, z) \tag{11}
\]

Time differentiating the ratio of non-elite capital to total capital $z = K_e/K$, using equation (9) and the non-elite investment function, the rate of change of $z$ is:

\[
\frac{dz}{dt}/z = [(i_{ne}^*/z^*) - i^*]k^{\alpha - 1} = \psi(k, z) \tag{12}
\]

where $i_{ne}^*$ and $i^*$ are as defined above. The reduced model is described by a system of two differential equations in $k$ and $z$, and time. 2/

The steady-state values of the capital-labor ratio $k^*$ and the wealth distribution ratio $z^*$ are given by the roots of (11) and (12) equated to zero:

\[
i^*k^{\alpha - 1} - \mu h^*k^\alpha - (n+\delta) = \phi(k^*, z^*) = 0 \tag{13}
\]

\[
[(i_{ne}^*/z^*) - i^*]k^{\alpha - 1} = \psi(k^*, z^*) = 0 \tag{14}
\]

The equilibrium growth rate of per capita output $g^* - n$ is solved by either of the following equations:

\[
g^* - n = [(dK/dt)/K - n]^* - i^*k^{\alpha - 1} - (n+\delta) \tag{15a}
\]

\[
g^* - n = [(dL/dt)/L - n]^* - \mu h^*k^\alpha \tag{15b}
\]

As a first step in determining the existence of a unique equilibrium pair $(k^*, z^*)$, the slopes of the steady-state equations (13) and (14) must be signed. For this purpose take the total derivatives of equations (13) and (14) with respect to $k^*$ and solve for $dz^*/dk^*$:

---

1/ The labor growth equation is derived as follows. Let (i) $L = EN$, where $L$ is labor, $N$ is population, and $E$ is a technology or efficiency index. $N$ is assumed to grow at a constant rate $n$, (ii) the efficiency of workers is assumed to increase with resources devoted to education, on-the-job training, health, and nutrition, (iii) $ih_{ne}$, where $h$ and $\mu$ is a constant that transforms resources measured in constant pesos into units of $L$ measured in man-years. Time differentiating (i), (iv) $dL/dt = (dE/dt)n + (dE/dt)N$. Substituting (ii) and (iii) into (iv) yields equation (10) in the text.

2/ Time is not explicit in the model. Partly for this reason, phase-diagramming is used to analyze the existence, uniqueness, and global stability of the growth model.

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\[
\frac{dz^*}{dk^*} \bigg|_{(dk/dt=0)} = \frac{[(1-\alpha)i^*+\mu a h^*k^*)/\partial i^*/\partial z^* - \mu k^*\partial h^*/\partial z^*]k^*}{z*} = 0;
\]

Thus, the wealth distribution curve, \( \frac{dz^*}{dk^*} \bigg|_{(dz/dt=0)} = 0 \), is indeterminate. From the indeterminacy of the response of the aggregate investment rate \( i^* \) to changes in \( z^* \), the partial derivative \( \partial h^*/\partial z^* = h(1-\gamma^*)\rho > 0 \). The indeterminacy arises from the indeterminacy of the expression for \( \partial i^*/\partial z^* \) summarizing the net substitution effects of changes in \( z^* \) on \( i^* \) through changes in the rates of political competition \( \gamma_e \) and \( \gamma_{e_n} \). As \( z^* \) increases, the group rates of political competition move in opposite directions, with the elite rate falling and the non-elite rate rising. Thus, the elite rate of investment increases while the non-elite investment rate decreases.

The second composite term summarizes the net income effects of an increase in \( z^* \) on \( i^* \) via changes in the group income shares \( A \) and \( B \), with \( A \) decreasing and \( B \) increasing in value. The negative effect on \( i_e \) would be normally larger than the positive effect on \( i_{e_n} \), since \( i_e \) is much larger than \( i_{e_n} \). Consequently, the sign of the second composite term is likely to be negative. For reasonable values of the parameters, it turns out that \( \partial i^*/\partial z^* < 0 \). Combined with the result \( \partial h^*/\partial z^* > 0 \), this implies that \( \frac{dz^*}{dk^*} \bigg|_{(dk/dt=0)} < 0 \). Graphically the slope of the \( dk/dt=0 \) curve is negative.

Long-run equilibrium is illustrated in the phase diagram (Figure 1), where \( k^* \) and \( z^* \) are measured on the horizontal and vertical
Figure 1
Long-run Equilibrium

\[
\frac{dk}{dt} = 0
\]

\[
\frac{dz}{dt} = 0
\]
axes, respectively. 1/ The dz/dt=0 curve is horizontal at z* = z**, while the dk/dt=0 curve is downward-sloped. Long-run equilibrium occurs at the intersection of these two curves at the pair of values (k**,z**). This equilibrium is globally stable, as indicated by the arrows in the phase diagram. 2/

a. Calibration of the model

To say something concrete about the effects of public policies (fiscal and sectoral policies), the model is calibrated using a Cobb-Douglas production function \( F(K,L) = Lk^\alpha \), a long-run growth rate of GDP \( g^* \) of about 

1/ This growth model may be viewed as a modified version of the Pasinetti (1962) model, with important extensions that allow for endogenous growth and a positive rate of social extraction. These modifications, particularly endogenous growth, are critical because they resolve the "Pasinetti paradox" analyzed by Samuelson and Modigliani (1966), which says that the equilibrium rate of return to capital is given by the ratio \( n/s_c \) (n is the growth rate of labor adjusted for exogenous Harrod-neutral technical change and \( s_c \) is the saving rate of the capitalist class), and is thus independent of \( s_w \) (saving rate of the working class) and the form of the production function. Bearing in mind a rough correspondence between Pasinetti's capitalist and working classes and the modified model's elite and non-elite groups and the latter model's broader concept of saving, it is obvious from the steady-state equation (13) in the text that the equilibrium rate of return to capital in the modified model is given by \( (n+\delta+\lambda h^* k^* \alpha) \rho / i^* \), which from the definitions of \( h^* \) and \( i^* \) is dependent on group saving rates \( 1-c_e, 1-c_ne \) and the form of the production function.

2/ A phase diagram is a graphical tool to analyze the existence and stability of equilibrium for a system of two first-order differential equations not explicitly involving time. In Figure 1 the dk/dt=0 curve graphs the condition \( (dk/dt)/k = i^* k^{\alpha-1} - \mu h^* k^\alpha - (n+\delta) = \phi(k,\theta) = 0 \), which says that k is not changing. The dz/dt=0 curve graphs the condition \( (dz/dt)/z = [(i_ne^*/z) - i^*] k^{\alpha-1} - \Psi(k,\theta) = 0 \), which says that z is not changing. The intersection of the two curves defines the equilibrium point, at which neither k nor z is changing. The directional arrows suggest the movement of k and z when they are in disequilibrium. The horizontal arrows, parallel to the k axis, follow from the \( (dk/dt)/k = i^* k^{\alpha-1} - \mu h^* k^\alpha - (n+\delta) \) equation, which indicates that \( \partial (dk/dt)/k / \partial z < 0 \). This means that a movement to the right of the dk/dt=0 curve decreases dk/dt to a negative value; k will decrease, and the horizontal arrows point to the left. Similarly, a movement to the left of the dk/dt=0 curve increases dk/dt to a positive value; k will increase, and the horizontal arrows point to the right. The vertical arrows, parallel to the z-axis, follow from \( (dz/dt)/z = [(i_ne^*/z) - i^*] k^{\alpha-1} \) equation, which indicates that \( \partial (dz/dt)/z / \partial z < 0 \). This means that a movement above the dz/dt=0 curve decreases dz/dt to a negative value and z will fall; the vertical arrows point down. Similarly, a movement below the dz/dt=0 increases dz/dt to a positive value and z will increase; the vertical arrows point up.
0.05 per annum, rate of extraction $\beta = 1 - b$, retention rate definition 
$b = \text{SUM} \left\{ \left[ s_i \left(1 - \alpha_i \right) \nu_1 \right] \nu_1 \right\}$, non-elite consumption ratio function $c_{ne} = 0.80 + (\beta + r_{ne})1.855$, the equations for $i_e$, $i_{ne}$, $h$, $A$, and $B$ and the following reasonable values of the parameters: $\alpha = 0.4273$; $b = 0.7553$ (for derivation, see below); $c_e = 0.6319$; $r_e = -0.10562$; $r_{ne} = 0.124$; $\delta = 0.04$; and $n = 0.03$.

Reliable empirical production functions for the other sectors (mining, construction, transport and utilities, services) are not available. In their absence, it is assumed that $\alpha_o$ is equal to the estimated value of $\alpha_m$, which is 0.4. To determine the sensitivity of the results to this particular assumption, subsection 4.c conducts a sensitivity analysis using alternative values of $\alpha_o$ of 0.3 and 0.5.

Given the historical shares of sectoral value added in GDP, $\nu_i$, the economy-wide retention rate $b$ and the overall elasticity of GDP with respect to the aggregate capital stock $\alpha$ may be estimated as follows:

$$b = \text{SUM} \left\{ \left[ s_i \left(1 - \alpha_i \right) \nu_1 \right] \nu_1 \right\} = \left[ 0.418/(1 - 0.478) \right](0.35) + \left[ 0.3/(1 - 0.4) \right](0.20) + \left[ 0.5/(1 - 0.4) \right](0.45) = 0.7553.$$  

$$\alpha = \text{SUM} \left( \alpha_i \nu_1 \right) = 0.478(0.35) + 0.4(0.20) + 0.4(0.45) = 0.4273.$$  

To calibrate the model, the following steps were taken.

(1) The retention rate $b = 0.7553$ implies an extraction rate $\beta = 0.24473$ (both as fractions of labor's marginal product). The income share of the Philippine elite $A$ has averaged 54 percent from 1961 through 1988 (Medalla et al., 1995). Using the definitions $A = \rho(1 - z^*)$ and $\rho = \alpha + \beta(1 - \alpha)$, $z^*$ turns out to be 0.048. The historical average (1960-90) for $i^*$ is about 0.20 (Montes, 1995). Using this value and substituting it into the $dz/dt = 0$ equation, $i_{ne}^* = 0.20z^* = 0.01$ in terms of GDP. The value for $i_e^* = 0.20 - 0.01 = 0.19$ in terms of GDP. In terms of elite and non-elite incomes, $i_e = i_e^*/(1 - r_e)A = 0.319$ and $i_{ne} = i_{ne}^*/(1 - r_{ne})B = 0.024$, where $r_e = -0.106$, $r_{ne} = 0.124$, $A = 0.54$ and $B = 0.46$. Several iterations were performed on the equations for $i_e$ and $i_{ne}$ corresponding to alternative values for $c_e$ and $\epsilon$ in the $c_{ne}$-function $c_{ne} = 0.80 + (\beta + r_{ne})\epsilon$ to be

1/ The $s_i$'s for $i = a, m$ are actual values 0.418 and 0.30, and the $\nu_i$'s are historical average values 0.35, 0.20, and 0.45 for $i = a, m$, and $o$. The factor shares and output elasticities for agriculture are for rice (Hayami and Kikuchi, 1981, and Kikuchi, 1991) and those for manufacturing are from Sicat (1968). The factor share for "others" $s_o = 0.50$ is a conservative assumption (value added in the other sectors is evenly split between K and L). Together with an assumed value for $\alpha_o = 0.40$, $b_o$ equals 0.8333, somewhat higher than $b_a = 0.80$ and much higher than $b_m = 0.50$.

2/ It started at about 56 percent in 1961 and declined to 52 percent in 1988.
consistent with \( i_e = 0.319 \) and \( i_{ne} = 0.024 \). The iterations yielded \( c_e = 0.632 \), \( c_{ne} = 0.957 \), and \( \epsilon = 1.855 \). The other equilibrium values of interest are: \( \gamma_e^* = 0.0293 \), \( \gamma_{ne}^* = 0.0001 \) and \( h^* = 0.00747 \) (all measured as ratios to GDP).

(2) Given \( i^* = i_e^* + i_{ne}^* = 0.20 \), \( k^* = 4.03 \) is obtained from the steady-state condition \( (dK/dt)/K = g^* = 0.05 \). (3) Finally, the constant transformation parameter \( \mu \) is obtained from the steady-state condition \( (dL/dt)/L = g^* = 0.05 \), given that \( k^* = 4.03 \) and \( h^* = 0.00747 \). This produces a value of \( \mu = 1.475 \).

This calibration produces model values that are reasonably consistent with the observed post-war historical growth and income distribution data in the Philippines: a growth rate of GDP of 5 percent per annum and of GDP per capita of 2 percent per annum, and income shares of 54 percent and 46 percent, respectively, for the elite and non-elite groups of Philippine society. The implied value for the non-elite share of capital was about 5 percent of the total capital stock; the retention rate \( b \) and social extraction rate \( \beta \) were 75.5 percent and 24.5 percent of labor's marginal product, respectively; spending on political competition, mostly by the elite was nearly 3 percent of GDP; the aggregate rate of investment was 20 percent of GDP, of which 19 percent was undertaken by the elite; and the non-elite expenditures on nutrition, education, training, health care and others aimed at improving the efficiency of labor averaged less than one percent of GDP.

The calibrated capital accumulation and wealth distribution curves are shown in the upper panel of Figure 2 labelled "\( dk/dt=0 \) (\( \beta=0.244 \))" and "\( dz/dt=0 \) (\( \beta=0.244 \))", respectively. The two curves intersect at \( z^{**} = 0.048 \) and \( k^{**} = 4.03 \), corresponding to \( \beta = 0.244 \). By construction, of course, this pair of values is consistent with the observed income shares of the elite and non-elite and with the average 5 percent steady-state annual rate of growth in GDP over the postwar period as shown in the lower panel.

b. Simulating the effects of public policies

Policies aimed at high growth with equity through reductions in the rate of social extraction include macroeconomic and financial measures that (i) minimize the net tax-benefit ratio applied to non-elite income and

1/ As previously noted, the constant term equal to 0.80 in the function \( c_{ne} - 0.80 + (\beta+r_{ne})^{1.855} \) serves to impose a floor on the consumption rate as \( \beta+r_{ne} \) approaches zero. Owing to this constant term, the overall elasticity of \( c_{ne} \) with respect to \( \beta+r_{ne} \), which is equal to \( \epsilon \{1-(0.80/c_{ne})\} \), is much lower than \( \epsilon = 1.855 \). Evaluated at the mean value of \( c_{ne} = 0.9 \), the overall elasticity of \( c_{ne} \) with respect to \( \beta+r_{ne} \) is only about a tenth of \( \epsilon \).

2/ \( k^* = [(g^*+\delta)/i^*]^{1/(1-\alpha)} \).

3/ \( \mu = (g^*-\alpha)/h^*k^\alpha \).
(ii) encourage an increase in the non-elite ownership of the capital stock; and sectoral and institutional measures that (iii) eliminate extraction activities by each group including inter alia, strengthening and enforcing tenant-farmer rights and the role of labor unions in the collective-bargaining process with the objective of raising the share of wages in value added to levels dictated by the relative contribution of labor to GDP (measured by $1-\alpha$), opening up elite family corporations and subjecting them to more competitive pressure, and dismantling of oligopolies and oligopsonies. The model is simulated to determine the implications of some of these policies for the distribution of national income and wealth and overall economic growth. There are seven policy simulations. The first four simulations are sectoral and institutional policies in agriculture, industry and other sectors aimed at altering separately (the first three simulations) and jointly (the fourth simulation) the sectoral factor shares in line with estimated values of $\alpha$ and $1-\alpha$ for each sector. The next three simulations are fiscal in nature. Two simulations assume unchanged extraction rates, one characterized by a neutral fiscal stance (zero values for $r$'s) and the other by a progressive net tax incidence (reversal of the existing regressive incidence). The third and final experiment simulates the ideal situation in which extraction is completely eliminated and fiscal policy is neutral in its net tax incidence.

(1) **Sectoral and institutional policies**

The agrarian policy simulation involves raising the ratio of the actual rental and wage shares in farm output to the ratio $\alpha_a/(1 - \alpha_a)$. This could be accomplished by negotiating share-cropping and lease-holding arrangements between farmers and the landlords, and instituting procedures for compliance and adjudication of disputes. The simulation targets the actual wage share $s_a$ to the level of the production elasticity $(1 - \alpha_a)$, such that $b_a = 1$.

The results are reported in Table 2. The overall rate of retention $b$ rises from 75.5 percent to 82.5 percent, implying a decline in the rate of extraction $\beta$ from 24.5 percent to 17.5 percent of labor's marginal product. The asset distribution $z$ increases to 11.5 percent of the total capital stock (from 5 percent). The distribution of income improves, with the non-elite share increasing to 53 percent of GDP (from 46 percent). The aggregate investment rate dips slightly from its base value of 0.2, with the non-elite share rising from 5 percent to 11.5 percent. The human investment rate nearly triples to more than two percent of GDP. These developments redress the imbalance in physical and human capital accumulation, and lower the ratio of capital to effective labor to 2.5 (from 4). The productivity of both capital and labor is enhanced substantially, and the growth rate of per capita GDP increases to 4.5 percent per annum (from 2 percent).

The industrial policy simulation involves the improvement in the functioning of industrial labor markets to ensure that the actual factor shares do not deviate significantly from those implied by the estimated $\alpha_m$. ©International Monetary Fund. Not for Redistribution
Figure 2
Effects of Eliminating Extraction

Growth Rate

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Table 2. Steady-State Economic Performance under Alternative Public Policies 1/

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1/ Assumptions: n = 0.03; δ = 0.04; α = 0.4273; α_a = 0.478; α_m = 0.4; α_o = 0.4; c_e = 0.63; c_ne = 0.80 + (β + r_ne)1.855; μ = 1.475. The extraction rate β is a fraction of labor’s marginal product; z is a fraction of total K owned by the non-elite; and A, B, i*, i_e*, i_ne*, γ*, γ_e*, γ_ne*, h* are fractions of GDP; k* is ratio of capital to effective labor; and g*-n is the growth rate of per capita GDP.

2/ τ_e = -0.106; τ_ne = 0.124; s_a = 0.418; s_m = 0.3; s_o = 0.5.
3/ τ_e = -0.106; τ_ne = 0.124; s_a = 1-α_a = 0.522; s_m = 0.3; s_o = 0.5.
4/ τ_e = -0.106; τ_ne = 0.124; s_a = 0.418; s_m = 1-α_m = 0.6; s_o = 0.5.
5/ τ_e = -0.106; τ_ne = 0.124; s_a = 0.418; s_m = 0.3; s_o = 1-α_o = 0.6.
6/ τ_e = -0.106; τ_ne = 0.124; s_a = 1-α_a = 0.522; s_m = 1-α_m = 0.6; s_o = 1-α_o = 0.6.
7/ τ_e = 0.124; τ_ne = -0.106; s_a = 0.418; s_m = 0.3; s_o = 0.5.
that is, $s_m = 1 - \alpha_m$, so that $b_m = 1$. Table 2 reports the results. The economy-wide retention rate $b$ reaches a high level of 85.5 percent of labor's marginal product, implying an extraction rate $\beta$ of 14.5 percent (a reduction of 10 percentage points from the base level). The effects on income and wealth distribution are more favorable than those produced by the agrarian reform, with the non-elite share of income and wealth increasing to more than 14 percent of the capital stock and more than 56 percent of GDP, respectively. The change in the composition of investment in favor of the non-elite strengthens, as does the rate of human investment, which rises to 2.7 percent of GDP. The capital-labor ratio is rationalized further to just over two, half of its base level. The larger enhancement in efficiency of the economy is reflected in a higher growth rate of per capita GDP (annual rate of 5.5 percent).

The policy reform in the other sectors has a quantitative target of raising $s_Q$ to $(1-\alpha_0)$. Since the reduction in the rate of extraction is broadly similar to the reduction under the agricultural policy reform, the effects on wealth and income distribution, physical and human capital accumulation, and growth rate of per capita capacity output are also broadly in line with those generated by the agrarian reform.

The last sectoral/institutional simulation involves simultaneous reforms in all sectors of the economy with the quantitative objective of ensuring that actual factor shares do not deviate significantly from those dictated by marginal productivity pricing. The retention rate rises to unity and the extraction rate to zero. The macroeconomic effects are dramatic. Political competition is eliminated. The non-elite increases its share of wealth to more than 26 percent of the total capital stock and its share of income to more than 68 percent of GDP (nearly two thirds as wage income and just over a third as capital income). The non-elite steps up its investment rate to 4.6 percent of GDP, and the rate of human investment reaches its highest level at more than 6 percent of capacity GDP. This development rationalizes the capital-labor ratio from about four to just over one. 1/ The growth rate of per capita GDP increases to 9.5 percent per annum.

The effects of eliminating extraction on wealth distribution, capital intensity and the growth rate of per capita output are graphed in Figure 2. In the upper panel, as $\beta$ is reduced to zero the $dz/dt=0$ curve shifts upward.

1/ As the ratio of capital to effective labor $(K/EN)$ falls, the ratio of capital to raw labor $(K/N)$ rises. Let $k_n = (K/N)$. Thus, $k_n = E_k$, and $(dk_n/dt)/k_n = (dE/dt)/E + (dk/dt)/k = (dE/dt)/E + (dk/dt)/K - (dE/dt)/E - n = (dk/dt)/K - n$, where $n$ is the exogenous rate of growth in raw labor (working population). Since $(dk/dt)/K$ is a declining function of $k$, $(dk_n/dt)/k_n$ is also a declining function of $k$. In the first quadrant $(dk/dt)/K$ and $(dk_n/dt)/k_n$ are both positive. This means that as $k$ falls, the rate of increase in $k_n$ goes up, implying that the new equilibrium level of $k_n$ is higher.
and the \( \frac{dk}{dt} = 0 \) curve shifts downward to the left. The equilibrium non-elite share of wealth \( z^* \) increases to 0.264 and the equilibrium capital intensity \( k^* \) decreases to 1.10. In the lower panel, as extraction is eliminated the capital growth curve shifts downward, but the labor growth curve shifts upward by much more. Consequently, the equilibrium capital-labor ratio falls to 1.10 and the growth rate of per capita capacity GDP increases to 9.5 percent per year.

Since political competition involves socially unproductive spending, its elimination and the re-orientation of resources previously devoted to it toward investments in physical and human capital are desirable developments from the perspective of strong economic performance. Similarly since the rate of non-elite saving is positively enhanced by reduced rates of extraction, maximizing the former by minimizing the latter is also a desirable objective for public policy.

(2) Fiscal policies

As alternatives to sectoral/institutional policies that eliminate the rate of extraction, two fiscal policy simulations are performed conditional on the existing rate of extraction and the results are compared with those that would have prevailed under full elimination of extractive activities (the penultimate column in Table 2). The final simulation complements or supports the full elimination of extraction with a neutral fiscal policy stance.

The first simulation under an unchanged extractive regime involves a neutral fiscal policy, that is, tax and expenditure policies that produce zero values for \( \tau_e \) and \( \tau_{ne} \). The wealth and income distribution profiles improve, although by less than the improvement under the full elimination of extraction. The neutral fiscal stance raises the non-elite share of wealth to 20 percent and the share of income to more than 54 percent. The decline in the aggregate rate of investment is less by a percentage point, to 18.5 percent of GDP, with the elite maintaining a much larger share. The rate of human investment, at about 3 percent of GDP, is only half of the level attained under full elimination of extraction. Consequently, the growth rate of per capita GDP is more than three and a half percentage points lower, at 5.8 percent per year. The lower levels of investment in physical and human capital partly reflect the amount of resources consumed by political competition, at more than 2 percent of GDP.

The second fiscal policy simulation preserves the existing rate of extraction but acts to neutralize it by reversing the net tax incidence on the two groups, with the net tax rates assuming the following values: \( \tau_e = -0.124 \) and \( \tau_{ne} = -0.106 \). The results, reported in the last column of Table 2, are as dramatic as those attained when extraction is fully eliminated. While yielding a strong growth rate of per capita GDP of 8.5 percent per annum (only a percentage point lower than under full elimination of extraction), the distributional effects on wealth are much larger—the
non-elite share of capital increases to 38.5 percent of wealth (26.4 percent under no extraction)—while the distributional impact on income is broadly similar, with the non-elite income share rising to 65 percent. The aggregate rate of investment is lower at 16.7 percent of GDP, with the change in its composition leaning more in favor of the non-elite. The rate of human investment is only 0.6 percentage lower, at 5.4 percent of GDP. The rate of political competition remains positive at 1.6 percent of GDP, with the non-elite now accounting for more than two fifths (owing to the substantial increase in the non-elite share of capital). This rate of political spending naturally detracts from an otherwise higher growth rate of GDP. The redistributive fiscal policy in favor of the non-elite essentially finances this political competition and makes it possible for the non-elite to maintain a high growth rate of human investment and thus to support a high level of economic growth that is comparable to the level associated with the zero-extraction regime.

Since the ultimate goal for public policy is to minimize the wastage of scarce resources and to attain the maximum feasible growth rate in capacity output and at the same time to convince both groups of society to accept this goal, the final simulation involves a policy package consisting of a neutral fiscal policy stance and the elimination of extractive activities and hence of political competition by both groups. Neutrality in fiscal policy may be needed to persuade both groups, mainly the elite, to forego the rate of extraction and to convince the non-elite to forego progressivity in fiscal policy. 1/ The implementation of this policy package requires prior political reforms aimed at strengthening the regulatory capacity and independence of the state from the particularistic interests of the private sector.

The results are more balanced in many respects, and therefore have a better chance of acceptance by both groups. Besides attaining the highest level of per capita growth rate of capacity output (11.3 percent per year), largely on account of the elimination of political competition, the non-elite increases its share of capital to 40 percent of the total capital stock and its share of income to 75 percent of GDP. The aggregate rate of investment stands at about 16 percent of GDP, with the elite accounting for about 60 percent. What is most noteworthy is that, owing to the elimination of extraction, the rate on human investment is maximized at 8.5 percent of capacity GDP, which allows for maximum efficiency of the labor force. The capital-labor ratio is rationalized at 0.77, which implies a 158 percent increase of the output-capital ratio over its base level. At this stage, the elite-non-elite distinction gets blurred. The elite, representing a tenth of households, now accounts for 60 percent of capital (down from the base level of 95 percent) and for a quarter of GDP (down from the base level of 54 percent). An egalitarian society is born.

1/ Progressivity in net tax incidence likely will be resisted by the elite.
c. Sensitivity of results to the assumption about \( \alpha \)

Table 3 shows the sensitivity of the results for the base run and for the simulated effects of the assumed elimination of extraction to changes in the assumption about the elasticity of output with respect to the capital stock, \( \alpha \). Alternative values of \( \alpha \) equal to 0.38 and 0.47 were assumed. 1/

As regards the sensitivity of the calibration of the model to alternative values of \( \alpha \), Table 3 shows that \( \epsilon \) declines as \( \alpha \) gets larger, with \( \epsilon \) corresponding to \( \alpha = 0.4273 \) close to the average value. The wealth distribution variable \( z \)--the non-elite share of capital--is not affected by changes in \( \alpha \). As expected, the equilibrium capital-labor ratio increases with \( \alpha \). 2/ The estimate for the transformation parameter \( \mu \) is in the 1.3-1.6 range. 3/

On the sensitivity of the simulated effects of eliminating extraction, Table 3 shows that the improvement in the distribution of wealth and income and the decline in the equilibrium capital-labor ratio are not sensitive to changes in the assumption about \( \alpha \). To the extent that \( \alpha \) is actually higher (at 0.4723 instead of 0.4273), the model overpredicts the growth rate of per capita output by two percentage points. Even in this case, however, the elimination of extraction that produces a growth rate of per capita GDP on the order of 7 percent per annum is not insignificant. The reverse is true: to the extent that \( \alpha \) is lower (at 0.3823) the model underpredicts per capita economic growth by more than two percentage points.

III. The Philippine Macroeconomic Experience

That the present analytical framework can shed light on the long-run growth performance of the Philippine economy should not come as a surprise; it was intended to do just that. The question is whether the Philippines fits in the above conceptualization. The institutional facts about Philippine social, political and economic structures point to an affirmative answer. Aided by a weak and underdeveloped state machinery, the political and economic elite had a dominant position over the non-elite by virtue of majority ownership of land and other productive capital assets and the effective exercise of political power. The social extraction parameter \( \beta \) and the political competition rate \( \gamma \) summarize the "politics of growth" and

1/ These were generated by alternative values of \( \alpha_0 \) equal to 0.3 and 0.5 (the base value of \( \alpha_0 \) is 0.4).
2/ An increase in \( \alpha \) tends to raise the rate of investment in \( K \) and to lower the spending on \( L \) (since \( 1-\alpha \) is smaller), thus increasing the ratio of \( K \) to \( L \).
3/ Recall that \( \mu \) translates spending on education, on-the-job training, health and nutrition, measured in constant pesos, into labor-augmentation in efficiency units, measured in man-years.
Table 3. Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th>$\alpha = 0.3823$</th>
<th>$\alpha = 0.4273$</th>
<th>$\alpha = 0.4723$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base 1/</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\epsilon$</td>
<td>2.149</td>
<td>1.855</td>
<td>1.512</td>
</tr>
<tr>
<td>$\mu$</td>
<td>1.616</td>
<td>1.475</td>
<td>1.271</td>
</tr>
<tr>
<td>$z$</td>
<td>0.048</td>
<td>0.048</td>
<td>0.048</td>
</tr>
<tr>
<td>$k^*$</td>
<td>3.64</td>
<td>4.03</td>
<td>4.54</td>
</tr>
<tr>
<td><strong>Simulated effects of eliminating extraction 2/</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$z$</td>
<td>0.280 (+0.232)</td>
<td>0.264 (+0.216)</td>
<td>0.227 (+0.179)</td>
</tr>
<tr>
<td>$A$</td>
<td>0.275 (-0.265)</td>
<td>0.314 (-0.226)</td>
<td>0.365 (-0.175)</td>
</tr>
<tr>
<td>$B$</td>
<td>0.725 (+0.265)</td>
<td>0.686 (+0.226)</td>
<td>0.635 (+0.175)</td>
</tr>
<tr>
<td>$k^*$</td>
<td>0.84 (-2.80)</td>
<td>1.10 (-2.93)</td>
<td>1.58 (-2.96)</td>
</tr>
<tr>
<td>$g^*-n$</td>
<td>0.112 (+0.092)</td>
<td>0.095 (+0.075)</td>
<td>0.073 (+0.053)</td>
</tr>
</tbody>
</table>

1/ That is, $r_e = -0.106$; $r_{ne} = 0.124$; $A = 0.54$; $B = 0.46$; $g^* = 0.05$; and $g^*-n = 0.02$.

2/ Meaning $b = 1$, which implies $\beta = 0$. The parameters $\epsilon$ and $\mu$ are held identical to their respective base values. Numbers in parentheses represent deviations from base values.
"growth of politics," respectively. Both politics and economy were characterized by parallel oligopolies, whose powers were disguised by ostensible trappings of democracy and an unruly but ultimately ineffective press. 1/ New entrants did not destabilize the "game" because they only wanted in. 2/

The political and economic power of the elite had been manifested not only in oligopolistic behavior in output markets and oligopsonistic behavior in labor markets, but also in the exercise of brute force. 3/ Referring to the monopolization of the sugar industry under martial law, Seagrave (1988, pp. 285-86) states:

"(Through the early 1980s), cane workers were paid less than a dollar a day. The sugar barons always had been criticized for this exploitation and for salting their profits abroad, but under the (monopolization of the sugar industry), costs rose and profits fell, planters stopped their old-fashioned paternalism (such as it was), abolished free services, cut payrolls, and forced laborers to pay old debts. Said one grower: 'If the planters are squeezed, we squeeze our labor.' Real income in the canefields dropped to the lowest point since the beginning of the plantation system in the late eighteenth century. In 1986, most Filipino sugar workers received less than 80 cents a day, in pesos that had lost their buying power by more than half, so in real terms they earned one-third their 1940 wages. On Negros alone, 750,000 children were suffering malnutrition, existing on meager rations of sweet potato and cassava, hundreds of them going blind, thousands suffering brain damage. While the world agonized over famine in Ethiopia, a worse famine was sweeping what Manila travel brochures persisted in calling Sugarlandia."

1/ In a July 1992 paper, the Commissioner of the Philippine Securities and Exchange Commission reports that only 80 corporations among the country's top 1,000 were publicly listed because most Filipino companies were "actually glorified family corporations."

2/ There is the popular statement attributed to a Filipino politician, "What are we in power for."

3/ The labor-capital relations in Philippine agriculture and the objective of maximizing short-run industrial profits of the traditional Filipino family capitalist under oligopsonistic labor markets contrast with the Japanese "non-capitalist" market economy in which the independent landowning farmer has replaced the traditional landlord in agriculture, and in which the objective of the industrial "stakeholder" is to maximize long-run output and preserve market shares while preserving "employee sovereignty." See Sakakibara (1993).
On the exercise of coercion at the local level, McCoy (1993, p. 15) states: "On the frontiers, local elites formed private armies to defend their extraction of net resources through logging, mining, or fishing—the basis for wealth in many localities." He also cites as a specific example the extralegal transport "tax" paid by tobacco farmers to a provincial warlord during the 1960s.

In the Philippine context a high concentration of capital in the hands of a few (low z) and a positive rate of extraction (a high level of β, supported by a positive and high level of τ_{ne}) reflected the following forces at work:

1. **Wealth distribution**

A low z stemmed from a highly skewed distribution of capital assets, particularly land, with the majority of Filipinos owning little land or physical capital. Since land was proven collateral for obtaining credits used in generating future income, the highly skewed wealth distribution translated into a correspondingly highly skewed distribution of income. It had been suggested that a policy of raising the non-elite share of capital through sectoral reform and fiscal policies would improve income distribution and simultaneously raise the long-run growth rate of per capita capacity output.

2. **The rate of social extraction**

A high extraction rate β was sustained by the following factors.

   a. **Inflation**

   Recall that the obverse of the retention rate b is the social extraction rate \( \beta = 1-b \), where \( b = ae \), "a" is the fraction of the price of the domestic good produced by labor and capital reflected in the valuation of the real wage rate, and "e" is the fraction of the marginal physical product of labor actually paid out. The term "a" is the price or inflation adjustment factor, and the term "e" is the real or productivity adjustment factor. The discussion below focuses first on the inflation factor, then on the actual division of output between capital and labor.

   As analyzed by Bautista (1976), Philippine inflation had been fueled by inadequate food supplies and high import dependency coupled with a lack of "export substitution." Policies impinging upon food production capability exacerbated food shortages, while trade and industrial policies served to keep the high import and the low export ratios, thus making domestic inflation heavily influenced by developments in external prices and periodic depreciation of the exchange rate. The domestic import-substituting industry had been protected by import restrictions and high tariffs, resulting in inflated prices of industrial products. To these factors may be added periodic excess liquidity generated by Central Bank financing of
the fiscal deficit, which reflected the narrowness of the tax base (particularly low taxation of income from property) and generous subsidies to the business elite.

These considerations are important particularly to a country like the Philippines that already suffers from severe inequalities in the distribution of income and wealth (low $B$ and low $z$), because of the land-tenure arrangements, lax enforcement of minimum wage legislation, and the highly regressive nature of the incidence of both statutory taxation and inflation. 1/ On the latter Bautista (1976, p. 204) comments, "The redistributive inequities of rising consumer prices is a fertile ground for social conflict against which reasonable safeguards should be provided...," such as "income support programs for those hurt by the inflation, emergency surtaxes on income and wealth exceeding specified cut-off levels, changes in government expenditure pattern to provide greater benefits to low-income families... ." Some of these safeguards are included in the net tax-spending policy parameter $\tau_{ne}$ in the present framework. 2/

b. **Extractive activities**

These activities are summarized by the "real" retention parameter "$e$" in the extraction rate definition $\beta = 1-b-1-ae$, and include a feudal land tenure system and an oligopsonistic industrial structure, reflecting the dominance of a few members of the land-based business elite (Seagrave, 1988;)

1/ Although the growth model treats $\beta$ and $r$'s as exogenous, there is a possibility that they are endogenous variables that interact with the major macroeconomic variables. A high extraction rate $\beta$ exacerbates asset inequality by producing a small value of $z$, which tends to concentrate political power in the elite and to encourage a relatively high value for the net tax incidence $\tau_{ne}$ and a low or even negative value for $\tau_e$, a low value for the retention rate "$b$" and thus a high value for the social extraction rate $\beta$. A high-$\beta$ value, in turn, further exacerbates asset inequality (measured by a yet lower level of $z$).

2/ For empirical evidence on the negative effects of inflation on income equality in 18 industrial and developing countries, see Bulir and Gulde (1995). In explaining Philippine inflation, Bautista (1976) cites supply and demand factors. On the demand side, given the narrow tax base fiscal deficits were often financed partly by inflationary money-creation at the central bank. On the supply side, Bautista mentions the inadequate policies with regard to food production capability (inadequate irrigation, transportation, and other infrastructure facilities in food-producing regions; inadequate provision of agricultural credit, fertilizer, technical assistance and marketing facilities; existing land tenure system). In addition, the policy of import substitution of finished products has engendered high import requirements of the economy; energy conservation and, development policies have been inadequate; and incentives for a diversified export structure have been weak; these policies have subjected the domestic economy to the inflationary tensions generated in the foreign trade sector.
McCoy, 1993). The ILO Report (1974, p. 18) comments, "At any rate, most of the gain in agricultural income resulting from an improvement in agricultural terms of trade and an increase in productivity per hectare in the 1960s accrued to landowners, whether landlords or owner-cultivators." A meaningful agrarian policy that includes strengthened and enforced farmer-tenant rights, and industrial policies that strengthen labor's bargaining position in wage negotiations likely will reduce the extraction rate "1-b" by lowering the actual rental-wage ratios across industries to correspond more closely to the ratio of output elasticities of capital and labor.

The aforementioned high extraction rate \( \beta \) was supported by a positive rate of net taxation of non-elite income \( r_{ne} \). Based on studies on the incidence of direct and indirect taxation and on the distribution of public goods reported by Tan (1976), the Philippine tax system was found to be highly regressive, owing mainly to the reliance on indirect taxes such as customs duties, production and sales taxes. Both the 1961 and 1971 studies of tax incidence of the Philippine National Tax Research Center indicated that the poorest families paid 37 percent taxes, the middle income families, 18 percent. Netting out the benefits received (such as educational and health services), the redistributive effects of public finance were found to be very weak when all public goods were counted including administrative expenses and national defense.

All the above elements were buttressed by political factors. The privatization of public interests (dominance of private over public interests) reflected the absence or inadequacy of political independence and regulatory capacity on the part of the Philippine ruling elite (Montes, 1988, 1989; Montes and Ravalo, 1995).

In sum the ability of the Philippine political and economic elite to extract a fraction \( \beta \) of labor's marginal revenue product was reinforced by certain institutional arrangements and policy distortions: the dominance of a few, land-based families in the political arena, which enabled public finance activities to work in their interests and against the non-elite; agricultural, industrial, and trade regimes that were stacked in favor of the elite and that led to periodic food shortages and balance of payments crises and thus to inflationary pressures; the existing land tenure system and industrial structure that extracted a portion of labor's marginal product and the elite's effective suppression of legitimate labor union activity, backed by private armies at the local level.

The results were declining real wage incomes, driven to subsistence levels in large sections of the dominant agricultural sector, resulting from ceilings on prices of food and other agricultural products and high prices of industrial products that served as inputs to the agricultural sector. Stagnant or declining agricultural wage incomes (in real terms) dampened the demand for industrial products (the Keynes-Kalecki effect) and, combined with the existence of efficiency wages in the formal urban sector, led to
persistent unemployment and excess capacity. As regards declining real incomes in the manufacturing sector, Bautista (1976, p. 197) states:

"Output per worker had risen at rates much higher than the observed increases in nominal earnings of either salaried or wage employees in periods of relative price stability (1955-60 and 1965-69) as well as in periods of comparatively higher inflation rates (1960-65 and 1969-71) ... . What is evident is that the real incomes of both salaried employees and wage earners have been declining continuously since 1955 except in the second half of the 1960s." 1/

These developments intensified political competition to increase the level of $\beta$ in order to maintain total elite income. The extraction parameter $\beta$ reflected these wage-price distortions 2/ emanating from the ruling elite's fiscal, agricultural, trade and industrial policies, and from the same land tenure system inherited from the Spanish colonial era.

Although the growth framework developed in this paper does not explicitly incorporate a variable rate of unemployment, the relationship between the rate of factor utilization and the rate of extraction is particularly useful at this juncture, because unlike export-oriented (EO) industrialization, the Philippine elite opted for an import-substituting (IS) industrial strategy. The higher $\beta$ associated with the IS strategy has important implications. First, the scale of operations of industrial firms is generally smaller than that of firms that cater to the world export markets (EO strategy). Empirical studies have shown that the scale factor is more important than relative factor prices in determining the level of

1/ For an explanation of declining real wages in the Philippines in terms of the standard trade-theoretic Stolper-Samuelson-Rybczynski model sans growth, see Lal (1983). Lal (1983) observes (p. 11): "There is some evidence of a falling wage share and output capital ratio and rising capital intensity over the last two decades." Since the elasticity of substitution between capital and labor is close to unity (Williamson, 1971), which would imply in the steady state constant factor shares, constant output capital ratio, and constant capital intensity in a standard neoclassical growth model with exogenous labor-augmenting technical progress, Lal (1983, p. 45, footnote 3) explains the observed stylized facts about the Philippines by invoking "sufficiently Hicks or Harrod capital using biased technical progress... ." By contrast, the growth model developed in the present paper can explain these stylized facts, despite its standard neoclassical assumption of Harrod-neutral labor-augmenting technical progress. The decline in real wages owing to repeated devaluations of the peso is captured in the less than unitary value of the retention parameter "b" in the present framework.

2/ These distortions drove a wedge (Sicat's $\lambda$ and the present paper's "b") between the rental-wage ratio and the ratio of the marginal products of capital and labor.
capital utilization (Bautista et al. 1981); even when faced with lower capital costs, large firms find it easier to utilize capital at a higher rate, owing to technological and management economies of scale. Conversely, relatively smaller firms such as those operating in the Philippines tend to have a lower rate of capital utilization. Second, as a higher extraction rate $\beta$ reduces real wages, the factor utilization rate declines because of the shrinking domestic demand for industrial products.

3. Distributional issues

The Cobb-Douglas production function implies the following long-term equilibrium income shares: $\rho(1-z)$ for the elite and $\rho z + \omega$ for the non-elite. The relative income share of the elite decreased and that of the non-elite increased with a higher non-elite share of capital $z$ and a decline in the elite's economic and political power, manifested in a lower rate of extraction $\beta$. In the example of the progressive fiscal policy under a regime of unchanged levels of extraction by the elite, the non-elite share of wealth and income rose from 5 percent to more than 38 percent and from 46 percent to 65 percent, respectively. For reasonable values of the parameters, it was found that an excessively extractive society exhibited a lower growth rate of per capita output (of 2 percent per year) owing to (i) the increase in political competition that detracted from each group's (particularly the elite's) rate of investment and (ii) the poverty-induced deterioration in both physical and human capital accumulation by the non-elite (low ratio of expenditures on education, training, health care, nutrition and similar efficiency-enhancing spending). The lower growth rate of human capital was the result of lower levels of non-elite disposable real income, employment and rate of saving. Thus, throughout Philippine history the attempt by the Filipino elite to raise its income share, through a larger rate of extraction of non-elite incomes, had resulted in a more unequal distribution of income and wealth and lower growth rate of per capita capacity output in the long run.

IV. Conclusion

Considerations of social equity argue for lowering the rate of social extraction and improving the distribution of wealth and income. This paper has shown that they should be made explicit objectives of economic growth, because their attainment are essential to a broad-based and rapid increase in the growth rate of per capita capacity output. A substantially less unequal distribution of wealth, a more progressive incidence of public finance (or at least a neutral net tax incidence) to provide the majority of the working population access to basic goods and infrastructure services, a more neutral trade and industrial policy ("neutral" with respect to exports and import substitutes), improved labor market policies to promote efficiency in resource allocation, and sound macroeconomic policies that achieve and maintain a low-inflation environment would imply a high value for the retention rate, a low value for the social extraction rate, much...
improved distribution of income and wealth, and a rapid growth rate of per capita capacity output.

Strengthening the political independence and regulatory capacity of the Philippine state is required to make economic policy reforms implementable (the lowering of the net tax rate on the non-elite by the ruling elite, the needed reforms in the wage-setting process in the different sectors) so that extraction falls to a minimum level and wealth ownership is broadened.

This paper has suggested that in a society such as the Philippines where the initial distribution of economic wealth and political power has had long historical roots and been largely non-market determined, the implementation of progressive or at least neutral fiscal policy and sectoral-cum-institutional policies will not impede economic growth and efficiency. On the contrary it has been shown that such policies are an evolutionary way to correct the initial (non-market determined) wealth distribution, lower the social rate of extraction, raise the efficiency of both capital and labor, and accelerate the growth rate of per capita capacity output.
APPENDIX

Derivation of Group Allocation Rates

Assume a well-behaved, unit-homogeneous production function for each group j,

\[ Y(j) = K_1^{\theta_1}(j)K_2^{\theta_2}(j)L(j)^{1-\theta_1-\theta_2}, \]  

which, in intensive form, is:

\[ y(j) = k_1^{\theta_1}(j)k_2^{\theta_2}(j) \]  

where \( Y(j) \) is real output, \( K_1(j) \) is physical capital, \( K_2(j) \) is "political" capital, \( L(j) = E(j)N(j) \) is the working population in efficiency units, \( E(j) \) is an efficiency index, \( N(j) \) is raw population, and \( j = e, ne \). For simplicity ignore depreciation and let the elite \( N(e) \) and non-elite \( N(ne) \) population grow at the same constant rate \( n \) as the total population \( N \); the group populations represent constant fractions \( \eta \) and \( (1-\eta) \) of \( N \): \( N(e) = \eta N, N(ne) = (1-\eta)N \).

Group surpluses are divided into expenditures on physical capital \( I(j) \), political capital \( P(j) \), and human capital \( [d(E(j))/dt]N(j) \):

\[ I(j) = \sigma_1 s(j)Y(j) \]  

\[ P(j) = \sigma_2 s(j)Y(j) \]  

\[ [d(E(j))/dt]N(j) = \mu(1-\sigma_1-\sigma_2)s(j)Y(j) \]  

where the \( \sigma \)'s are allocation rates, \( s(j) = 1-c(j) \) is group surplus, and \( \mu \) is a constant parameter that transforms surplus income (constant pesos) into units of \( L \) (man-years). Given the unit-homogeneity of each group production function, and denoting the proportionate rate of change of a variable by "grw" the steady-state growth rate of group income is:

\[ g*(j) = grw(Y(j)) = grw(K_1(j)) = grw(K_2(j)) = grw(L(j)) \]

\[ = \mu(1-\sigma_1-\sigma_2)s(j)k_1^{\theta_1}(j)k_2^{\theta_2}(j) + n \]  

where \( k_1^* \) and \( k_2^* \) are constant steady-state values of \( k_1(j) \) and \( k_2(j) \), respectively.

The optimal problem is to maximize (5) with respect to \( \sigma_1, \sigma_2, k_1^*, \) and \( k_2^* \) subject to:

\[ grw(k_1) = \sigma_1 s(j)k_1^*^{\theta_1}(j)k_2^{\theta_2}(j) \]
Form the Lagrangian expression,

\[
\Gamma = \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) + n
\]

\[
+ \zeta_1[s_1(j)k_1^1(j)k_2^2(j) - \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n]
\]

\[
+ \zeta_2[s_2(j)k_1^1(j)k_2^2(j) - \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n](8)
\]

where \(\zeta_1\) and \(\zeta_2\) are Lagrange multipliers. The optimal problem is then to maximize (8) with respect to \(\sigma_1\), \(\sigma_2\), \(k_1\), \(k_2\), \(\zeta_1\), and \(\zeta_2\). The first-order conditions are:

\[
\frac{\partial \Gamma}{\partial \sigma_1} = -\mu s(j)k_1^1(j)k_2^2(j) + \zeta_1[s(j)k_1^1(j)k_2^2(j) - \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n] = 0
\]

\[
\frac{\partial \Gamma}{\partial \sigma_2} = -\mu s(j)k_1^1(j)k_2^2(j) + \zeta_1 s(j)k_1^1(j)k_2^2(j) + \zeta_2 s(j)k_1^1(j)k_2^2(j) + \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n = 0
\]

\[
\frac{\partial \Gamma}{\partial k_1^1} = \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_1^1(j)k_2^2(j)
\]

\[
+ \zeta_1 s(j)k_1^1(j)k_1^1(j)k_2^2(j) - \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n = 0
\]

\[
\frac{\partial \Gamma}{\partial k_2^2} = \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) + \zeta_2 s(j)k_1^1(j)k_2^2(j) + \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n = 0
\]

\[
\frac{\partial \Gamma}{\partial \zeta_1} = s(j)k_1^1(j)k_1^1(j)k_1^1(j)k_2^2(j)
\]

\[
- \mu(1 - \sigma_1 - \sigma_2)s(j)k_1^1(j)k_2^2(j) - n = 0
\]
From (9)-(10), $\xi_2/\xi_1 = k^*_2/k^*_1$. From (13)-(14), $k^*_2/k^*_1 = \sigma_2/\sigma_1$.

Collecting terms in (11) and (12),

\[
(1-\xi_1-\xi_2)\mu(1-\sigma_1-\sigma_2)s(j)k^*_1\theta_1(j)k^*_2\theta_2(j) + \xi_1\sigma_1s(j)(\theta_1-1)k^*_1\theta_1-1k^*_2\theta_2 - \xi_2\sigma_2s(j)\theta_1k^*_1\theta_1-1k^*_2\theta_2-1 = 0
\]

Premultiplying (11)' by $k^*_1/k^*_2(\theta_1/\theta_2)$ and substituting into (12)' yield,

\[
\xi_1\sigma_1s(j)\theta_2k^*_1\theta_1-1k^*_2\theta_2-2 + \xi_2\sigma_2s(j)(\theta_2-1)k^*_1\theta_1-1k^*_2\theta_2-1
- \xi_1\sigma_1s(j)(\theta_1-1)(\theta_2/\theta_1)k^*_1\theta_1-1k^*_2\theta_2-1
+ \xi_2\sigma_2s(j)\theta_2k^*_1\theta_1k^*_2\theta_2-2 = 0
\]

Collecting terms in (15), premultiplying by $1/\xi_1$, and substituting $\xi_2/\xi_1 = k^*_2/k^*_1 = \sigma_2/\sigma_1$ yield the optimal allocative decision rule:

\[
\sigma_1/\sigma_2 = \theta_1/\theta_2
\]

or that the ratio of allocation rates should be set equal to the ratio of group income shares. 1/ In the text $\theta_1 = \alpha$, $\theta_2 = \beta(1-\alpha)$, and $1-\theta_1-\theta_2 = (1-\beta)(1-\alpha)$.

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1/ The assumed well-behaved properties of the group production functions ensure that the second-order conditions for an optimum are met.
References

Bautista, Romeo, "Inflation in the Philippines," in Philippine Economic Problems in Perspective, by José Encarnación et al. (Quezon City: Institute of Economic Development and Research, School of Economics, University of the Philippines, 1976).


