THE ROLE OF FISCAL POLICY IN HUMAN DEVELOPMENT AND GROWTH

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Abstract

This paper develops a dynamic intertemporal general equilibrium model of a small open economy that incorporates and endogenizes human development and also various indicators of social progress. The model is calibrated to 15 Latin American economies to study the effect of marginal increases in different types of useful and wasteful public expenditures under alternative financing schemes. The model seeks to provide quantitative policy assessments to guide government spending/financing decisions when policymakers pursue a specific objective such as growth, welfare, human development or social progress. The estimates presented in this paper indicate that infrastructure spending dominates other forms of public spending (education, health, government consumption and transfers to low-wealth households) in terms of sizable positive effects on growth performance, welfare, human development and social progress.

JEL Classification: E62, H2, H5, H63

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1. INTRODUCTION

Since the publication in 1990 of the first Human Development Report (HDR) by the United Nations Development Programme (UNDP), the idea of human development as the ultimate goal of the development process has gained increasing influence on the development debate and contributed to a renewed call on the international community and national authorities to support and achieve an adequate level of resource mobilization for investing in the formation of human capabilities. For the so-called human development approach, the improvement of social outcomes – sanitation, health care, safe water, elementary education, adequate shelter, clean environment, etc. – is a goal in itself, independent of its effect on economic performance and efficiency.

With the support of the work of Amartya Sen (1985, 1987, 1990) and the UNDP's milestone publication, the Human Development Reports, the capabilities approach has successfully arisen as a paradigm shift in the international development discourse. However, it has not yet delivered on the initial promise (Sen, 1985, 1987; Dréze and Sen, 1989) of offering a new perspective on a range of policy issues, in general, and on public social spending policies, in particular. Advocates of the approach have indeed made strong policy recommendations regarding budgetary allocations through the HDRs. The Human Development Report 1991 introduces four government spending ratios (the public expenditure ratio, the social allocation ratio, the social priority ratio, the human expenditure ratio) as indicators of national policy commitment to the social sector. The report advices developing countries to achieve a human expenditure ratio - the percentage of national income devoted to human priority concerns - of 5% to do well in the promotion of human development. The 20/20 Initiative, officially adopted during the World Summit for Social Development in 1995 and originated in a proposal included in the 1992 HDR, suggests that every developing country direct 20% of its domestic budget to basic needs and every donor country earmark 20% of its official development assistance for the same purpose. Several of the recently released reports focus on attaining the Millennium Development Goals (MDGs), an international commitment to achieve specific quantitative outcomes which requires international and national resource mobilization to scaling up social service delivery.

Despite sharp policy initiatives and commitments, as indicated above, there is a lack of understanding of a number of fundamental policy issues. The literature remains silent regarding the question of how economic resources transform into human development attainments, how limited resources should be allocated within social sectors and how compatible is the human development approach and economic growth. To be able to reap the benefits of the recommended proactive public action stance policymakers must also understand how to finance human development and whether or not the social benefit of increased social service delivery outweighs the cost of revenue mobilization. To make an impact on economic policy, the human development approach should develop a coherent policy perspective.

The human development idea has not yet had major influence on macro theory though a number of authors have attempted to introduce social expenditures in an endogenous growth framework aimed at characterizing optimal expenditure policies. The literature on the optimal allocation of government spending or optimal composition of government expenditures is basically an extension of Barro's (1990) seminal paper and Futagami et al. (1993), Glomm and Ravikumar (1997) and Devarajan, et al. (1998) work and extends the basic proposition that the growth-maximizing tax rate is equal to the elasticity of the government spending flow or public capital in the aggregate production function. Agénor (2005a,b) introduces two categories of government expenditures, infrastructure investment and education expenditures to study optimal taxation and allocation of government spending in a related framework. He shows that the growth-maximizing value of the tax rate is equal to the sum of the elasticities of output with respect to infrastructure services and educated labor and that the allocation of spending depends on the parameters characterizing both the schooling technology and goods producing technology. In Agénor (2005c) the government allocates resources between infrastructure investment and health services and the growth-maximizing tax rate is equal to the sum of the elasticities of output with respect to infrastructure services and effective labor. Moreover, the growth-maximizing allocation of spending between the two categories is shown to depend on the parameters describing the technologies for goods and health services. Agénor and Neanidis (2006) generalize the preceding results when the government spends on health, education and infrastructure. Under this setup the optimal composition of government spending is shown to depend on "(…) all parameters characterizing the technologies for producing goods, health services and educated labor" (p. 24).

It is difficult to devise a link between the current state of the literature on optimal composition of public expenditures and the practical determination of spending policies by policymakers. The literature has been unable to produce a simple rule or set of principles to offer practical recommendations to guide policy reform in developing countries. In real-world policy experiences it is rare to see comprehensive fiscal reforms implementing or claiming to be guided by optimal composition principles. But more importantly, from a human development perspective, the literature on optimal expenditure shares is deficient in the sense that policies are assessed only on the basis of their effect on welfare or income growth. The literature has failed to incorporate human development as an end in itself and as an instrument to increase productivity.

The present paper departs from the existing literature along various important dimensions. This paper is a first attempt to introduce and endogenize human development and various indicators of social progress into a dynamic intertemporal general equilibrium model of a small open economy with endogenous growth and imperfect access to world capital markets. The paper does not seek to provide insight into the best composition of government spending but to provide insight into how to achieve a better one, either from a social welfare point of view, from an economic growth standpoint or from a human development perspective. The level of human development is assumed to be embodied in individuals and is defined as a multidimensional achievement index, as an aggregate of attainment levels of some basic human functionings. To endogenize human development, a functionings production function is specified as a reduced form representation of the relative importance of private and public provisioning of key social services in human development. Social spending is thus motivated by the provision of human-development-enhancing social services. It is also assumed that public infrastructure services affect material production directly.

The paper studies how the economy responds to small temporary and permanent changes in various categories of government spending (infrastructure, education, health, wasteful government consumption and lump-sum transfers to low-wealth households) to identify specific effects on the time path of economic activity, social welfare, human development and social progress. The paper also assesses the relative merits of alternative forms of raising the necessary revenue to finance the expenditure increase. The financing options are: distortionary tax financing (consumption and labor income taxation) and deficit financing (with access to perfect and imperfect – e.g., upward-sloping supply curve of debt - capital markets). Across all policy experiments the "initial" and "final" steady state level of debt is the same. Hence, as a direct corollary of the government's intertemporal budget constraint, agents realize that debt financing implies higher future distortionary taxation to pay for it. The paper follows the approach recommended by Slemrod and Yitzhaki (2001) of integrating expenditure and financing decisions for public good provision. Knowing the quantitative effect of a given spending/financing decision, policymakers may improve - at the margin - the composition of government spending by increasing or redirecting resources in favor of the provision of those public goods with the highest impact on a desired social outcome (growth, welfare, human development or a particular social indicator or MDG).[1] Even though the full characterization of optimal fiscal policies is unknown or cannot be easily described by a set of simple principles, the proposed approach of marginal interventions may be used to prescribe welfare improving reforms.

The outline of the paper is the following. Section 2 describes the basic structure of model economy and introduces human development. Section 3 discuses various issues regarding the model's stationary representation and solution method. Section 4 discusses calibration. Section 5 sets up experimental designs and conducts policy experiments. Section 6 performs sensitivity analysis to assess how the results depend on model features and parameter values. Finally, Section 7 provides some conclusions.

2. THE MODEL

Consider a real small open economy facing imperfect access to world capital markets. The economy is inhabited by a continuum of heterogeneous households who are

[1] The capabilities approach proposes an evaluation of policies on the basis of their impact, not on economic growth and welfare but on achieved basic functionings. The use of this non-welfarist criterion may lead, under certain circumstances, to the violation of the Pareto principle, that is, policy choices may make everybody worse off (Kaplow and Shavell, 2001).

infinitely lived and have perfect foresight over the future path of fiscal policies. In addition, there are a large number of perfectly competitive firms and a government.

Following convention, economy-wide per-capita aggregates are represented by capital letters while variables under the household's control are denoted by lower case letters. In equilibrium, aggregate magnitudes are consistent with appropriately aggregated individual choices. Relative prices and rental rates are also in lower case. Further, time is discrete and indexed by t, $t = 1, 2, \ldots, \infty$, and each period t in the model is assumed to be one year.

2.1 Human Capital Accumulation

This paper makes use of a hybrid engine of growth in which labor-augmenting technical change comes from a mixture of schooling and learning by doing.[2] Specifically, the aggregate stock of human capital (H_t) is a composite of two types of knowledge acquired by participating in private sector activities: knowledge and skills obtained in the process of schooling (H_t^s) and knowledge and skills obtained on the job (H_t^l):[3]

$$H_t = \lambda^{\eta} (H_t^s)^{\alpha^H} (H_t^l)^{1-\alpha^H}, \qquad \alpha^H \in [0,1], \quad \lambda^{\eta} > 0 \tag{1}$$

where λ^{η} is a scaling factor and α^H measures the relative importance of educational human capital in the process of human capital accumulation. Educational human capital is created by deliberately taking time from production activities and putting it into the schooling sector as in Lucas (1988):

$$H_{t+1}^s = (1-\delta^H) H_t^s + \chi^s (1-N_t) \Im_t H_t, \qquad \delta^H \in [0,1], \quad \chi^s \geq 0, \quad (H_0, H_0^s) \text{ given} \tag{2}$$

where δ^H is the depreciation rate of the stock of educational human capital. The time endowment of the representative worker is normalized to unity per period and N_t stands for the fraction of the time endowment devoted to material production. χ^s is the rate at which human capital services in the education sector is translated into accumulated knowledge.[4] $\Im_t$ is a multidimensional index of human development and the achieved level of human development is assumed to be embodied in individuals. See below for modeling details on how $\Im_t$ is specified and endogenized. Human capital can also be

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[2] Jovanovic's (1997) survey identifies four possible sources of growth of knowledge: research, schooling, learning by doing, and training. In principle, all these factors could potentially have a bearing on the process of human capital accumulation.

[3] In the same spirit Göcke (2004) and Hu and Mino (2005) modeled human capital. In Killingsworth (1982) human capital accumulation occurs via both training and learning by doing.

[4] This simple specification of the educational human capital technology employs household time as its only input. It can be easily generalized by including inputs such as private goods investment (say tuitions) as in King and Rebelo (1990) and Kim (1998) and/or public goods (public spending on education, R&D, etc.) as in Glomm and Ravikumar (1998), Corsetti and Roubini (1996) and Jones and Manuelli (1999).

enhanced as a result of a non-deliberate action, as a by-product of production experiences as in Arrow's (1962) learning-by-doing mechanism. The aggregate stock of human capital acquired through learning by doing evolves as follows:

$$H^{l}_{t+1} = (1-\delta^{H}) H^{l}_{t} + \chi^{l} Y_{t}, \qquad \chi^{l} \geq 0, \qquad H^{l}_{0} \text{ given} \tag{3}$$

where χ^{l} is the knowledge acquisition rate, the rate at which the current production experience, given by total output Y_t, is translated into accumulated knowledge.

2.2 Households

Total population is constant and categorized into two types of households differing in borrowing-saving opportunities. P_o households, henceforth identified by subscript $_o$, are savers or Ricardian and P_r households, henceforth identified by subscript $_r$, are spenders or liquidity-constrained consumers.[5,6] Without loss of generality household population is normalized to one, i.e. $P_r + P_o = 1$. Savers are characterized as high-wealth households who consume but do not work and smooth consumption over time by trading in physical and financial assets. They own all the firms and are entitled to claim any profits that may result. Spenders or low-wealth households, on the other hand, follow the rule of thumb of consuming their disposable labor income every period and do not save or borrow due to credit market imperfections. Spenders cannot accumulate physical assets but can accumulate human capital through formal schooling. Since the schooling decision has intertemporal implications, spenders are not myopic as is generally assumed in the literature based on Mankiw's (2000) savers-spenders theory of fiscal policy.

2.2.1 Liquidity-Constrained Households

The representative restricted household has preferences over sequences of a composite consumption good. The composite consumption good is a combination of two goods treated as imperfect substitutes by a CES (Constant Elasticity of Substitution) Armington aggregator: consumption of goods produced domestically, $c^{d}_{r,t}$, and consumption of imported goods, $c^{m}_{r,t}$. The household optimally chooses plans for consumption $(\{c^{d}_{r,t}, c^{m}_{r,t}\}^{\infty}_{t=0})$, for the allocation of its time endowment between work and schooling $(\{n_{r,t}\}^{\infty}_{t=0})$ and for the accumulation of human capital $(\{h_{t+1}, h^{s}_{t+1}\}^{\infty}_{t=0})$, taking as given the

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5 The savers-spenders terminology corresponds to Mankiw's (2000) behavioral taxonomy. Household types could be renamed as stakeholders and workers, respectively, if we draw on Danthine and Donaldson's (1995) terminology.

6 The Ricardian/Non-Ricardian dichotomy has been introduced in the literature to overcome the failure of the Barro-Ramsey model (and the Diamond-Samuelson model) to explain why aggregate consumption follows closely the evolution of current income and the fact that many households have net worth near zero. See Campbell and Mankiw (1989, 1990). Galí et al. (2004) claim that the presence of rule-of-thumb consumers may potentially help explain existing evidence on the effect of government spending.

sequences of prices, taxes and the economy's level of human development, to maximize its discounted lifetime utility:

$$\max \quad \sum_{t=0}^{\infty} \beta^t \log(c_{r,t}) \tag{P1}$$

subject to:

$$c_{r,t} = \lambda_r^c \left[\alpha_r^c (c_{r,t}^d)^{-\nu^c} + (1-\alpha_r^c)(c_{r,t}^m)^{-\nu^c} \right]^{-\frac{1}{\nu^c}}, \quad 1 \geq \alpha_r^c \geq 0, \quad \lambda_r^c > 0, \quad \nu^c > -1 \tag{P1.1}$$

$$(1+\tau_t^c)(p_t^d c_{r,t}^d + c_{r,t}^m) \leq (1-\tau_t^w) w_t n_{r,t} h_{r,t} \Im_t - \tau_t \tag{P1.2}$$

$$h_{r,t} = \lambda^{\eta} (h_{r,t}^s)^{\alpha^H} (H_t^l)^{1-\alpha^H} \tag{P1.3}$$

$$h_{r,t+1}^s = (1-\delta^H) h_{r,t}^s + \chi^s (1-n_{r,t}) h_{r,t} \Im_t, \qquad (h_{r,0}, h_{r,0}^s) \text{ given} \tag{P1.4}$$

where β, $1 > \beta > 0$, is the subjective discount factor, λ_r^c is a scaling parameter, α_r^c is a parameter determining the relative share of the components of the composite consumption good and ν^c is the substitution parameter determining the elasticity of substitution between domestic and imported consumption goods, given by $(1+\nu^c)^{-1}$. w_t is the real wage rate and p_t^d is the price of the domestically produced good in terms of the *numéraire*, the imported good. τ_t^c is the consumption tax rate, τ_t^w is the labor income tax rate and τ_t stands for a lump-sum tax (or transfer if negative). Condition (P1.1) is a CES Armington aggregator of consumption goods, condition (P1.2) is the budget constraint and equations (P1.3) and (P1.4) are the laws of motion for the composite human capital stock and for its educational component, respectively.

2.2.2 Ricardian Households

The representative high-wealth household optimally chooses streams for the composite consumption good and its components $(\{c_{o,t}, c_{o,t}^d, c_{o,t}^m\}_{t=0}^{\infty})$, for the composite investment good and its components $(\{i_{o,t}, i_{o,t}^d, i_{o,t}^m\}_{t=0}^{\infty})$, and plans for the stock of physical capital $(\{k_{o,t+1}\}_{t=0}^{\infty})$, for government bond holdings $(\{b_{o,t+1}\}_{t=0}^{\infty})$ and for foreign borrowing $(\{d_{o,t+1}\}_{t=0}^{\infty})$ to maximize its discounted lifetime utility taking as given prices, rental rates and fiscal policy. The Ricardian household solves the following optimization problem:

$$\max \quad \sum_{t=0}^{\infty} \beta^t \log(c_{o,t}) \tag{P2}$$

subject to:

$$c_{o,t} = \lambda_o^c \left[\alpha_o^c (c_{o,t}^d)^{-\nu^c} + (1-\alpha_o^c)(c_{o,t}^m)^{-\nu^c}\right]^{-\frac{1}{\nu^c}}, \quad 1 \geq \alpha_o^c \geq 0, \quad \lambda_o^c > 0, \quad \nu^c > -1 \qquad \text{(P2.1)}$$

$$d_{o,t+1} - b_{o,t+1} = (1+r_t^d)\,d_{o,t} - (1+r_t^b)\,b_{o,t} + p_t^d[(1+\tau_t^c)c_{o,t}^d + i_{o,t}^d] + (1+\tau_t^c)c_{o,t}^m + i_{o,t}^m - (1-\tau^k)(r_t\,k_{o,t} + \Pi_{o,t}) - (p_t^* - p_t^d)X_{o,t} + \Psi^d[d_{o,t+1}, d_{o,t}] + \tau_t \qquad \text{(P2.2)}$$

$$i_{o,t} = \lambda_o^i \left[\alpha_o^i (i_{o,t}^d)^{-\nu^i} + (1-\alpha_o^i)(i_{o,t}^m)^{-\nu^i}\right]^{-\frac{1}{\nu^i}}, \quad 1 \geq \alpha_o^i \geq 0, \quad \lambda_o^i > 0, \quad \nu^i > -1 \qquad \text{P2.3)}$$

$$k_{o,t+1} = (1-\delta^k)\,k_{o,t} + i_{o,t} - \Psi^k[i_{o,t}, k_{o,t}], \qquad 1 \geq \delta^k \geq 0, \qquad (k_{o,0}, d_{o,0}, b_{o,0}) \text{ given} \qquad \text{(P2.4)}$$

where δ^k is the depreciation rate on physical capital. λ_o^c and λ_o^i are scaling factors, α_o^c and α_o^i are share parameters and ν^c and ν^i are substitution parameters determining the elasticity of substitution between domestic goods and imports in consumption and investment. Conditions (P2.1) and (P2.3) are Armington aggregator functions for consumption and investment goods. Condition (P2.2) is the budget constraint and condition (P2.4) is the law of motion for the capital stock.

The term $(p_t^* - p_t^d)X_{o,t}$ in the budget constraint represents profits arising from export broking activities. It is convenient to assume the existence of an export broker who buys an exogenously given amount of goods $(X_{o,t})$ from the representative producing firm at the domestic price p_t^d and sells it abroad at the exogenous world price p_t^* per unit of export good, where p_t^* is the price of the export good in terms of the import good, or the terms of trade. The net proceeds of such sales are transferred to households. To simplify matters, exports and terms of trade are assumed to remain constant throughout the analysis. $\Pi_{o,t}$ are firm profits transferred to households. Profits and capital income $(r_t\,k_{o,t})$ are taxed at a constant rate τ^k, where r_t is the rental price of capital services. r_t^d is the interest rate charged on foreign debt and r_t^b denotes the return on government bonds. All rates of return are expressed in terms of imports. $\Psi^k[\bullet]$ is a quadratic adjustment cost function that increases the cost of installing new capital goods.

It is well known that the equilibrium dynamics of a small open economy, with asset trading restricted to a noncontingent bond, exhibit a random walk property in the linearized solution, preventing the use of local approximation methods to study the behavior of the economy around a stationary growth path. To induce stationarity in the equilibrium dynamics, convex portfolio adjustment costs, which help pin down the steady state level of foreign debt, are introduced.[7] Adjustment costs are represented by a quadratic function $\Psi^d[\bullet]$ in condition (P2.2).

[7] See Schmitt-Grohé and Uribe (2003) for an overview of several alternative solutions to this unit-root problem.

2.3 Firms

A homogeneous domestic good Y_t is produced by using private capital (K_t), public capital in infrastructure $(K_{g,t})$ and labor input. The production technology is Cobb-Douglas and displays constant returns to scale,

$$Y_t = \lambda^y (K_{g,t})^{1-\alpha^y-\omega^y} (N_t H_t \Im_t)^{\alpha^y} (K_t)^{\omega^y}, \qquad (\alpha^y, \omega^y) \in (0,1), \quad \lambda^y > 0 \tag{4}$$

In the above, λ^y is a scale parameter, ω^y represents the capital share parameter in final output and α^y is an analogous parameter for labor. Since all production factors $(K_t, H_t, K_{g,t})$ are reproducible and the technology exhibits constant returns to scale in the reproducible factors, the model economy generates endogenous growth. Growth will not come to a halt even if each individual factor is subject to diminishing returns.

The representative firm solves a succession of static profit maximization problems:

$$\max \quad \Pi_t = p_t^d Y_t - w_t N_t H_t \Im_t - r_r K_t \qquad \text{subject to (4)} \tag{P3}$$

In order to maximize profits, the firm rents capital and hires labor in competitive markets. The firm's input demands obey the standard optimality condition: the marginal product must be equated to the rental price for each factor input.

2.4 Government

In per capita terms, the government's instantaneous budget constraint is given by

$$B_{t+1} = (1+r_t^b) B_t + p_t^d (G_{i,t} + G_{h,t} + G_{e,t} + G_{c,t}) - \tau_t^c [p_t^d (C_{r,t}^d + C_{o,t}^d) + C_{r,t}^m + C_{o,t}^m] - \tau_t^w w_t N_t H_t \Im_t - \tau^k (r_t K_t + \Pi_t) - \tau_t \tag{5}$$

Government spending is split into six categories. The government invests in infrastructure $(G_{i,t})$, health services $(G_{h,t})$ and education $(G_{e,t})$, and spends on household transfer payments $(-\tau_t)$, unproductive consumption $(G_{c,t})$ and interest payments $(r_t^b B_t)$. The government finances its outlays by collecting taxes on private consumption $(\tau_t^c [p_t^d (C_{r,t}^d + C_{o,t}^d) + C_{r,t}^m + C_{o,t}^m])$, labor income $(\tau_t^w w_t N_t H_t \Im_t)$, and capital income and profits $(\tau^k (r_t K_t + \Pi_t))$, by imposing lump-sum taxes (τ_t) and by issuing debt in the domestic capital market. The distinction between government bonds issued domestically and those issued abroad is inconsequential because (Ricardian) households have access to international markets. Households borrow on behalf of the government when they attempt to arbitrage away any difference between domestic and world interest rates.

The publicly provided stock of infrastructure capital obeys the following law of motion:

$$K_{g,t+1} = (1-\delta^{k})K_{g,t} + G_{i,t} \qquad (6)$$

2.5 Human Development

Following the quantitative approach of the 1990 UNDP Human Development Report, human development is defined as a multidimensional achievement index, as an aggregate of attainment levels of some basic human functionings. Specifically, human development $(\Im_t)$ is measured as a CES composite of q indicators $\Im_{j,t}$, $j = 1, \ldots, q$, of alternative dimensions of wellbeing:

$$\Im_t = \left[\sum_{i=1}^{q} \frac{1}{q} (\Im_{j,t})^{-\rho} \right]^{-\frac{1}{\rho}} \qquad (7)$$

This CES specification includes as special cases other well-known mean estimators for averaging information.[8] The human development index (HDI) proposed by the United Nations (1990) is a special case of $\Im$ with $q = 3$ and $\rho = -1$; so, it is simply the arithmetic mean of three dimensions of human development (adjusted real income per capita, the level of educational attainment and life expectancy at birth).

In contrast to the UNDP parameterization, here ρ is assumed to take on values in the open interval $(-1, 0)$, thus the chosen averaging formula is the so-called Inverse Power Mean (Vijayamohanan Pillai, 2004). The Inverse Power Mean satisfies several desirable properties of a HDI. $\Im$ is monotonically increasing in every component $\Im_j$, that is, an improvement along one dimension of human development improves the overall achievement index, and concave, that is, the increase in the overall index generated by an improvement in one particular attribute of wellbeing is smaller when the level of human development is high than when it is small (i.e. diminishing returns). The function also exhibits constant returns to scale and the degree of substitution possibilities between any pair of indicators of achievement $(\Im_i, \Im_j)$, $i \neq j$, is finite and constant and given by $(1+\rho)^{-1}$.[9]

[8] Vijayamohanan Pillai (2004) provides a discussion of the properties of the various candidates for a multidimensional development index that arise as special cases of the Generalized CES mean (7). As ρ varies it is possible to characterize the following mean definitions: 1) As $\rho \to \infty$, $\Im \to \min\{\Im_j\}$; 2) For $\rho > 1$, $\Im$ defines the so-called CES Proper Mean; 3) For $\rho = 1$, $\Im$ represents the Harmonic Mean; 4) For $0 < \rho < 1$, $\Im$ defines the Inverse CES Mean; 5) As $\rho \to 0$, $\Im \to$ Geometric Mean; 6) For $-1 < \rho < 0$, $\Im$ is called Inverse Power Mean; 7) $\Im$ corresponds to the Arithmetic Mean when $\rho = -1$; 8) For $\rho < -1$, $\Im$ defines the Power Mean; and finally 9) $\Im \to \max\{\Im_j\}$ as $\rho \to -\infty$.

[9] The UNDP HDI has an infinitely high elasticity of substitution and does not exhibit diminishing returns.

$\Im_j$, in turn, is a sigmoid function of the original value of the social indicator Z_j, i.e., a monotonically increasing smooth function with S-shaped graph. Also known as the "squashing function" it maps ("squashes") all real input values $(Z_j \in \Re)$ onto the unit interval $[0,1]$. The function form used here is defined by:

$$\Im_{j,t} = \left[1 + \exp\left\{-\xi_j (Z_{j,t} - \theta_j)\right\}\right]^{-1}, \qquad \xi_j > 0, \quad j = 1, \ldots, q \tag{8}$$

with parameters ξ_j and θ_j dictating the steepness and central point of the sigmoid, respectively. A very high value of ξ_j leads to a very steep sigmoid, resembling more nearly a step-like or threshold function around the central point θ_j. The parameter θ_j controls the position on the x-axis: the sigmoid is closer to zero for $Z_j < \theta_j$ and closer to 1 for $Z_j > \theta_j$.[10]

Since each component indicator $\Im_j$ is normalized to be on a scale from 0 to 1, the overall index $\Im$ is bounded between zero and one as well. Due to the boundedness of the HDI, human development - understood as the realization of basic human capabilities - cannot be the economy's engine of growth. Human development may indeed affect the process of human capital accumulation, labor productivity growth and resource allocation - and therefore growth and economic performance - along the transitional adjustment path but human development-based growth will simply come to a standstill.

It is worth mentioning that in the ensuing empirical implementation, and also in contrast to the UNDP HDI, the set of Z_j's does not include the adjusted real GDP variable which serves as a proxy for "income for a decent standard of living" (UNDP, 1990, p. 13). There are two reasons to pursue this approach. First, income - as argued by Anand and Sen (2000) - is only an indirect indicator of human development; an instrument to obtain functionings. Then, a set of non-income-based indicators provides a more direct measure of functionings achievements. Second, to evaluate the pro-poorness of fiscal policy in the experiments that follow it would be helpful to separate out its effect on income and non-income (or social) dimensions of human welfare.

[10] The UNDP HDI also uses normalized scores:

$$\Im_{j,t} = \frac{Z_{j,t} - Z_{j,\min}}{Z_{j,\max} - Z_{j,\min}}$$

where $Z_{j,\min}$ and $Z_{j,\max}$ are the fixed minimum and maximum goalposts or benchmarks, i.e. the global smallest and largest possible values of each underlying indicator, and where $\Im_j : [0,1] \to R^1$ satisfies the properties of monotonicity $(\Im_j((Z_{j,\min} - Z_{j,\min})/(Z_{j,\max} - Z_{j,\min})) = 0)$ and normalization $(\Im_j((Z_{j,\max} - Z_{j,\min})/(Z_{j,\max} - Z_{j,\min})) = 1)$. See Chakravarty (2003) for details.

Finally, let us now turn to the modeling of functionings achievements. Let Z_t be a qx1 vector of achieved functionings, $Z_t = [Z_{1,t} \quad Z_{2,t} \quad \ldots \quad Z_{q,t}]^T$. The functionings production function relates social outcome indicators and (detrended) resources:

$$F_z Z_t = F_c + F_g \begin{bmatrix} \ln G_{i,t} - \ln H_t \\ \ln G_{h,t} - \ln H_t \\ \ln G_{e,t} - \ln H_t \\ \ln G_{c,t} - \ln H_t \end{bmatrix} + F_y (\ln Y_t - \ln H_t) \tag{9}$$

where F_z is a qxq matrix with ones on the main diagonal and possibly nonzero off-diagonal elements characterizing contemporaneous interactions between social indicators; F_c is a qx1 vector of constants and the conformable matrix F_g and column vector F_y contain the direct elasticities of each component of Z with respect to government spending (disaggregated by function) and GDP, respectively.

The functionings production function is a reduced form representation of the importance of private and public provisioning of key social services in human development. For the so-called income-centered approach, it is the command over resources in terms of per capita private income (Y) what translates into increased human capabilities and human development while for the human development approach it is the public provisioning of public goods (G_i, G_h, G_e, G_c) what mainly contributes to functioning attainment (Anand and Ravallion, 1993; Sen, 2000).

2.6 Resource Constraints, World Capital Market and Equilibrium

Feasibility must be satisfied in equilibrium. The resource constraint for the domestic good implies that supply equals demand:

$$Y_t = C^d_{r,t} + C^d_{ot,} + I^d_{o,t} + (G_{i,t} + G_{h,t} + G_{e,t} + G_{c,t}) + X_t \tag{10}$$

In addition, total output is exhausted in paying capital and labor services their marginal products and transferring residual profits to households

$$p^d_t Y_t = w_t N_t H_t \Im_t + r_t K_t + \Pi_t \tag{11}$$

The current account gives the change in the country's net asset position and can be derived by aggregating the flow budget constraints over all households and after imposing the government's budget constraint:

$$D_{t+1} = (1 + r^d_t) D_t + (C^m_{r,t} + C^m_{o,t} + I^m_{o,t}) - p^*_t X_t \tag{12}$$

where total imports amount to $(C^m_{r,t} + C^m_{o,t} + I^m_{o,t})$.

One additional equation completes the description of the model. The economy faces an imperfect world capital market where it can borrow any amount at a rate equal to the sum of a constant world interest rate r^* and a borrowing spread that depends on the level of government indebtedness, $\mu_t = \mu(B_{t+1}/H_{t+1})$:

$$r^d_t = r^* + \mu\left(\frac{B_{t+1}}{H_{t+1}}\right), \qquad \mu'>0 \tag{13}$$

An upward sloping supply curve of debt is used to reflect the fact that developing countries face limited borrowing opportunities in international capital markets (see Turnovski, 1997; Senhadji, 2003).

The following analysis focuses on the competitive equilibrium of the described economy. A competitive equilibrium is a sequence of feasible allocations and prices such that, given the path of fiscal policy, all liquidity constrained households solve problem P1, all Ricardian households solve problem P2, firms maximize profits P3, the government satisfies its budget constraint, the human development index and human and physical capital accumulation laws are satisfied and markets clear in every period. In equilibrium, individual decisions are consistent with aggregate outcomes. For instance,

$$K_t = P_o k_{o,t}, \qquad D_t = P_o d_{o,t}, \qquad B_t = P_o b_{o,t}, \qquad N_t = n_{r,t} \tag{14}$$

$$C^d_{r,t} = P_r c^d_{r,t}, \qquad C^d_{o,t} = P_o c^d_{o,t}, \qquad I^d_{o,t} = P_o i^d_{o,t}, \qquad I^m_{o,t} = P_o i^m_{o,t}, \quad \ldots \text{etc.}$$

3. STATIONARY REPRESENTATION AND SOLUTION METHOD

As the knowledge frontier expands over time macroeconomic (per capita) aggregates will grow without bound and the economy will become arbitrarily large. For computational purposes it is convenient to work with the stationary representation which can be derived by normalizing all growing per capita variables by the level of human capital, i.e. by expressing aggregates in terms of efficiency units of labor.[11] The economy thus transformed into a stationary one has a well-defined steady state around which the model's behavior can be analyzed. The technical appendix provides the entire system of nonlinear equations describing the equilibrium of the transformed economy.

To obtain the approximate solution of the model, the nonlinear system of stationary necessary conditions describing the economy's equilibrium relationships is linearized around the deterministic steady state. The resulting multivariate linear rational

[11] With logarithmic preferences there is no need to transform the subjective discount factor (King et al., 2002).

expectations equation system can be cast into Binder and Pesaran's (1995, 1997) canonical form, containing only a vector of one-period lagged and a vector of one-step ahead dependent variables:

$$X_t = A X_{t-1} + B X_{t+1} + W_t \qquad (15)$$

where X_t is a vector containing all endogenous variables expressed in percent deviation from trend and the input vector W_t is a function of (possibly one-period ahead, current and one-period lagged) exogenous policy variables expressed in percent deviation from initial steady state values. Government spending, lump-sum transfers and government debt issues belong to the set of forcing variables. The matrices A and B are complicated functions of the model's parameters. In contrast to many numerical solution methods available, Binder and Pesaran's method does not require the $\{W_t\}-$process to be linear or covariance stationary. Equation (15) is solved numerically with the Quadratic Determinantal Equation method. That is:

$$X_t = C X_{t-1} + \sum_{i=0}^{\infty} F^i W_{t+i} \qquad (16)$$

where the matrix C in the first term on the right-hand side, or the so-called backward component of the solution, is the solution to this quadratic matrix equation: $BC^2 - C - A = 0$ and F is obtained from the following expression: $F = (I - BC)^{-1} B$. The second term on the right side is the forward component of the solution and requires knowing the evolution of fiscal policy variables over the course of the infinite future. In the ensuing experiments the infinite sum is truncated at some finite value (400 periods). Because in the designed experiments the infinite sum converges, the length of the truncated horizon has been chosen so as to achieve a desired degree of precision (adding other 2500 periods for example increases the sum by less than 10^{-7} in absolute terms).

In setting up computational policy experiments the trajectories for government spending variables, lump-sum transfers and public debt issues are specified in advance ($\{W_t\}_{i=1}^{i=1000+400}$) and given the starting point (say, $X_0 = 0$, starting from a zero deviation from the initial steady state), it is possible to compute with the help of equation (16) the equilibrium dynamics of the economy from period 1 to period, say, 1000.

4. CALIBRATION

The model is calibrated to 15 individual Latin American countries[12] and also to the region as a whole. In this case, two regional averages were taken to epitomize the representative regional economy: a simple (equally weighted) average and a PPP-adjusted GDP-weighted average of the input data used in the calibration process. Each model economy

[12] The 15 countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Jamaica, Mexico, Panama, Peru, Uruguay and Venezuela.

is parameterized in such a way that its long-run or steady state features mimic those of the individual economy over the 2000-2005 period. By way of example, this section illustrates the calibration procedure using Colombian data. Exactly the same data sources and steps are followed to calibrate the model for other countries or cross-country averages. Table 1 reports calibrated parameter values.

4.1 Macroeconomic Aggregates and Structure

Being consistent with notation introduced in the technical appendix, a tilde is used to denote variables in efficiency units and the time subscript is dropped to denote steady state values. Without loss of generality, the steady state level of per capita output is normalized to 100 (i.e., $\hat{Y} = 100$) and steady state relative prices are normalized to unity $(p^d = p^* = 1)$. With data on the GDP share of: 1) gross fixed capital formation (15.87%, of which private investment amounts to 7.07% and public investment to 8.8%), 2) government expenditures (28.3%, of which 6.24% is spent on health services, 4.89% on education, and the rest 17.16% on government consumption), 3) exports (16.02%) and 4) imports (16.15%, of which 10.71% corresponds to imports of consumption goods and 5.44% to imports of capital goods), it is possible to compute total consumption using the NIPA's GDP definition. The required data are taken from the World Bank's WDI and LDB Working databases and from various IMF country reports.

Acting consistently with the model, consumption of the domestic good is calculated as the difference between total consumption and imports of consumption goods. Similarly, investment expenditure on domestic goods is defined as the difference between total investment and imports of capital goods. The split of private consumption (both of domestically produced and imported goods) between savers and spenders is based on the proportion of non-Ricardian consumers estimated by López et al. (2000) for a sample of developing countries ($P_r = 0.64$). All government purchases are assumed to buy domestic goods and services. The following is the breakdown of the model economy's final demand expenditure: $\hat{Y} = 100$, $\hat{C}_r^d = 28.96$, $\hat{C}_r^m = 6.85$, $\hat{C}_o^d = 16.29$, $\hat{C}_o^m = 3.86$, $\hat{I}_o^d = 1.63$, $\hat{I}_o^m = 5.44$, $\hat{G}_i = 8.80$, $\hat{G}_h = 6.24$, $\hat{G}_e = 4.89$, $\hat{G}_c = 17.16$, $\hat{X} = 16.02$. Note that the resource constraint for the domestic good (condition (A22) in the technical appendix) is satisfied.

In a similar fashion, capital stocks, government bond holdings and foreign debt holdings can be obtained from the corresponding shares in GDP of their empirical counterparts. The government debt-output ratio for Colombia is 51.42% and private external debt is estimated at 10% of GDP. Data source: Fitch Research database. Then set $\hat{B} = 51.42$ and $\hat{D} = 10$. In line with data reported by Loayza et al. (2005), the ratio of the total capital stock to GDP is 2.38. Along the deterministic steady state, conditions (A16) and (A21) imply that the ratio of public capital to private capital is equal to the already known ratio of public to private investment. Then, $\hat{K} = 106.26$ and $\hat{K}_g = 132.21$. From these conditions it is also possible to obtain $\delta^k = 4.93\%$.

The fraction of time devoted to human capital accumulation can be calibrated from the expression $(1-N) = \delta^H \cdot (\text{average years of schooling})$.[13] The average number of years of schooling per person for the working-age population in Colombia has been estimated in 5.27. Assuming a human capital depreciation rate of 4% $(\delta^H = 0.04)$ (Collard, 1997), the fraction of time devoted to production is $N = 0.789$.

The gross rate of growth is defined as $\eta_t = H_{t+1}/H_t$ and its steady state value is estimated at $\eta = 1.0172$, consistent with an observed average rate of growth of per capita GDP of 1.72% (using WDI database).

4.2 Social Indicators and Human Development Index

The performance with regard to human welfare and development is measured by a set of eight social indicators (i.e., $q = 8$).[14] The number of indicators included is severely limited by the availability of relevant and reliable estimates of the parameters relating social achievements, on the one hand, and the deployment of public and private resources on the other. The eight dimensions of basic social progress considered are the following - including the corresponding values achieved by Colombia:

$Z_1 =$ poverty headcount ratio at \$1 a day (PPP)	= 0.070
$Z_2 =$ poverty headcount ratio at \$2 a day (PPP)	= 0.194
$Z_3 =$ gross enrollment rate in primary and secondary education	= 0.929
$Z_4 =$ average years of schooling	= 5.27
$Z_5 =$ under-5 mortality rate (per 10 live births)	= 0.205
$Z_6 =$ maternal mortality rate (per 1000 live births)	= 1.300
$Z_7 =$ percent of population with access to improved water source	= 0.930
$Z_8 =$ Gini index	= 0.586

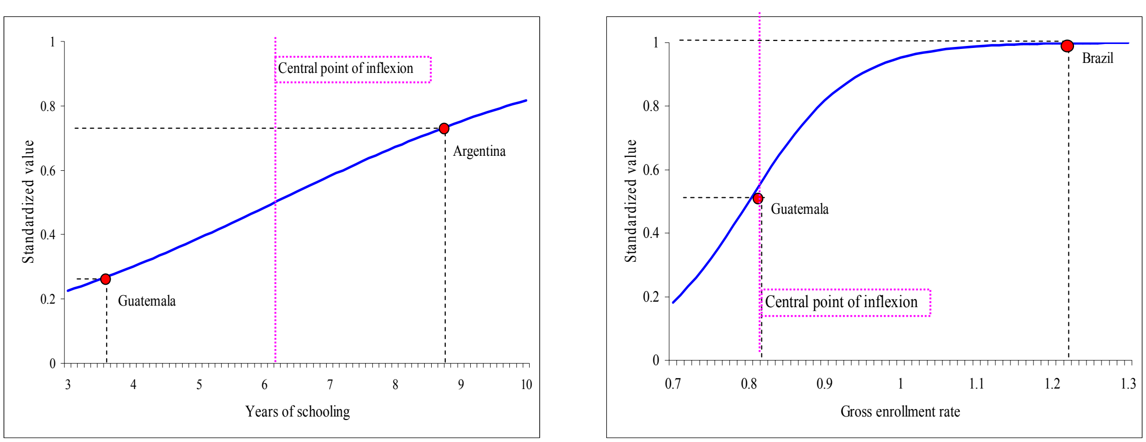
All data taken from the WDI database except for indicator Z_4, which is taken from Barro and Lee (2000). The value of each indicator is then standardized by a sigmoid function which is fully described by two parameters. The "squashing" process takes the reciprocal of indicators Z_1, Z_2, Z_5, Z_6 and Z_8, instead of their original values, to ensure that higher indicator values are associated with higher achievements. For each indicator, the central point of inflexion is calibrated to ensure that the center position of the sigmoid coincides with the indicator's average value.[15] The slope is calibrated by forcing the normalized

[13] See Gourinchas and Jeanne (2002).
[14] Undoubtedly, this HDI definition will attract as much criticism as the UNDP definition over issues such as the appropriate aspects of development to be included in it (see Alkire, 2002), redundancy, weighting, etc. This debate - though very relevant - is beyond the scope of the paper.
[15] The average value is calculated by averaging the minimum and maximum values obtained from a sample of 19 Latin American countries including Guatemala, Honduras, Nicaragua and Panama in addition to those 15 countries listed in footnote 12.

value to equal approximately 0.25 when the indicator attains its minimum value and to take on approximately the value 0.75 at the sample maximum. The first panel of Figure 1 illustrates the calibration procedure of the sigmoid function for Z_4. The average number of years of schooling ranges from 3.49 (Guatemala) to 8.83 (Argentina). The point of inflexion of the sigmoid curve is at $Z_4 = 6.16 = (3.49 + 8.83)/2$. The value of the sigmoid at the inflexion point is 0.5. Then, set $\theta_4 = 6.16$. When the slope is 0.39 (set $\xi_4 = 0.39$), the normalized score is close to 0.25 at the minimum (Guatemala) and 0.75 at the maximum (Argentina).

A slightly different approach is followed when a country in the sample is close to fulfill a basic human and social goal. For instance, various countries in the region are close to guarantee universal access to basic infrastructure (Z_7) or education services (Z_3). In these cases, the point of inflexion is set at the sample minimum and the slope is calibrated by forcing normalized scores to take values on the range 0.5-1.0 over the sample of countries. This procedure is illustrated in the second panel of Figure 1 for the gross rate of enrollment in primary and secondary education, which ranges between 80.9% (Guatemala) and 121.5% (Brazil). Calibrated parameter values for all eight sigmoid functions are presented in Table 2. Lacking specific evidence in the literature on the elasticity of substitution between social indicators pick, as a first approximation, $\rho = -0.5$, the midpoint within its admissible range. Then, the level of human development attained by Colombia is estimated at $\Im = 0.532$.

Figure 1
Example of Calibration of Sigmoid Functions



Human development is endogenized by specifying each of the components of the index, namely each social indicator, as a function of the overall level of economic activity, government spending aggregates, and other social indicators as expressed in equation (9). The lack of estimates for individual countries prevents the use of a different parameterization for each country. The following calibration of elasticities is based on cross-country evidence, generally from developing countries and sometimes just from Latin America.

Z_1: Based on Iradian's (2005) econometric results it is possible to obtain estimates of the elasticity of poverty, measured by the percentage of population living on less than \$1 a day and adjusted for purchasing power parity, with respect to real GDP per capita at -1.08, with respect to social spending $(G_i + G_h + G_e)$ as a percent of GDP at -0.63 and with respect to inequality, measured by the Gini coefficient (Z_8), at 1.4.[16]

Z_2: For this poverty measure Wodon (2000) reports a GDP elasticity of -0.94 and an inequality elasticity (Z_8) of 0.74 based on Latin America data.

Z_3: The work of Baldacci et al. (2002) obtains an estimate of the elasticity of the primary and secondary school enrollment rate with respect to GDP per capita of 0.30 while the elasticity with respect to government spending on education (in percent of GDP) is estimated at 0.20. Baldacci et al. (2004) find that the stock of health capital, proxied by the under-5 child mortality rate (Z_5), contributes to the accumulation of education capital, measured by the composite primary and secondary enrollment rate, with an elasticity of -0.19.[17]

Z_4: Regression coefficients reported by De Gregorio and Lee (2002) imply that, evaluated at mean values, the elasticity of the average years of school attainment with respect to GDP per capita is 1.45 and the elasticity with respect to social spending relative to GDP is 0.0013.

Z_5: Leipziger et al. (2003) estimate the elasticity of the under-five mortality rate with respect to per capita GDP to -0.14, the elasticity with respect to the Gini index of inequality (Z_8) to 0.29 and the elasticity with respect to the share of households with access to piped water (Z_7) to -0.08. The authors also provide an estimate of the elasticity with respect to basic infrastructure (K_g)[18] of -0.19. Gupta et al. (2002) estimate the elasticity of the under-five child mortality rate with respect to health spending (percent of GDP) at -0.29.

Z_6: Bokhari et al. (2006) provide point estimates of the elasticity of the maternal mortality rate with respect GDP per capita at -0.41, an elasticity with respect to government health expenditures at -0.54 and an elasticity with respect to infrastructure capital (K_g) at -0.11.

[16] Similar estimates are obtained by Wodon (2000). The GDP elasticity of poverty is estimated at -1.3 and the inequality elasticity at 1.46.
[17] A similar value (-0.18) is estimated by Gupta et al. (2002).
[18] Notice that the elasticity with respect to infrastructure capital does not really fit into equation (9) specification. However, there is no problem in incorporating this generalization.

Z_7: The elasticity of the proportion of population with access to an improved water source with respect to per capita GDP is set to 0.47, consistent with Wodon's (2000) estimate.

Z_8: Estimates presented by Iradian (2005) allow computing the income elasticity of the Gini index evaluated at the sample mean at -1.45. The authors also estimate the elasticity with respect to the school enrollment rate (Z_3) at -0.15 and with respect to government spending on social sectors relative to GDP at -0.17. Calderón and Servén (2004) found a statistically robust relation between inequality and infrastructure. Based on their estimate, an elasticity of inequality with respect to infrastructure of -0.19, evaluated at mean values, is obtained.

4.3 Equilibrium Restrictions

The remaining parameter values are drawn directly from existing empirical work or obtained from the set of restrictions imposed by the model's deterministic stationary equilibrium.

Along the steady state path, conditions (A11) and (A12) imply that in equilibrium the rates of return of essentially identical financial assets should be equalized, i.e. $r^d = r^b$, and $\beta = \eta/(1+r^d)$. Using data from the WDI database Colombia's real interest rate is estimated at $r^d = 9.84\%$. As a result set $\beta = 0.926$. Consistent with the model, the interest rate is viewed as composed of two parts: an exogenously given world interest rate, proxied by the U.S. interest rate $(r^* = 4\%)$[19], and a borrowing premium calculated by difference to be $\mu = 5.84\%$. The borrowing premium is endogenized by equation (13) and equation (A24) provides a specific functional form where ε is the semi-elasticity of the borrowing spread with respect to the government debt-GDP ratio. Based on Arora and Cerisola (2001) set $\varepsilon = 0.12$.[20]

Ostry and Reinhart (1992) estimate the elasticity of substitution between nontradables and importables in consumption to be 1.28 for a sample of developing countries. Take this value as a reasonable approximation for the elasticity of substitution between domestic and imported goods in consumption. Moreover, lacking specific evidence on the elasticity of substitution between domestic and imported goods in investment, I use the same estimate as for the consumption elasticity. This implies $\nu^c = \nu^i = -0.22$. Based on

[19] See Prescott (1986) and Backus et al. (1994).

[20] This figure is obtained by averaging point estimates provided for four Latin American countries (Argentina, Brazil, Colombia and Mexico). In contrast to Arora and Cerisola (2001), in most empirical studies on the determinants of debt spreads in emerging markets the debt variable used as explanatory variable is defined as total external debt and not as government debt as assumed in (13) or (A24). Eichengreen and Mody (2000) estimate $\varepsilon = 1.3$, Min (1998) estimates $\varepsilon = 1$ and Cantor and Packer (1996) find no significant relation between the debt-GDP ratio and yield spreads.

the steady state versions of conditions (A3), (A8) and (A9), set $\alpha_r^c = 0.755$, $\alpha_o^c = 0.755$ and $\alpha_o^i = 0.281$. On the basis of conditions (A7), (A13) and (A15) set $\lambda_r^c = 1.692$, $\lambda_o^c = 1.692$ and $\lambda_o^i = 1.768$.

Using the model's tax base definition, the revenue collected with a capital income tax amounts to:

$$\text{Capital income tax revenue to output ratio} = \tau^k \left(r\frac{\hat{K}}{\hat{Y}} + \frac{\hat{\Pi}}{\hat{Y}} \right) = \tau^k \left(r\frac{\hat{K}}{\hat{Y}} + (1-\alpha^y - \omega^y) \right) \quad (17)$$

and also, combining conditions (A10) and (A11) yields a relationship between real and financial asset returns:

$$r^d = (1-\tau^k)\, r \left[\alpha_o^i (\lambda_o^i)^{-v^i} \left(\frac{\hat{I}_o^d}{\hat{I}_o} \right)^{-v^i - 1} \right] - \delta^k \quad (18)$$

Equations (17) and (18) set up a system of simultaneous equations to solve for both r, the marginal product of capital, and τ^k, the tax rate on capital income, if data on the elasticity of output with respect to public infrastructure $(1-\alpha^y - \omega^y)$ and the size of capital income tax revenue are available. Easterly and Servén (2003) estimate for a sample of developing countries the elasticity of output to public infrastructure capital at 0.16 and based on IMF country reports, it is possible to calculate that the revenue collected from capital income represents 8.71% of GDP in Colombia. Hence set $r = 19.39\%$ and $\tau^k = 23.8\%$.

Condition (A18) implies that ω^y in a Cobb-Douglas technology with constant returns to scale is simply the capital's share of output, $\omega^y = r\hat{K}/\hat{Y}$. Then, set $\omega^y = 0.206$. Constant returns to scale implies: $\alpha^y = 0.634$. Using the definition of the labor's share of output (A17), $\alpha^y = w N \Im/\hat{Y}$, set $w = 151.12$. Note that the constraint (A21) is satisfied with equality. Using the production function specification, the scaling parameter is calibrated at $\lambda^y = 30.36$.

The remaining tax rates can be obtained from tax collection data and model's tax base definitions. Consumption taxes represent 10.26% of GDP and labor income taxes 0.39% of GDP in Colombia. Accordingly, set $\tau^c = 18.33\%$ and $\tau^w = 0.6\%$.

Conditions (A4), (A6) and (A11) entail that $\alpha^H = (1-N)(r^d + \delta^H)/(\eta - 1 + \delta^H)$. Thus, set $\alpha^H = 0.51$. As a first approximation, the steady state ratio of educational human capital to aggregate human capital is set at $\hat{H}^s = 0.5$ (and $\hat{H}^l = 0.5$). Condition (A6) yields $\chi^s = 0.255$; condition (A2) yields $\chi^l = 0.0003$ and condition (A1) implies $\lambda^\eta = 2.0$.

The results of the described parameterization strategy are shown in Table 1 and Table 2.

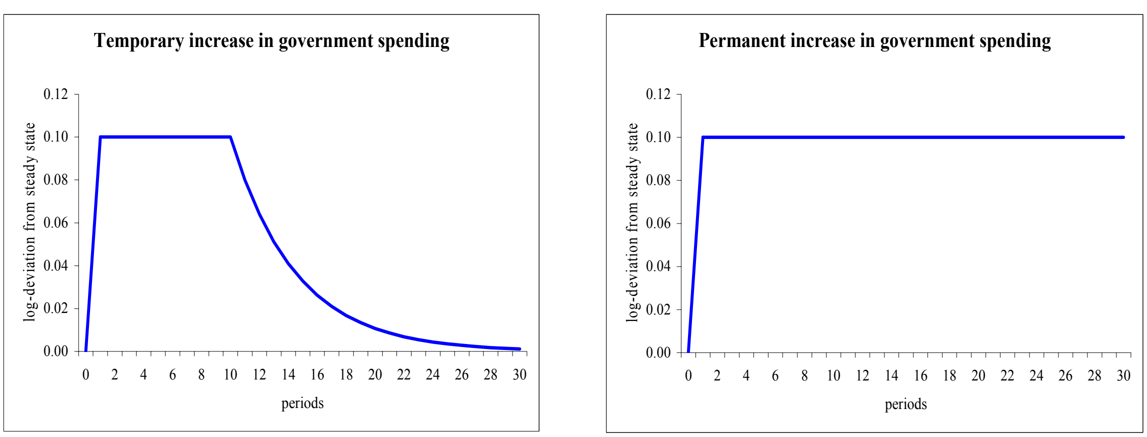
5. POLICY EXPERIMENTS

5.1 Experimental design

Policy experiments conducted in this section are intended to study the effect on economic activity, welfare, human development and social progress of alternative government spending/financing decisions. To perform the experiments it only remains to specify the trajectory of the forcing variables: government spending and government debt. In order to satisfy the government's flow budget constraint (A19), one of the tax rates should be determined endogenously in the rational expectations equilibrium while the other two are kept constant at their initial steady state values. The tax rate on capital income is always held constant. The trajectories of government spending and debt are spelled out in terms of percent deviations from initial steady state levels and specified for 1400 periods starting from year $t = 1$. In period $t = 0$ the economy is on its steady-state balanced growth path.

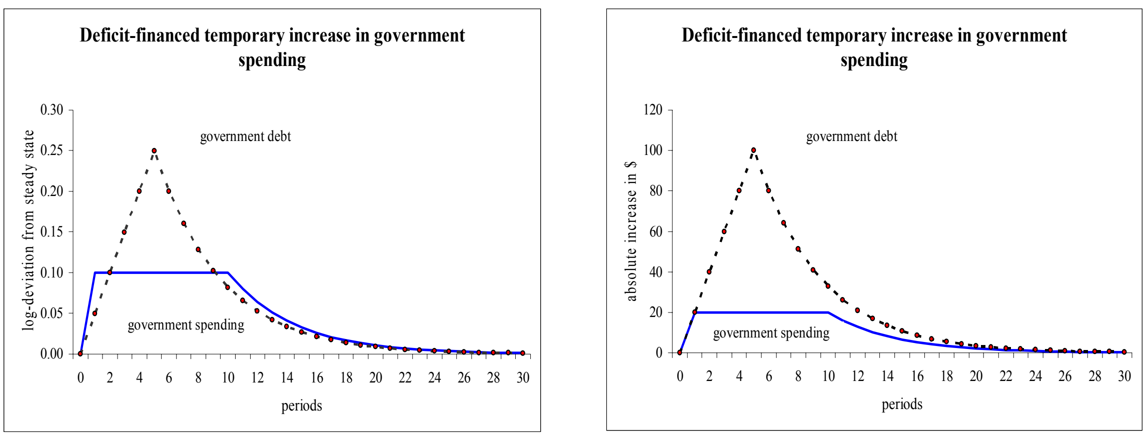
The first panel of Figure 2 depicts the trajectory of a temporary government spending increase. During a ten-year period, approximately the time horizon of the MDGs, the government increases spending by 10% above its steady state growth path. From then on spending falls back, with a persistence parameter of 0.8, to its initial steady state level. The right panel shows the time path of a permanent spending increase. Based on Barro's (1979) tax-smoothing result, a permanent increase in public spending is always financed with higher taxation.

Figure 2
Experimental Design: Tax-Financed Government Spending Increase



The path of debt is held constant over time (i.e., there is no deviation from its steady state level) under a tax-financing scheme. Under a deficit-financing scheme, debt is issued during the first five years to finance the increase in government spending but does not cover interest payments. From then on debt is slowly retired, with a persistence parameter of 0.8. Distortionary taxation is used in the future to cover debt service (principal and interest). Figure 3 shows an example of time paths for debt and spending in terms of log-deviations from trend (left panel) and in terms of absolute dollar changes (right panel). The figure assumes that the initial level of debt is higher than the initial level of spending. During the first five years, debt increases in absolute terms at a rate of the amount of additional spending per year. All policy experiments are comparable since the initial and final steady state level of debt is the same.

Figure 3
Experimental Design: Debt-Financed Government Spending Increase When Future Distortionary Taxation is Used to Pay for It



This paper compares the effects of permanent and transitory increases of the following items of public spending: 1) infrastructure investment, 2) health, 3) education, 4) government consumption, and 5) transfers to low-wealth households. The alternative financing modes are: 1) distortionary tax financing (consumption and labor income taxation) and 2) debt financing with perfect ($\varepsilon = 0$) and imperfect ($\varepsilon = 0.12$ or $\varepsilon = 1$) access to world capital markets, and debt service paid for by levying distortionary taxes (consumption or labor income taxes) in the future.

5.2 Measuring Effects

The evaluation of experiments focuses on a subset of implications: effects on economic performance, welfare, human development and progress along various social dimensions. Given the diverse nature of the experiments and the interest of keeping the analysis consistent across experiments, experimental results are summarized by comparable performance metrics.

To measure the effect on economic performance two metrics are computed. The first metric is a cumulative elasticity of output with respect to government spending. It is defined as follows:

$$\Xi_Y = \frac{\dfrac{PV(\{Y_t^g\}_{t=1}^{t=1000}) - PV(\{Y_t\}_{t=1}^{t=1000})}{PV(\{Y_t\}_{t=1}^{t=1000})}}{\dfrac{PV(\{G_t^g\}_{t=1}^{t=1000}) - PV(\{G_t\}_{t=1}^{t=1000})}{PV(\{G_t\}_{t=1}^{t=1000})}} \tag{19}$$

The elasticity is defined as the ratio of the percentage change in per capita GDP to the percentage change in a given category of government spending. The percentage change in output is obtained by comparing the present value of GDP of the economy under the new policy regime of increased government spending, $PV(\{Y_t^g\}_{t=1}^{t=1000})$, and the present value of the GDP trajectory if there is no change in the fiscal policy stance, $PV(\{Y_t\}_{t=1}^{t=1000})$, that is, if the economy remains on its steady state balanced growth path. After some manipulation, present values can be expressed in terms of known magnitudes,

$$PV(\{Y_t^g\}_{t=1}^{t=1000}) = \hat{Y}_0\eta_0\left(\sum_{t=1}^{t=1000}\left(\frac{\eta_0}{1+r^*+\mu}\right)^{t-1}\left(1+\text{logdev}[\hat{Y}_t^g]\right)\left(\prod_{j=1}^{t}\left(1+\text{logdev}[\eta_j^g]\right)\right)\right) \tag{20}$$

where $\text{logdev}[\hat{Y}_t^g]$ is the log-deviation of output and $\text{logdev}[\eta_t^g]$ is the log-deviation of the endogenous (gross) rate of growth at time t from their steady state values. The trajectory of aggregate output is thus described by both the evolution of detrended output and the accumulated effect of changes in the economy's trend growth rate. For the economy with no change in the policy stance, the expression simply boils down to:

$$PV(\{Y_t\}_{t=1}^{t=1000}) = \hat{Y}_0\eta_0\left(\sum_{t=1}^{t=1000}\left(\frac{\eta_0}{1+r^*+\mu}\right)^{t-1}\right) \approx \hat{Y}_0\eta_0\left(\frac{1+r^*+\mu}{1+r^*+\mu-\eta_0}\right) \tag{21}$$

Identical procedure *mutatis mutandis* is followed to compute the percentage change of government spending.

The second metric is the cumulative marginal product of government spending, that is, the dollar value, in present value terms, of the additional GDP generated over time per dollar, in present value terms, of additional government spending,

$$\text{Cumulative marginal product} = \Xi_Y \frac{Y}{G} \tag{22}$$

which is defined as the cumulative elasticity multiplied by the inverse of the observed share in GDP of the corresponding government spending category.

The metric used to measure the welfare effect of an increase in government spending is the compensating variation in consumption. Lifetime utility is the standard welfare criterion. The expected welfare level resulting from the baseline policy stance is given by: $W = W(\{C_t\}_{t=1}^{t=1000}) = \sum_{t=1}^{t=1000} \beta^{t-1} \log(C_t)$. On the other hand, the alternative policy regime of increased government spending yields the following level of welfare: $W^g = W^g(\{C_t^g\}_{t=1}^{t=1000}) = \sum_{t=1}^{t=1000} \beta^{t-1} \log(C_t^g)$, where $\{C_t^g\}$ is the path of private consumption (either total consumption or low-wealth household consumption) under the alternative regime. The compensating variation Δ is defined as follows:

$$W^g(\{(1-\Delta)C_t^g\}_{t=1}^{t=1000}) = W(\{C_t\}_{t=1}^{t=1000}) \tag{23}$$

i.e., as the fraction of consumption households are willing to sacrifice for living in an economy with higher public spending financed through alternative schemes. This equation has an approximate analytic solution in terms of known allocations:

$$\Delta \approx (1-\beta)\left(\sum_{t=1}^{t=1000} \beta^{t-1}\left(\text{logdev}[\hat{C}_t^g] + \sum_{j=1}^{t} \text{logdev}[\eta_j^g]\right)\right) \tag{24}$$

Finally, the effects on human development and indicators of social progress are measured by long-run elasticities obtained in policy experiments with permanent shocks to government spending. The elasticity of human development with respect to a given category of government spending is defined as:

$$\Xi_{\Im} = \frac{\text{logdev}[\Im_{1000}^g]}{\text{logdev}[\hat{G}_{1000}^g]} \tag{25}$$

Similarly, the elasticity of any social indicator Z_j, $j = 1,\ldots,q$, is given by,

$$\Xi_{Z_j} = \frac{\text{logdev}[Z_{j,1000}^g]}{\text{logdev}[\hat{G}_{1000}^g]} \tag{26}$$

5.3 Simulation Results

5.3.1. Effects on Economic Performance

Table 3 through Table 7 show the cumulative elasticity of output with respect to five government spending categories: infrastructure investment, health, education, government consumption, and transfers to low-wealth households under alternative financing schemes. Elasticities are computed for 15 individual countries and for two

Latin America regional averages. For the typical (weighted average) Latin American country infrastructure spending exhibits the strongest impact on GDP. The elasticity with respect to public spending on basic infrastructure services ranges from 0.18, for a deficit-financed temporary spending increase when capital markets heavily punish further indebtedness (ε = 1), to 0.21, under any other form of finance and under alternative persistence assumptions (temporary or permanent). Health and education expenditures have a much smaller impact. For both, the largest elasticity value of 0.05 is achieved in the presence of permanent increases in spending. A temporary increase financed through distortionary consumption taxation presents a slightly smaller elasticity (0.04). Moreover, transfers to low-wealth households have a negligible effect on the economy while government consumption spending exhibits a barely positive elasticity under a permanent shock regime and turns negative in the case of distortionary tax finance (-0.02) or in the case of debt finance with access to an imperfect capital market (ε = 0.12) (-0.08). It is interesting to note that cumulative elasticities of GDP are basically the same if revenue is raised either with a consumption tax or a labor income tax.

Table 8 through Table 12 present estimates of the cumulative marginal productivity of public spending. An additional dollar spent on public infrastructure yields \$6.1 to \$6.3 of added GDP depending on how additional spending is financed. This return falls to \$5.3 when the economy is hindered by restricted access to international financial markets (ε = 1). The marginal productivity of government spending is \$0.90 to \$1.5 in GDP per additional dollar spent on health, and \$0.70 to \$1.2 of extra GDP per every dollar spent, in discounted-value terms, on education. When the economy faces adverse credit conditions (ε = 1) returns may become negative, \$0.20 for health spending and \$0.40 for the provision of additional education services. The marginal returns of both government consumption spending and transfers to low-wealth households are, in general, slightly negative or cero, once the impact of its financing is taken into account. Under unfavorable credit market conditions, the marginal productivity of unproductive spending may be highly negative (as large as \$2 per dollar of additional spending).

The ensuing discussion seeks to bring insight into the underlying mechanisms leading to the estimated differences in the quantitative impact of the various categories of government spending. As mentioned before, the role played in the model by social spending on education and health is motivated by its effect on human development. Therefore, the definition of human development is relevant to determine the qualitative importance and the quantitative size of the effect of social spending. For instance, due to the fact that Latin America has relatively high gross rates of enrollment in primary and secondary education, the effect of additional education spending on human development is expected to be small - remember the diminishing returns property of the HDI - if it operates mainly through the enrollment channel. The implication is that the definition of human development should not be a fixed, unchanged and unmodifiable notion. Once basic education needs are covered, public education spending may have a more substantive contribution to human development through its effect on tertiary enrollment, R&D, etc. And the definition of human development has to reflect that fact. The definition adopted in this paper reflects the United Nations concern with average achievements in basic aspects of human development. Then, the estimated elasticities should be interpreted as the size of the effect of social spending on economic performance operating through the average achievement in basic dimensions of human development. The elasticities are not measuring the effect of education and health expenditures channeled through other possible social and economic dimensions.

Further insight into the nature of the dynamic effect of public spending can be garnered from the examination of impulse response functions. Figure 4 through Figure 6 plot the impulse responses of key model variables to a one-time positive and persistent shock in government spending (by category) equal to one percent of GDP. The persistence parameter is set at 0.8 for all spending categories in the case of transient shocks. Figure 4 draws the effect of a temporary spending increase financed with consumption taxation; Figure 5 draws the effect of a temporary deficit-financed increase in spending with distortionary consumption taxation used to pay for debt service payments and with perfect access to credit markets and Figure 6 depicts the effect of a permanent increase in spending financed through distortionary consumption taxation when the private sector has access to a perfect capital market.

The model separates the effect on aggregate economic activity into two separate parts one that shows the effect on detrended GDP and one that displays the effect on the trend growth rate. Figure 4 shows that government consumption spending has slightly negative effects on the two parts, implying that additional tax-financed non-productive spending is contractionary. Instead, tax-financed useful spending has a net expansionary effect. It is relatively small for education and health spending which operates mainly through the growth rate channel and stronger for infrastructure spending. Capital spending impacts both the growth rate and the transitional dynamics of detrended GDP.

The behavior of the growth rate is the result of increased accumulation of educational human capital as raw labor is temporarily reallocated from material production to the schooling sector. All government spending categories crowd out private investment and decrease the stock of private capital. However, it is only in the case of a capital spending increase that this contractionary impact is outweighed by a pronounced increase in public capital and by an increase in labor productivity originated in higher human development attainment. Figure 5 and Figure 6 show that regardless of the specifics of the policy experiments roughly the same pattern of responses emerges.

5.3.2 Effects on Welfare

This section assesses the welfare implications of alternative government spending/financing policies. Table 13 through Table 17 show welfare benefits (+) or losses (-) incurred along the transitional adjustment path followed by the economy after being hit by an increase in a given category of public spending. Reported results measure changes in low-wealth household welfare. An overall measure of welfare change for an aggregate of all types of households (not reported) yields similar results.

Figure 4
Impulse Responses to a Temporary 1% of GDP Increase in Government Spending By Category
(% deviations from trend)---(consumption tax finance)

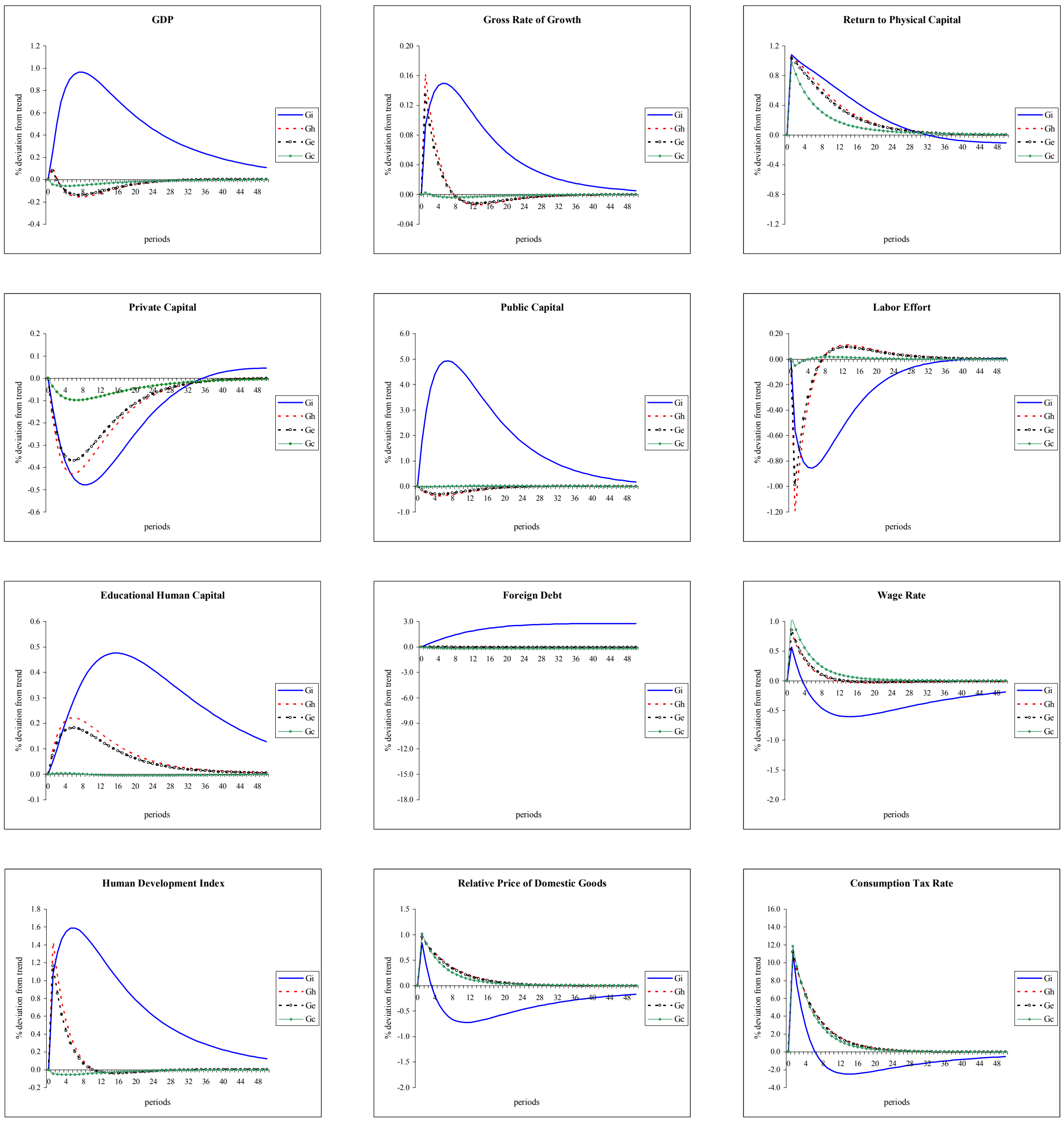


Figure 5
Impulse Responses to a Temporary 1% of GDP Increase in Government Spending By Category Under Debt Finance with Imperfect Access to World Capital Markets
(ε = 1)
(% deviations from trend)---(future consumption tax finance)

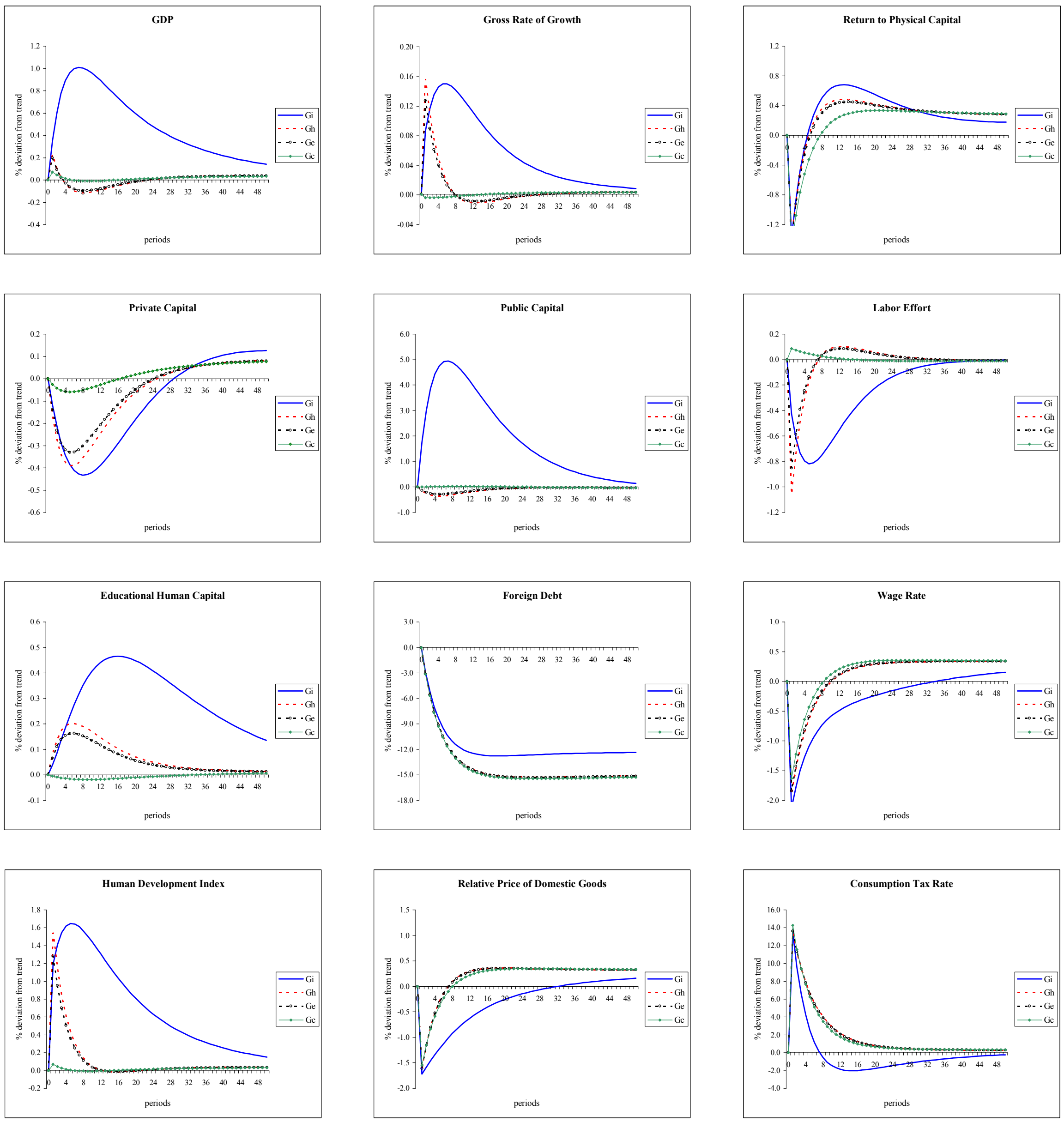
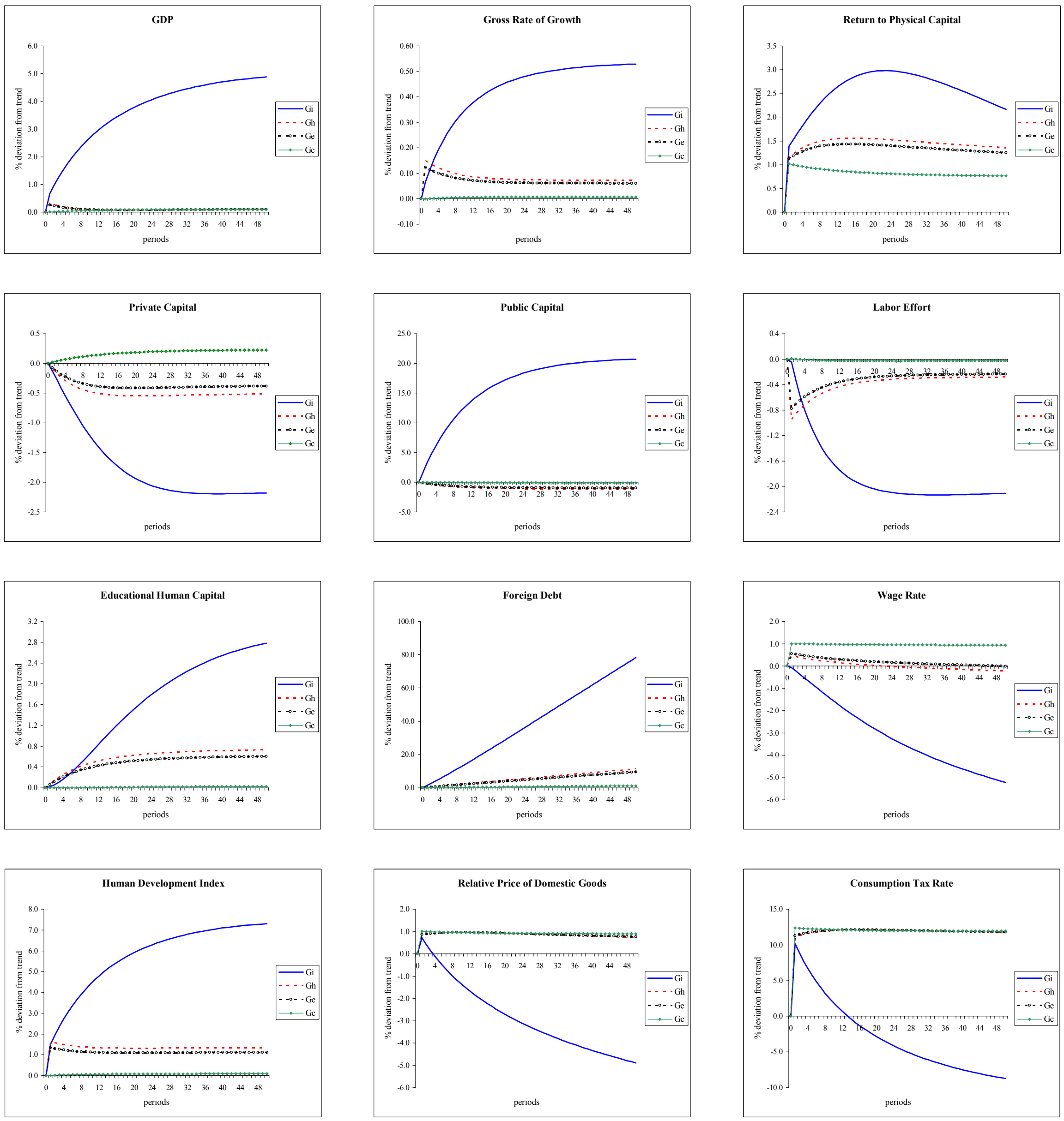


Figure 6
Impulse Responses to a Permanent 1% of GDP Increase in Government Spending By Category
(% deviations from trend)---(consumption tax finance)



Under consumption tax financing, the estimated welfare gain of increased infrastructure spending ranges from 1.3% to 2.2% of low-wealth household consumption and the variation depends on the chosen form of financing and persistence assumptions. When the economy faces restricted access to financial markets ($\varepsilon = 1$) the welfare benefits fall to 0.7%.

The rest of spending categories yields negative welfare benefits or almost zero, as in the case of transfers to low-wealth households. The estimated welfare effect of increased health spending ranges from -0.1% to -0.3%; ranges from -0.3% to -0.5% for education spending and from -2.9% to -$4% for government consumption. Somewhat larger losses are estimated when the economy borrows at a high premium on world capital markets and when labor income taxation is used instead of consumption taxation to financed public spending.

5.3.3 Effects on Human Development and Social Progress

The human development approach argues that effects on income growth and welfare should not be the only considerations to be taken into account in the design, evaluation and determination of social policies. Other dimensions of well-being are as important on their own right. The capabilities approach assesses policies in terms of achieved basic functionings, an empirical compromise for the more general notion of the broadening of the opportunities to make life valuable: "Thus, in practice, one might have to settle often enough for relating well-being to achieved - and observed - functionings, rather than trying to bring in the capability set" (Sen, 2004).

The effect of government spending on basic functionings attainment is measured by the long-run elasticity of the HDI and its defining social indicators with respect to a permanent increase in a given category of government spending. The elasticity of the human development index with respect to infrastructure spending is 0.17; it falls to 0.04 for health and education spending and 0.01 for government consumption spending (see Table 18 through Table 21). The effects of transfers to low-wealth households (not reported) are zero or negligible.

The impact that infrastructure spending has on human development operates through a strong effect on economic activity and a chain of improvements due to direct influence and feedback on many dimensions of social progress. The infrastructure spending elasticity of poverty is -0.69 for the $1/day poverty line and -0.32 for the $2/day poverty line; the elasticity of the Gini inequality index is -0.33; the elasticities of the under-five and maternal mortality rates are -0.24 and -0.12, respectively; the elasticity of the average years of schooling is 0.12; of the gross enrollment rate in primary and secondary education is 0.05 and the elasticity of access to improved water source is 0.04. The effect of spending on health is mainly channeled through the $2 per day poverty rate with elasticity -0.24 and mortality rates, with an elasticity of -0.53 for maternal mortality and -0.30 for child mortality. Education spending exerts its effect through enrollment rates (elasticity = 0.20) and the $1/day poverty line (elasticity = -0.31).

6. SENSITIVITY ANALYSIS

The purpose of this section is to implement sensitivity analysis to evaluate the robustness of the results. In particular, the research focus of this section is to identify what structural features of the model have greatest influence on the estimated responses to a change in public infrastructure spending.

First, consider the sensitivity of the analysis to the possibility of inefficiency in public investment spending in creating productive infrastructure capital. The discussion so far has assumed - as is naturally assumed in the literature - that an additional unit of public investment today raises the next period's public capital stock by one unit. However, Pritchett (1996) estimates that in developing countries only half of the money spent on government investment is effective in creating new tangible assets. Arestoff and Hurlin (2006) claim that the following specification for the public capital accumulation equation appropriately captures the issue of inefficiency (this expression corresponds to the stationary version of the equation):

$$\eta_t \hat{K}_{g,t+1} = (1-\delta^k)\hat{K}_{g,t} + \varpi \hat{G}_{i,t}, \qquad 0 < \varpi < 1 \qquad \text{(A20')}$$

where ϖ is an efficiency parameter, and measures the fraction of government spending outlays that effectively translates into an increase in the stock of public capital. Arestoff and Hurlin (2006) use a non-parametric approach to estimate the efficiency parameter at approximately 0.40. When this specification and calibration is used instead of (A20), simulation results demonstrate that the two specifications yield very similar log-linear dynamics, though the economies are log-linearized around slightly different equilibrium steady state positions. Notice that under both specifications the direct effect on the next period's public capital stock of an exogenously given percentage deviation of government spending from its steady state level is the same, independent of ϖ:

$$(\log \hat{K}_{g,t+1} - \log \hat{K}_g) = \frac{\eta - 1 + \delta^k}{\eta}(\log \hat{G}_{i,t} - \log \hat{G}_i) \qquad (27)$$

The results from the simulation runs show that the cumulative marginal productivity of public spending on infrastructure falls approximately by 70 cents, from \$6.10 to \$ 6.30 under the benchmark parameterization $(\varpi = 1)$ to \$5.40-\$5.60 when government ineffectiveness, in the form of resource waste, is taken into consideration $(\varpi = 0.4)$. Regarding the effect on human development, the infrastructure spending elasticity of the human development index falls slightly from 0.17 to 0.16 as a result of introducing inefficiency in public spending.

Next, consider the impact of infrastructure spending and infrastructure capital on human development and social progress. This effect operates through the functionings production function. While infrastructure spending does not affect any social indicators directly, public infrastructure capital impacts on three of them: Z_5, Z_6 and Z_8. When the corresponding elasticities are shut down, one at a time, in Z_5 or Z_6, the cumulative marginal productivity of capital spending falls by 15 cents approximately. It falls by 80 cents if the infrastructure elasticity of the Gini index (Z_8) is set to zero. If infrastructure elasticities are shut down all at once, the cumulative marginal productivity is slashed by up to 84 cents. Under the conditions of the latter experiment, the elasticity of human development with respect to public infrastructure spending falls from 0.17 to 0.09.

Infrastructure spending may also exert an indirect effect on human development through its effect on economic activity. When income elasticities in the functionings production function are shut down one at a time for Z_1, Z_2, Z_3, Z_5, Z_6 and Z_7, the estimated reduction in the marginal productivity of infrastructure spending does not surpass 35 cents. If the estimated income elasticity of the average years of schooling (Z_4) is set to zero, the marginal productivity of public spending falls by 67 cents and by $1.20 if it is assumed that inequality (Z_8) is unresponsive to aggregate output. If income elasticities are shut down all at once, the cumulative marginal productivity falls by $2 approximately, from $6.10-$6.30 to $4.20 and the infrastructure spending elasticity of the HDI falls from 0.17 to 0.11.

Now consider the effect of infrastructure capital on the goods production function. The infrastructure elasticity of aggregate output has been estimated by Easterly and Servén (2003) at 0.16, which is the baseline parameter value used in the preceding simulations. The cumulative marginal productivity of infrastructure spending falls to $4.92 and $3.67, respectively, when the infrastructure elasticity of aggregate output is set at alternatively at 0.10 and 0.05.

All in all, sensitivity analysis of the model seems to suggest that the relatively strong effect of government infrastructure spending on economic performance and human development does not seem to depend on a specific feature of the model economy and also demonstrates that it exhibits low sensitivity to small changes in parameter values and to the introduction of government spending inefficiency.

7. CONCLUDING REMARKS

This paper develops a dynamic intertemporal endogenous growth model that incorporates and endogenizes human development and also various indicators of social progress to study the interplay between fiscal policy, growth, welfare, human development and functionings achievement. Through a number of policy experiments, I am able to evaluate the quantitative effect of alternative government spending/financing decisions. The proposed approach promotes quantitative insight on the sort of fiscal policies that can enhance a desired policy objective and allows policymakers to rank spending priorities consequently. The estimates presented in this paper indicate that infrastructure spending dominates other forms of public spending (education, health, government consumption and transfers to low-wealth households) in terms of sizable positive effects on growth performance, welfare, human development and social progress.

The approach developed in this paper provides quantitative policy assessments that can be used by policymakers to design welfare improving reforms.

TECHNICAL APPENDIX: Model Equations

This appendix presents the non-linear system of equations that characterizes the economy's stationary equilibrium. The original model economy is non-stationary because there is endogenous growth, as human capital can be accumulated without bound. It can be shown that the economy's gross rate of growth is determined by the rate of human capital accumulation, $\eta_t = H_{t+1}/H_t$. To induce stationarity the common trend is removed by dividing all growing variables by H_t. A tilde is used to denoted normalized variables, i.e., $\hat{H}^s_t = H^s_t/H_t$, $\hat{H}^l_t = H^l_t/H_t$, etc. Equilibrium conditions for Ricardian and liquidity constrained households have been aggregated over their corresponding populations, i.e. $\hat{C}^d_{r,t} = P_r \hat{c}^d_{r,t}$, $\hat{I}^d_{o,t} = P_o \hat{i}^d_{o,t}$, etc., where $P_r + P_o = 1$. Quadratic adjustment cost functions and a borrowing spread function have been specified.

Human Capital Accumulation:

$$\eta_t = \lambda^{\eta}\left[(1-\delta^H)\hat{H}^s_t + \chi^s(1-N_t)\Im_t\right]^{\alpha^H}\left[(1-\delta^H)\hat{H}^l_t + \chi^l\,\hat{Y}_t\right]^{1-\alpha^H} \qquad \text{(A1)}$$

$$\eta_t\,\hat{H}^l_{t+1} = (1-\delta^H)\hat{H}^l_t + \chi^l\,\hat{Y}_t \qquad \text{(A2)}$$

Liquidity Constrained Households:

$$\left(\frac{\alpha^c_r}{1-\alpha^c_r}\right)\left(\frac{\hat{C}^d_{r,t}}{\hat{C}^m_{r,t}}\right)^{-\nu^c-1} = p^d_t \qquad \text{(A3)}$$

$$\frac{(1-\tau^w_t)\,w_t}{(1+\tau^c_t)\,p^d_t\,\hat{C}_{r,t}}\left(\frac{\hat{C}^d_{r,t}}{\hat{C}_{r,t}}\right)^{-\nu^c-1} = \frac{\beta}{\eta_t}\frac{(1-\tau^w_{t+1})\,w_{t+1}}{(1+\tau^c_{t+1})\,p^d_{t+1}\,\hat{C}_{r,t+1}}\left(\frac{\hat{C}^d_{r,t+1}}{\hat{C}_{r,t+1}}\right)^{-\nu^c-1}\left(1-\delta^H+\frac{\chi^s\,\alpha^H\,\Im_{t+1}}{\hat{H}^s_{t+1}}\right) \qquad \text{(A4)}$$

$$(1-\tau^w_t)\,w_t\,N_t\,\Im_t - P_r\,\hat{\tau}_t = (1+\tau^c_t)(p^d_t\,\hat{C}^d_{r,t} + \hat{C}^m_{r,t}) \qquad \text{(A5)}$$

$$\eta_t\,\hat{H}^s_{t+1} = (1-\delta^H)\hat{H}^s_t + \chi^s(1-N_t)\Im_t \qquad \text{(A6)}$$

$$\hat{C}_{r,t} = \lambda^c_r\left[\alpha^c_r(\hat{C}^d_{r,t})^{-\nu^c} + (1-\alpha^c_r)(\hat{C}^m_{r,t})^{-\nu^c}\right]^{-\frac{1}{\nu^c}} \qquad \text{(A7)}$$

Ricardian Households:

$$\left(\frac{\alpha^c_o}{1-\alpha^c_o}\right)\left(\frac{\hat{C}^d_{o,t}}{\hat{C}^m_{o,t}}\right)^{-\nu^c-1} = p^d_t \qquad \text{(A8)}$$

$$\left(\frac{\alpha_o^i}{1-\alpha_o^i}\right)\left(\frac{\hat{I}_{o,t}^d}{\hat{I}_{o,t}^m}\right)^{-\nu^i-1} = p_t^d \tag{A9}$$

$$\left(\frac{\left(\frac{\hat{C}_{o,t}^d}{\hat{C}_{o,t}}\right)^{-\nu^c-1}\left(\frac{\hat{I}_{o,t}^d}{\hat{I}_{o,t}}\right)^{\nu^i+1}}{(1+\tau_t^c)\hat{C}_{o,t}\left[1-\psi^k\left(\frac{\hat{I}_{o,t}}{\hat{K}_{o,t}}-(\eta-1+\delta^k)\right)\right]}\right) = \frac{\beta}{\eta_t}\left(\frac{\left(\frac{\hat{C}_{o,t+1}^d}{\hat{C}_{o,t+1}}\right)^{-\nu^c-1}\left(\frac{\hat{I}_{o,t+1}^d}{\hat{I}_{o,t+1}}\right)^{\nu^i+1}}{(1+\tau_{t+1}^c)\hat{C}_{o,t+1}\left[1-\psi^k\left(\frac{\hat{I}_{o,t+1}}{\hat{K}_{o,t+1}}-(\eta-1+\delta^k)\right)\right]}\right) *$$

$$\left\{1-\delta^k+\left(\frac{(1-\tau^k)r_{t+1}}{p_{t+1}^d}\right)\alpha_o^i(\lambda_o^i)^{-\nu^i}\left(\frac{\hat{I}_{o,t+1}^d}{\hat{I}_{o,t+1}}\right)^{-\nu^i-1}\left[1-\psi^k\left(\frac{\hat{I}_{o,t+1}}{\hat{K}_{o,t+1}}-(\eta-1+\delta^k)\right)\right]-\right.$$

$$\left.\left(\frac{\psi^k}{2}\right)\left(\frac{\hat{I}_{o,t+1}}{\hat{K}_{o,t+1}}-(\eta-1+\delta^k)\right)^2+\psi^k\left(\frac{\hat{I}_{o,t+1}}{\hat{K}_{o,t+1}}-(\eta-1+\delta^k)\right)\left(\frac{\hat{I}_{o,t+1}}{\hat{K}_{o,t+1}}\right)\right\} \tag{A10}$$

$$\frac{[\eta_t-\psi^d(\hat{D}_{o,t+1}-\hat{D}_{o,t})]\left(\frac{\hat{C}_{o,t}^d}{\hat{C}_{o,t}}\right)^{-\nu^c-1}}{(1+\tau_t^c)p_t^d\,\hat{C}_{o,t}} = \beta\frac{[1+r_{t+1}^d-\psi^d(\hat{D}_{o,t+2}-\hat{D}_{o,t+1})]\left(\frac{\hat{C}_{o,t+1}^d}{\hat{C}_{o,t+1}}\right)^{-\nu^c-1}}{(1+\tau_{t+1}^c)p_{t+1}^d\,\hat{C}_{o,t+1}} \tag{A11}$$

$$\frac{\left(\frac{\hat{C}_{o,t}^d}{\hat{C}_{o,t}}\right)^{-\nu^c-1}}{(1+\tau_t^c)p_t^d\,\hat{C}_{o,t}} = \frac{\beta}{\eta_t}(1+r_{t+1}^b)\frac{\left(\frac{\hat{C}_{o,t+1}^d}{\hat{C}_{o,t+1}}\right)^{-\nu^c-1}}{(1+\tau_{t+1}^c)p_{t+1}^d\,\hat{C}_{o,t+1}} \tag{A12}$$

$$\hat{C}_{o,t} = \lambda_o^c\left[\alpha_o^c(\hat{C}_{o,t}^d)^{-\nu^c}+(1-\alpha_o^c)(\hat{C}_{o,t}^m)^{-\nu^c}\right]^{-\frac{1}{\nu^c}} \tag{A13}$$

$$\eta_t(\hat{D}_{o,t+1}-\hat{B}_{o,t+1}) = (1+r_t^d)\hat{D}_{o,t}-(1+r_t^b)\hat{B}_{o,t}+p_t^d[(1+\tau_t^c)\hat{C}_{o,t}^d+\hat{I}_{o,t}^d]+(1+\tau_t^c)\hat{C}_{o,t}^m+\hat{I}_{o,t}^m-$$

$$(1-\tau^k)(r_t\hat{K}_{o,t}+\hat{\Pi}_{o,t})-(p_t^*-p_t^d)\hat{X}_{o,t}+\left(\frac{\psi^d}{2}\right)(\hat{D}_{o,t+1}-\hat{D}_{o,t})^2+P_o\,\hat{\tau}_t \tag{A14}$$

$$\hat{I}_{o,t} = \lambda_o^i\left[\alpha_o^i(\hat{I}_{o,t}^d)^{-\nu^i}+(1-\alpha_o^i)(\hat{I}_{o,t}^m)^{-\nu^i}\right]^{-\frac{1}{\nu^i}} \tag{A15}$$

$$\eta_t\hat{K}_{o,t+1} = (1-\delta^k)\hat{K}_{o,t}+\hat{I}_{o,t}-\left(\frac{\psi^k}{2}\right)\left(\frac{\hat{I}_{o,t}}{\hat{K}_{o,t}}-(\eta-1+\delta^k)\right)^2\hat{K}_{o,t} \tag{A16}$$

Firms:

$$w_t = p_t^d \alpha^y \lambda^y (\hat{K}_{g,t})^{1-\alpha^y-\omega^y} (N_t \Im_t)^{\alpha^y - 1} (\hat{K}_{o,t})^{\omega^y} \quad \text{(A17)}$$

$$r_t = p_t^d \omega^y \lambda^y (\hat{K}_{g,t})^{1-\alpha^y-\omega^y} (N_t \Im_t)^{\alpha^y} (\hat{K}_{o,t})^{\omega^y - 1} \quad \text{(A18)}$$

$$\hat{\Pi}_{o,t} = p_t^d (1-\alpha^y - \omega^y) \hat{Y}_t$$

Government:

$$\eta_t \hat{B}_{o,t+1} = (1+r_t^b) \hat{B}_{o,t} + p_t^d (\hat{G}_{i,t} + \hat{G}_{h,t} + \hat{G}_{e,t} + \hat{G}_{c,t}) - \tau_t^c [p_t^d (\hat{C}_{r,t}^d + \hat{C}_{o,t}^d) + \hat{C}_{r,t}^m + \hat{C}_{o,t}^m] -$$
$$\tau_t^w w_t N_t \Im_t - \tau^k (r_t \hat{K}_{o,t} + \hat{\Pi}_{o,t}) - \hat{\tau}_t \quad \text{(A19)}$$

$$\eta_t \hat{K}_{g,t+1} = (1-\delta^k) \hat{K}_{g,t} + \hat{G}_{i,t} \quad \text{(A20)}$$

Resource Constraints:

$$p_t^d \hat{Y}_t = w_t N_t \Im_t + r_t \hat{K}_{o,t} + \hat{\Pi}_{o,t} \quad \text{(A21)}$$

$$\hat{Y}_t = \hat{C}_{r,t}^d + \hat{C}_{o,t}^d + \hat{I}_{o,t}^d + (\hat{G}_{i,t} + \hat{G}_{h,t} + \hat{G}_{e,t} + \hat{G}_{c,t}) + \hat{X}_{o,t} \quad \text{(A22)}$$

Human Development:

Using equations (7), (8) and (9) it is possible to obtain an expression for the HDI as a function of government spending, public capital and the level of economic activity,

$$\Im_t = \Im(\hat{G}_{i,t}, \hat{G}_{h,t}, \hat{G}_{e,t}, \hat{G}_{c,t}, \hat{Y}_t, \hat{K}_{g,t}) \quad \text{(A23)}$$

Foreign Borrowing Rate:

$$r_t^d = r^* + \mu \cdot \exp[\varepsilon (\hat{B}_{o,t+1} - \hat{B}_o)] \quad \text{(A24)}$$

Macroeconomic aggregates are obtained by summing over all types of agents, i.e., $\hat{K}_t = \hat{K}_{o,t}$, $\hat{B}_t = \hat{B}_{o,t}$, $\hat{D}_t = \hat{D}_{o,t}$, etc.

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Table 1
Calibrated Parameter Values

Parameter	Description	Argentina	Bolivia	Brazil	Chile	Colombia	Costa Rica	Dominican Republic	Ecuador	El Salvador	Jamaica	Mexico	Panama	Peru	Uruguay	Venezuela	**Simple Average**	**Weighted Average**
η	Gross rate of growth	1.0095	1.0075	1.0114	1.0370	1.0172	1.0045	1.0131	1.0265	1.0008	1.0071	1.0084	1.0200	1.0177	1.0043	1.0048	1.0123	1.0114
$r^{\bullet}$	Foreign borrowing rate	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
μ	Borrowing spread	0.0486	0.0786	0.0662	0.0194	0.0584	0.0698	0.0408	0.0140	0.0769	0.0523	0.0064	0.0523	0.0867	0.0494	0.0213	0.0552	0.0497
ε	Semi-elasticity sovereign yield spread to government debt-GDP ratio	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
β	Subjective discount factor	0.9273	0.9007	0.9143	0.9788	0.9261	0.9051	0.9373	0.9739	0.8961	0.9220	0.9637	0.9338	0.9033	0.9218	0.9468	0.9243	0.9282
δ^k	Rate of depreciation of physical capital	0.0508	0.0386	0.0508	0.0481	0.0493	0.0726	0.0631	0.0409	0.0718	0.0462	0.0560	0.0383	0.0352	0.0391	0.0505	0.0497	0.0518
δ^h	Rate of depreciation of human capital stock	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
α^y	Labor share parameter in production function	0.4884	0.5111	0.3393	0.6388	0.6340	0.3888	0.5007	0.6042	0.4780	0.5028	0.5731	0.5380	0.3483	0.5533	0.5144	0.4936	0.4606
ω^y	Capital share parameter in production function	0.3516	0.3289	0.5007	0.2012	0.2060	0.4512	0.3393	0.2358	0.3620	0.3372	0.2669	0.3020	0.4917	0.2867	0.3256	0.3464	0.3794
χ^s	knowledge acquisition rate through schooling	0.1154	0.2364	0.2537	0.1793	0.2552	0.1315	0.2242	0.2475	0.2139	0.1661	0.1371	0.1542	0.1922	0.0920	0.1598	0.1802	0.1813
χ^l	Learning-by-doing knowledge acquisition rate	0.0002	0.0002	0.0003	0.0004	0.0003	0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0003	0.0003	0.0002	0.0002	0.0003	0.0003
ν^c	Parameter determining elasticity of substitution between consumption goods	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22
ν^i	Parameter determining elasticity of substitution between investment goods	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22
α_r^c	Share parameter in CES consumption aggregator function	0.8445	0.6948	0.7280	0.6463	0.7548	0.4826	0.4949	0.6732	0.5985	0.5770	0.5792	0.3196	0.7709	0.6936	0.6906	0.6146	0.6762
α_o^c	Share parameter in CES consumption aggregator function	0.8445	0.6948	0.7280	0.6463	0.7548	0.4826	0.4949	0.6732	0.5985	0.5770	0.5792	0.3196	0.7709	0.6936	0.6906	0.6146	0.6762
α_o^i	Share parameter in CES investment aggregator function	0.6231	0.3772	0.8161	0.5375	0.2813	0.5706	0.6225	0.5517	0.5188	0.4251	0.7257	0.5311	0.7214	0.5701	0.7445	0.5947	0.7123
λ_r^c	Consumption aggregator scaling parameter	1.4691	1.8141	1.7496	1.8930	1.6919	1.9984	1.9999	1.8516	1.9509	1.9698	1.9681	1.8395	1.6550	1.8162	1.8217	1.9337	1.8467
λ_o^c	Consumption aggregator scaling parameter	1.4691	1.8141	1.7496	1.8930	1.6919	1.9984	1.9999	1.8516	1.9509	1.9698	1.9681	1.8395	1.6550	1.8162	1.8217	1.9337	1.8467
λ_o^i	Investment aggregator scaling parameter	1.9237	1.9241	1.5440	1.9928	1.7684	1.9746	1.9244	1.9863	1.9982	1.9714	1.7543	1.9951	1.7630	1.9750	1.7146	1.9545	1.7811
λ^η	Growth equation scaling parameter	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
λ^y	Production function scaling parameter	14.2456	13.9848	4.6765	27.6590	30.3624	7.0667	11.5982	24.3522	13.6058	11.5105	19.1602	16.9276	4.6374	15.6153	12.7101	12.2070	9.8370
α^H	Weight parameter in Cobb-Douglas aggregator over learning and schooling	0.9186	0.7445	0.5547	0.3899	0.5100	0.8152	0.4488	0.3625	0.7926	0.5912	0.5165	0.7548	0.8753	0.8840	0.6004	0.6716	0.6383
ρ	Parameter determining elasticity of substitution between social indicators	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5

Table 2
Calibrated Parameter Values of Sigmoid Functions

Social Indicator Z_j	Slope ξ_j	Central Point θ_j
(Reciprocal) Poverty headcount ratio at $1 a day (PPP)	0.05	27
(Reciprocal) Poverty headcount ratio at $2 a day (PPP)	0.18	8.29
Gross enrollment rate in primary and secondary education	15	0.80
Average years of schooling	0.39	6.16
(Reciprocal) Under-5 mortality rate (per 10 live births)	2.08	0.67
(Reciprocal) Maternal mortality rate (per 1000 live births)	0.63	1.97
Percent of population with access to improved water source	30	0.83
(Reciprocal) GINI index	2.37	2.12

Table 3
Output Elasticity with respect to Government Spending on Infrastructure

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent (Tax Financing)	Temporary Increase			Permanent (Tax Financing)
	Tax Financing	Debt Financing $\varepsilon = 0.12$	Debt Financing $\varepsilon = 1$		Tax Financing	Debt Financing $\varepsilon = 0.12$	Debt Financing $\varepsilon = 1$	
Argentina	0.16	0.16	0.13	0.16	0.16	0.16	0.13	0.16
Bolivia	0.17	0.16	0.12	0.17	0.17	0.16	0.13	0.18
Brazil	0.16	0.15	0.11	0.15	0.16	0.15	0.11	0.15
Chile	0.61	0.61	0.63	0.63	0.62	0.62	0.63	0.63
Colombia	0.34	0.33	0.41	0.37	0.36	0.35	0.38	0.38
Costa Rica	0.13	0.12	0.11	0.12	0.12	0.12	0.11	0.12
Dominican Republic	0.31	0.30	0.27	0.30	0.30	0.29	0.26	0.30
Ecuador	0.59	0.58	0.59	0.60	0.59	0.59	0.59	0.60
El Salvador	0.17	0.16	0.08	0.17	0.16	0.15	0.09	0.17
Jamaica	0.17	0.17	0.15	0.17	0.16	0.16	0.14	0.17
Mexico	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.40
Panama	0.22	0.21	0.18	0.21	0.22	0.21	0.19	0.21
Peru	0.13	0.12	0.02	0.13	0.13	0.12	0.03	0.13
Uruguay	0.13	0.13	0.11	0.13	0.13	0.13	0.12	0.13
Venezuela	0.29	0.29	0.33	0.30	0.31	0.30	0.34	0.30
Average	0.21	0.20	0.16	0.21	0.21	0.20	0.16	0.21
Weighted Average	0.21	0.21	0.18	0.21	0.21	0.21	0.18	0.21

Table 4
Output Elasticity with respect to Government Spending on Health

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.04	0.03	-0.08	0.05	0.04	0.03	-0.08	0.05
Bolivia	0.05	0.04	0.01	0.06	0.05	0.04	0.01	0.06
Brazil	0.03	0.02	-0.08	0.04	0.03	0.02	-0.08	0.04
Chile	0.10	0.10	0.11	0.14	0.12	0.11	0.12	0.14
Colombia	0.10	0.09	0.15	0.12	0.12	0.11	0.13	0.12
Costa Rica	0.04	0.02	-0.04	0.04	0.03	0.02	-0.04	0.04
Dominican Republic	0.06	0.06	0.04	0.07	0.06	0.05	0.04	0.07
Ecuador	0.12	0.12	0.12	0.15	0.12	0.12	0.12	0.15
El Salvador	0.06	0.04	-0.07	0.06	0.05	0.04	-0.05	0.06
Jamaica	0.03	0.03	0.02	0.04	0.03	0.03	0.01	0.04
Mexico	0.05	0.04	0.05	0.07	0.06	0.05	0.05	0.07
Panama	0.06	0.04	0.01	0.09	0.06	0.05	0.01	0.09
Peru	0.03	0.02	-0.06	0.03	0.03	0.02	-0.05	0.03
Uruguay	0.04	0.03	0.02	0.04	0.04	0.04	0.02	0.04
Venezuela	0.04	0.04	0.07	0.07	0.06	0.06	0.08	0.07
Average	0.05	0.04	-0.01	0.06	0.05	0.04	-0.01	0.06
Weighted Average	0.04	0.03	-0.01	0.05	0.04	0.03	0.00	0.05

Table 5
Output Elasticity with respect to Government Spending on Education

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.04	0.02	-0.07	0.04	0.04	0.02	-0.07	0.04
Bolivia	0.06	0.04	-0.01	0.06	0.06	0.04	0.00	0.06
Brazil	0.04	0.02	-0.10	0.04	0.04	0.02	-0.10	0.04
Chile	0.11	0.10	0.12	0.16	0.14	0.12	0.13	0.16
Colombia	0.06	0.05	0.10	0.07	0.07	0.06	0.08	0.07
Costa Rica	0.03	0.01	-0.04	0.04	0.03	0.02	-0.03	0.04
Dominican Republic	0.10	0.09	0.07	0.10	0.09	0.09	0.07	0.10
Ecuador	0.19	0.18	0.19	0.22	0.19	0.19	0.19	0.22
El Salvador	0.07	0.05	-0.02	0.07	0.06	0.05	-0.02	0.07
Jamaica	0.05	0.04	0.01	0.05	0.04	0.04	0.00	0.05
Mexico	0.05	0.05	0.05	0.10	0.07	0.07	0.07	0.10
Panama	0.04	0.03	-0.01	0.07	0.04	0.03	0.00	0.07
Peru	0.04	0.03	-0.08	0.05	0.04	0.03	-0.07	0.05
Uruguay	0.05	0.05	0.04	0.05	0.05	0.05	0.04	0.05
Venezuela	0.05	0.05	0.08	0.07	0.06	0.06	0.08	0.07
Average	0.05	0.03	-0.02	0.06	0.05	0.03	-0.01	0.06
Weighted Average	0.04	0.03	-0.02	0.05	0.05	0.03	-0.01	0.05

Table 6
Output Elasticity with respect to Current Government Spending

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.00	-0.06	-0.51	0.01	0.01	-0.05	-0.51	0.01
Bolivia	0.02	-0.03	-0.16	0.03	0.02	-0.03	-0.16	0.03
Brazil	0.01	-0.17	-2.74	0.02	0.01	-0.17	-2.74	0.02
Chile	-0.12	-0.17	-0.08	0.06	0.01	-0.05	-0.04	0.06
Colombia	0.00	-0.03	0.15	0.03	0.06	0.03	0.07	0.04
Costa Rica	0.01	-0.03	-0.16	0.02	0.00	-0.03	-0.14	0.02
Dominican Republic	-0.01	-0.03	-0.15	0.03	-0.02	-0.04	-0.15	0.03
Ecuador	-0.05	-0.07	-0.06	0.04	0.00	-0.01	0.00	0.04
El Salvador	0.01	-0.05	-0.41	0.02	0.00	-0.05	-0.37	0.01
Jamaica	0.02	0.00	-0.06	0.02	0.00	-0.01	-0.09	0.02
Mexico	-0.08	-0.10	-0.09	0.02	-0.02	-0.04	-0.04	0.02
Panama	-0.04	-0.07	-0.18	0.05	-0.03	-0.06	-0.17	0.05
Peru	0.01	-0.10	-0.83	0.01	-0.01	-0.09	-0.73	0.01
Uruguay	0.00	-0.04	-0.20	0.02	0.01	-0.02	-0.16	0.02
Venezuela	-0.06	-0.07	0.06	0.01	0.01	0.00	0.09	0.01
Average	0.00	-0.05	-0.31	0.03	0.00	-0.05	-0.28	0.03
Weighted Average	-0.02	-0.08	-0.42	0.02	0.01	-0.05	-0.38	0.02

Table 7
Output Elasticity with respect to Government Transfers to Low-Wealth Households

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.00	-0.01	-0.03	0.00	0.00	-0.01	-0.03	0.00
Bolivia	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00
Brazil	0.00	-0.01	-0.04	0.00	0.00	-0.01	-0.04	0.00
Chile	0.01	0.02	0.01	0.00	0.00	0.01	0.01	0.00
Colombia	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.00	0.00
Costa Rica	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Dominican Republic	0.00	0.00	-0.01	0.00	0.00	0.00	-0.01	0.00
Ecuador	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00
El Salvador	0.00	-0.01	-0.04	0.00	0.00	-0.01	-0.03	0.00
Jamaica	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Mexico	-0.01	-0.01	-0.01	0.00	0.00	-0.01	-0.01	0.00
Panama	0.01	0.01	0.02	0.00	0.00	0.01	0.01	0.00
Peru	0.00	-0.01	-0.04	0.00	0.00	-0.01	-0.04	0.00
Uruguay	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Venezuela	-0.01	-0.01	0.00	0.00	0.00	-0.01	0.00	0.00
Average	0.00	0.01	0.02	0.00	0.00	0.01	0.02	0.00
Weighted Average	0.00	-0.01	-0.02	0.00	0.00	-0.01	-0.02	0.00

Table 8
Marginal Productivity of Government Spending on Infrastructure

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		(Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financing)	Financing	ε = 0.12	ε = 1	Financing)
Argentina	12.5	12.1	10.3	12.1	12.5	12.2	10.4	12.2
Bolivia	3.1	2.9	2.3	3.2	3.1	2.9	2.3	3.2
Brazil	9.4	9.0	6.6	8.9	9.4	9.0	6.6	8.9
Chile	9.1	9.1	9.3	9.4	9.3	9.2	9.3	9.4
Colombia	3.8	3.8	4.6	4.2	4.1	4.0	4.3	4.3
Costa Rica	9.9	9.6	8.6	9.3	9.7	9.5	8.5	9.1
Dominican Republic	5.4	5.3	4.7	5.4	5.3	5.2	4.6	5.3
Ecuador	11.6	11.6	11.6	12.0	11.6	11.6	11.6	12.0
El Salvador	6.1	5.6	3.0	6.1	5.9	5.5	3.2	6.0
Jamaica	5.2	5.1	4.6	5.2	5.0	4.9	4.2	5.1
Mexico	9.4	9.3	9.4	9.5	9.5	9.4	9.4	9.6
Panama	5.0	4.9	4.3	5.0	5.0	4.9	4.4	5.0
Peru	4.4	3.8	0.7	4.4	4.2	3.8	0.9	4.3
Uruguay	4.6	4.5	4.1	4.6	4.6	4.5	4.2	4.6
Venezuela	5.2	5.2	6.0	5.4	5.5	5.5	6.1	5.5
Average	5.2	4.9	3.8	5.2	5.1	4.9	3.9	5.2
Weighted Average	6.3	6.1	5.3	6.3	6.3	6.2	5.3	6.3

Table 9
Marginal Productivity of Government Spending on Health

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.9	0.5	-1.7	1.0	0.9	0.6	-1.7	1.0
Bolivia	1.3	1.0	0.3	1.4	1.3	1.0	0.3	1.4
Brazil	1.0	0.5	-2.3	1.1	1.0	0.5	-2.3	1.1
Chile	3.6	3.3	3.9	4.8	4.2	3.9	4.0	4.8
Colombia	1.6	1.5	2.4	2.0	1.9	1.8	2.0	2.0
Costa Rica	0.6	0.3	-0.7	0.8	0.6	0.4	-0.6	0.8
Dominican Republic	2.6	2.5	1.7	3.0	2.5	2.4	1.6	2.9
Ecuador	6.1	6.0	6.1	7.4	6.3	6.2	6.3	7.4
El Salvador	1.6	1.1	-1.9	1.7	1.5	1.1	-1.5	1.7
Jamaica	1.3	1.2	0.6	1.4	1.2	1.0	0.3	1.4
Mexico	1.7	1.6	1.6	2.6	2.1	1.9	1.9	2.6
Panama	1.0	0.8	0.1	1.8	1.1	0.9	0.2	1.8
Peru	1.3	0.7	-2.8	1.5	1.2	0.7	-2.4	1.5
Uruguay	1.3	1.2	0.7	1.4	1.3	1.2	0.8	1.4
Venezuela	1.4	1.4	2.4	2.3	1.9	1.9	2.6	2.2
Average	1.3	1.0	-0.3	1.6	1.3	1.0	-0.2	1.6
Weighted Average	1.2	0.9	-0.2	1.5	1.2	1.0	-0.1	1.4

Table 10
Marginal Productivity of Government Spending on Education

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.9	0.5	-1.7	1.0	0.9	0.6	-1.7	1.0
Bolivia	0.9	0.6	-0.1	1.0	0.9	0.7	-0.1	1.0
Brazil	0.9	0.4	-2.4	1.0	0.9	0.4	-2.4	1.0
Chile	2.9	2.7	3.2	4.1	3.6	3.2	3.3	4.1
Colombia	1.2	1.1	2.0	1.5	1.5	1.3	1.6	1.5
Costa Rica	0.6	0.3	-0.8	0.8	0.5	0.3	-0.7	0.8
Dominican Republic	4.2	4.0	3.3	4.5	4.0	3.9	3.2	4.5
Ecuador	6.6	6.5	6.6	7.9	6.8	6.7	6.8	7.8
El Salvador	2.5	2.0	-0.9	2.7	2.4	2.0	-0.6	2.6
Jamaica	1.0	0.8	0.3	1.0	0.8	0.7	-0.1	1.0
Mexico	1.0	0.9	0.9	1.9	1.4	1.2	1.2	1.8
Panama	0.8	0.6	-0.2	1.5	0.8	0.6	-0.1	1.5
Peru	1.5	0.9	-2.6	1.6	1.3	0.9	-2.2	1.6
Uruguay	2.1	1.9	1.5	2.2	2.1	2.0	1.6	2.2
Venezuela	1.6	1.6	2.5	2.4	2.1	2.0	2.7	2.3
Average	1.2	0.8	-0.5	1.4	1.1	0.9	-0.4	1.4
Weighted Average	0.9	0.7	-0.4	1.2	1.0	0.8	-0.3	1.2

Table 11
Marginal Productivity of Current Government Spending

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.0	-0.4	-3.5	0.1	0.1	-0.3	-3.5	0.1
Bolivia	0.1	-0.2	-1.1	0.2	0.1	-0.2	-1.0	0.2
Brazil	0.0	-0.5	-7.8	0.1	0.0	-0.5	-7.8	0.1
Chile	-0.9	-1.3	-0.6	0.4	0.1	-0.4	-0.3	0.4
Colombia	0.0	-0.2	0.9	0.2	0.3	0.2	0.4	0.2
Costa Rica	0.1	-0.3	-1.4	0.2	0.0	-0.2	-1.3	0.2
Dominican Republic	0.0	-0.2	-1.2	0.2	-0.1	-0.3	-1.2	0.2
Ecuador	-0.5	-0.6	-0.6	0.4	0.0	-0.1	0.0	0.4
El Salvador	0.1	-0.5	-4.1	0.2	0.0	-0.5	-3.6	0.1
Jamaica	0.1	0.0	-0.6	0.2	0.0	-0.1	-0.9	0.2
Mexico	-0.7	-0.8	-0.7	0.2	-0.2	-0.4	-0.3	0.2
Panama	-0.3	-0.6	-1.4	0.4	-0.3	-0.5	-1.3	0.4
Peru	0.1	-0.6	-5.4	0.1	-0.1	-0.6	-4.8	0.1
Uruguay	0.0	-0.2	-0.8	0.1	0.1	-0.1	-0.6	0.1
Venezuela	-0.5	-0.5	0.5	0.1	0.1	0.0	0.7	0.1
Average	0.0	-0.4	-2.0	0.2	0.0	-0.3	-1.8	0.2
Weighted Average	-0.1	-0.4	-2.0	0.1	0.0	-0.3	-1.8	0.1

Table 12
Marginal Productivity of Government Transfers to Low-Wealth Households

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	-0.38	-0.77	-3.02	0.00	-0.15	-0.75	-3.05	0.00
Bolivia	0.33	0.61	1.37	0.00	0.18	0.61	1.37	0.00
Brazil	-0.20	-0.66	-3.51	0.00	0.06	-0.66	-3.52	0.00
Chile	1.39	1.66	1.08	0.00	-0.08	1.26	1.18	0.00
Colombia	-0.57	-0.71	0.25	0.00	-0.03	-0.54	-0.34	0.00
Costa Rica	0.05	0.38	1.47	0.00	-0.04	0.30	1.38	0.00
Dominican Republic	-0.27	-0.45	-1.30	0.00	-0.13	-0.46	-1.25	0.00
Ecuador	1.11	1.27	1.18	0.00	0.05	0.93	0.87	0.00
El Salvador	-0.18	-0.78	-3.84	0.00	-0.15	-0.70	-3.45	0.00
Jamaica	0.13	0.25	0.87	0.00	0.14	0.31	1.12	0.00
Mexico	-0.94	-1.06	-1.00	0.00	-0.17	-0.84	-0.81	0.00
Panama	0.53	0.76	1.52	0.00	0.33	0.73	1.43	0.00
Peru	-0.22	-0.88	-4.50	0.00	-0.15	-0.80	-4.02	0.00
Uruguay	0.28	0.43	0.93	0.00	0.11	0.37	0.83	0.00
Venezuela	-0.97	-0.98	0.07	0.00	-0.04	-0.70	0.06	0.00
Average	0.34	0.68	2.05	0.00	0.15	0.64	1.90	0.00
Weighted Average	-0.40	-0.68	-1.82	0.00	-0.07	-0.61	-1.76	0.00

Table 13
Infrastructure Spending Increase: Welfare Benefits for Low-Wealth Households
(% of consumption)

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		(Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financing)	Financing	ε = 0.12	ε = 1	Financing)
Argentina	1.1	1.1	0.7	1.7	1.2	1.1	0.6	1.7
Bolivia	0.9	0.6	-0.2	1.3	0.6	0.2	-0.9	0.9
Brazil	1.5	1.3	0.6	2.0	1.6	1.5	0.6	2.3
Chile	3.1	3.0	2.8	11.8	3.2	3.0	2.8	12.0
Colombia	2.4	2.1	1.9	4.4	2.5	2.0	1.5	4.4
Costa Rica	0.8	0.8	0.6	1.0	0.8	0.8	0.6	1.1
Dominican Republic	1.7	1.5	1.2	2.7	1.5	1.3	1.0	2.6
Ecuador	3.2	3.1	3.1	10.3	3.2	3.1	3.1	10.3
El Salvador	1.1	1.0	0.2	1.5	1.0	0.8	0.1	1.3
Jamaica	0.9	0.8	0.5	1.4	0.8	0.7	0.2	1.2
Mexico	1.9	1.9	1.9	4.7	2.0	1.9	1.9	4.8
Panama	1.1	1.0	0.6	1.7	1.0	0.8	0.4	1.5
Peru	0.7	0.5	-0.5	1.0	0.5	0.2	-0.9	0.7
Uruguay	0.8	0.7	0.3	1.1	0.7	0.5	0.1	1.0
Venezuela	1.6	1.5	1.6	3.2	1.6	1.5	1.5	3.0
Average	1.3	1.1	0.4	2.0	1.1	0.9	0.1	1.8
Weighted Average	1.4	1.3	0.7	2.2	1.4	1.2	0.5	2.1

Table 14
Health Spending Increase: Welfare Benefits for Low-Wealth Households
(% of consumption)

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax Financing	Debt Financing ε = 0.12	Debt Financing ε = 1	Tax Financed	Tax Financing	Debt Financing ε = 0.12	Debt Financing ε = 1	(Tax Financing)
Argentina	-0.3	-0.6	-2.1	-0.4	-0.6	-1.0	-2.7	-1.0
Bolivia	-0.1	-0.3	-0.9	0.0	-0.4	-0.7	-1.6	-0.5
Brazil	-0.6	-0.8	-2.2	-0.7	-1.0	-1.4	-3.1	-1.4
Chile	0.2	0.2	0.1	1.3	0.2	0.1	0.0	1.0
Colombia	0.1	-0.1	-0.2	0.6	0.0	-0.4	-0.8	0.0
Costa Rica	-0.3	-0.5	-1.2	-0.3	-0.7	-1.0	-1.9	-0.8
Dominican Republic	0.2	0.2	0.0	0.4	0.1	0.0	-0.1	0.3
Ecuador	0.3	0.3	0.3	1.5	0.3	0.3	0.3	1.3
El Salvador	0.2	-0.1	-1.0	0.2	-0.1	-0.3	-1.2	0.0
Jamaica	0.0	0.0	-0.3	0.1	-0.1	-0.2	-0.6	-0.1
Mexico	0.1	0.0	0.0	0.5	0.0	0.0	-0.1	0.2
Panama	0.4	0.2	-0.2	0.9	0.0	-0.2	-0.8	0.3
Peru	-0.1	-0.2	-1.0	-0.1	-0.3	-0.5	-1.3	-0.3
Uruguay	-0.1	-0.2	-0.6	0.0	-0.3	-0.4	-0.9	-0.4
Venezuela	0.0	-0.1	0.0	0.2	-0.1	-0.2	-0.2	-0.2
Average	0.0	-0.2	-0.8	0.1	-0.3	-0.5	-1.2	-0.3
Weighted Average	-0.2	-0.3	-0.9	-0.1	-0.4	-0.7	-1.3	-0.6

Table 15
Education Spending Increase: Welfare Benefits for Low-Wealth Households
(% of consumption)

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax Financing	Debt Financing ε = 0.12	Debt Financing ε = 1	Tax Financed	Tax Financing	Debt Financing ε = 0.12	Debt Financing ε = 1	(Tax Financing)
Argentina	-0.3	-0.5	-1.9	-0.4	-0.6	-0.9	-2.4	-0.9
Bolivia	-0.3	-0.6	-1.6	-0.3	-0.8	-1.2	-2.6	-1.0
Brazil	-0.7	-1.1	-2.9	-1.0	-1.4	-1.8	-4.1	-1.8
Chile	0.2	0.1	0.0	1.4	0.2	0.1	0.0	1.0
Colombia	-0.1	-0.3	-0.4	0.1	-0.2	-0.5	-0.8	-0.3
Costa Rica	-0.3	-0.5	-1.1	-0.3	-0.7	-0.9	-1.7	-0.8
Dominican Republic	0.4	0.4	0.3	0.8	0.3	0.3	0.1	0.7
Ecuador	0.6	0.6	0.5	2.4	0.6	0.5	0.5	2.2
El Salvador	0.3	0.2	-0.6	0.5	0.1	0.0	-0.7	0.3
Jamaica	0.0	-0.2	-0.7	0.0	-0.3	-0.5	-1.3	-0.3
Mexico	0.0	-0.1	-0.1	0.5	-0.2	-0.2	-0.3	-0.1
Panama	0.2	0.1	-0.3	0.6	-0.1	-0.3	-0.7	0.1
Peru	-0.1	-0.3	-1.4	-0.1	-0.4	-0.6	-1.8	-0.4
Uruguay	0.1	0.0	-0.3	0.2	-0.1	-0.2	-0.6	-0.1
Venezuela	0.0	-0.1	0.0	0.3	-0.1	-0.2	-0.2	-0.1
Average	-0.1	-0.2	-0.9	0.0	-0.3	-0.6	-1.4	-0.4
Weighted Average	-0.3	-0.5	-1.3	-0.3	-0.6	-0.9	-1.8	-0.9

Table 16
Current Spending Increase: Welfare Benefits for Low-Wealth Households
(% of consumption)

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	-1.8	-2.7	-8.0	-2.7	-2.7	-4.0	-10.2	-4.4
Bolivia	-1.8	-2.6	-5.2	-2.3	-3.1	-4.3	-8.0	-4.0
Brazil	-8.7	-12.7	-38.7	-12.7	-14.8	-21.4	-79.8	-22.2
Chile	-0.8	-1.0	-1.4	-1.2	-0.8	-1.1	-1.6	-2.8
Colombia	-1.9	-2.6	-3.0	-2.4	-2.5	-3.5	-4.7	-4.4
Costa Rica	-1.1	-1.6	-3.0	-1.4	-2.0	-2.5	-4.6	-2.5
Dominican Republic	-0.9	-1.2	-2.0	-1.1	-1.6	-2.1	-3.0	-2.3
Ecuador	-0.6	-0.7	-0.8	-0.9	-0.7	-0.9	-1.0	-2.0
El Salvador	-0.8	-1.5	-4.4	-1.1	-1.5	-2.2	-5.1	-1.8
Jamaica	-0.7	-1.0	-2.0	-1.0	-1.2	-1.6	-3.3	-1.6
Mexico	-0.9	-1.0	-1.0	-1.1	-1.2	-1.4	-1.4	-2.5
Panama	-0.3	-0.7	-1.7	0.2	-1.2	-1.7	-3.0	-1.2
Peru	-2.1	-3.3	-9.1	-2.9	-3.6	-5.0	-12.0	-4.6
Uruguay	-2.8	-3.9	-7.8	-3.9	-4.5	-6.1	-11.1	-6.9
Venezuela	-1.5	-1.7	-1.5	-2.0	-1.9	-2.2	-2.1	-3.7
Average	-1.5	-2.2	-5.1	-2.0	-2.6	-3.5	-6.8	-3.7
Weighted Average	-2.9	-4.0	-8.3	-4.1	-4.6	-6.1	-11.2	-7.3

Table 17
Government Transfer Increase: Welfare Benefits for Low-Wealth Households
(% of consumption)

	Consumption Tax				Labor Income Tax			
	Temporary Increase			Permanent	Temporary Increase			Permanent
	Tax	Debt Financing		Tax	Tax	Debt Financing		(Tax
	Financing	ε = 0.12	ε = 1	Financed	Financing	ε = 0.12	ε = 1	Financing)
Argentina	0.0	-0.1	-0.4	0.1	-0.1	-0.1	-0.5	-0.1
Bolivia	0.0	0.0	-0.2	0.0	-0.1	-0.1	-0.3	-0.1
Brazil	0.0	-0.1	-0.5	0.1	-0.1	-0.2	-0.7	-0.1
Chile	0.0	0.0	-0.1	0.1	0.0	0.0	-0.1	-0.1
Colombia	0.0	-0.1	-0.1	0.1	-0.1	-0.1	-0.2	-0.1
Costa Rica	0.0	0.0	-0.1	0.0	-0.1	-0.1	-0.2	-0.1
Dominican Republic	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.1
Ecuador	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
El Salvador	0.0	0.0	-0.3	0.0	-0.1	-0.1	-0.3	-0.1
Jamaica	0.0	0.0	-0.1	0.0	0.0	-0.1	-0.2	-0.1
Mexico	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	-0.1
Panama	0.0	0.0	-0.1	0.0	0.0	-0.1	-0.2	-0.1
Peru	0.0	-0.1	-0.4	0.1	-0.1	-0.1	-0.5	-0.1
Uruguay	0.0	0.0	-0.2	0.0	-0.1	-0.1	-0.2	-0.1
Venezuela	0.0	0.0	0.0	0.1	-0.1	-0.1	-0.1	-0.1
Average	0.0	0.0	-0.2	0.0	-0.1	-0.1	-0.3	-0.1
Weighted Average	0.0	0.0	-0.2	0.1	-0.1	-0.1	-0.3	-0.1

Table 18
Elasticity of Human Development and Social Indicators with respect to a Permanent Increase in Government Spending on Infrastructure

	HDI	Poverty headcount ratio at $1 a day (PPP)	Poverty headcount ratio at $2 a day (PPP)	Gross enrollment in prim. & sec. education	Average years of schooling	Under-5 mortality rate	Maternal mortality rate	Access to Improved water source	GINI index
Argentina	0.07	-0.38	-0.17	0.04	0.02	-0.23	-0.10	0.01	-0.21
Bolivia	0.11	-0.46	-0.11	0.04	-0.04	-0.22	-0.08	-0.01	-0.18
Brazil	0.16	-0.63	-0.34	0.06	0.14	-0.24	-0.13	0.05	-0.34
Chile	0.23	-1.05	-0.50	0.07	0.23	-0.27	-0.15	0.07	-0.47
Colombia	0.18	-0.68	-0.23	0.05	0.04	-0.24	-0.11	0.01	-0.28
Costa Rica	0.09	-0.50	-0.27	0.05	0.10	-0.25	-0.13	0.03	-0.29
Dominican Republic	0.28	-1.11	-0.51	0.07	0.23	-0.28	-0.16	0.08	-0.49
Ecuador	0.30	-1.05	-0.50	0.07	0.23	-0.26	-0.15	0.07	-0.47
El Salvador	0.14	-0.58	-0.23	0.05	0.05	-0.23	-0.11	0.02	-0.26
Jamaica	0.15	-0.69	-0.33	0.06	0.12	-0.25	-0.13	0.04	-0.33
Mexico	0.28	-1.00	-0.55	0.07	0.28	-0.27	-0.17	0.09	-0.50
Panama	0.18	-0.65	-0.29	0.05	0.10	-0.22	-0.11	0.03	-0.30
Peru	0.09	-0.49	-0.12	0.04	-0.03	-0.21	-0.08	-0.01	-0.19
Uruguay	0.10	-0.62	-0.24	0.05	0.06	-0.22	-0.11	0.02	-0.27
Venezuela	0.26	-0.92	-0.41	0.06	0.17	-0.25	-0.13	0.06	-0.40
Average	0.17	-0.68	-0.29	0.05	0.09	-0.24	-0.12	0.03	-0.31
Weighted Average	0.17	-0.69	-0.32	0.05	0.12	-0.24	-0.12	0.04	-0.33

Table 19
Elasticity of Human Development and Social Indicators with respect to a Permanent Increase in Government Spending on Health

	HDI	Poverty headcount ratio at $1 a day (PPP)	Poverty headcount ratio at $2 a day (PPP)	Gross enrollment in prim. & sec. education	Average years of schooling	Under-5 mortality rate	Maternal mortality rate	Access to Improved water source	GINI index
Argentina	0.02	-0.30	0.02	0.05	-0.05	-0.29	-0.52	-0.02	-0.02
Bolivia	0.02	-0.16	0.02	0.05	-0.03	-0.29	-0.53	-0.01	0.00
Brazil	0.04	-0.28	-0.02	0.06	-0.01	-0.30	-0.53	0.00	-0.04
Chile	0.04	-0.21	-0.04	0.06	0.01	-0.30	-0.54	0.00	-0.05
Colombia	0.05	-0.23	-0.01	0.05	-0.02	-0.30	-0.53	-0.01	-0.03
Costa Rica	0.03	-0.37	-0.03	0.06	-0.02	-0.30	-0.53	-0.01	-0.05
Dominican Republic	0.05	-0.21	-0.04	0.06	0.01	-0.30	-0.54	0.00	-0.04
Ecuador	0.05	-0.19	-0.04	0.06	0.01	-0.30	-0.54	0.00	-0.04
El Salvador	0.04	-0.27	0.01	0.05	-0.04	-0.29	-0.53	-0.01	-0.02
Jamaica	0.03	-0.20	-0.02	0.06	0.00	-0.30	-0.54	0.00	-0.03
Mexico	0.04	-0.21	-0.04	0.06	0.01	-0.30	-0.54	0.00	-0.05
Panama	0.05	-0.30	-0.03	0.06	0.00	-0.29	-0.53	0.00	-0.05
Peru	0.01	-0.14	0.03	0.05	-0.04	-0.29	-0.52	-0.01	0.01
Uruguay	0.02	-0.24	0.01	0.05	-0.03	-0.29	-0.52	-0.01	-0.02
Venezuela	0.05	-0.21	-0.02	0.06	0.00	-0.29	-0.53	0.00	-0.04
Average	0.04	-0.23	-0.01	0.05	-0.01	-0.29	-0.53	0.00	-0.03
Weighted Average	0.04	-0.24	-0.02	0.06	-0.01	-0.30	-0.53	0.00	-0.03

Table 20
Elasticity of Human Development and Social Indicators with respect to a Permanent Increase in Government Spending on Education

	HDI	Poverty headcount ratio at $1 a day (PPP)	Poverty headcount ratio at $2 a day (PPP)	Gross enrollment in prim. & sec. education	Average years of schooling	Under-5 mortality rate	Maternal mortality rate	Access to Improved water source	GINI index
Argentina	0.02	-0.27	0.02	0.20	-0.05	0.00	0.02	-0.02	-0.02
Bolivia	0.03	-0.27	0.00	0.20	-0.03	0.00	0.01	-0.01	-0.03
Brazil	0.04	-0.36	-0.03	0.20	-0.02	-0.01	0.01	-0.01	-0.06
Chile	0.04	-0.27	-0.05	0.20	0.02	-0.01	0.00	0.00	-0.06
Colombia	0.03	-0.19	-0.02	0.20	-0.01	-0.01	0.00	0.00	-0.03
Costa Rica	0.03	-0.33	-0.03	0.20	-0.01	-0.01	0.01	0.00	-0.05
Dominican Republic	0.09	-0.21	-0.05	0.20	0.02	0.00	0.00	0.01	-0.05
Ecuador	0.09	-0.28	-0.06	0.20	0.02	-0.01	0.00	0.01	-0.06
El Salvador	0.05	-0.17	0.03	0.20	-0.04	0.00	0.02	-0.01	0.00
Jamaica	0.04	-0.40	-0.05	0.20	0.00	-0.01	0.00	0.00	-0.07
Mexico	0.06	-0.41	-0.08	0.20	0.02	-0.02	0.00	0.01	-0.09
Panama	0.04	-0.27	-0.04	0.20	0.00	0.00	0.01	0.00	-0.05
Peru	0.02	-0.19	0.06	0.19	-0.07	0.01	0.02	-0.02	0.02
Uruguay	0.03	-0.16	0.04	0.20	-0.05	0.01	0.02	-0.02	0.01
Venezuela	0.05	-0.21	-0.02	0.20	0.00	0.00	0.00	0.00	-0.03
Average	0.03	-0.27	-0.02	0.20	-0.01	-0.01	0.01	0.00	-0.04
Weighted Average	0.04	-0.31	-0.03	0.20	-0.01	-0.01	0.01	0.00	-0.05

Table 21
Elasticity of Human Development and Social Indicators with respect to a Permanent Increase in Current Government Spending

	HDI	Poverty headcount ratio at $1 a day (PPP)	Poverty headcount ratio at $2 a day (PPP)	Gross enrollment in prim. & sec. education	Average years of schooling	Under-5 mortality rate	Maternal mortality rate	Access to Improved water source	GINI index
Argentina	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
Bolivia	0.01	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	-0.01
Brazil	0.01	-0.04	-0.03	0.00	0.02	0.00	0.00	0.01	-0.02
Chile	0.01	-0.02	-0.02	0.00	0.01	0.00	0.00	0.00	-0.01
Colombia	0.01	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	-0.01
Costa Rica	0.01	-0.04	-0.04	0.00	0.03	0.00	-0.01	0.01	-0.02
Dominican Republic	0.02	-0.04	-0.04	0.00	0.03	0.00	-0.01	0.01	-0.02
Ecuador	0.01	-0.02	-0.01	0.00	0.01	0.00	0.00	0.00	-0.01
El Salvador	0.01	-0.02	-0.02	0.00	0.01	0.00	0.00	0.00	-0.01
Jamaica	0.01	-0.03	-0.02	0.00	0.02	0.00	0.00	0.01	-0.01
Mexico	0.01	-0.02	-0.02	0.00	0.01	0.00	0.00	0.00	-0.01
Panama	0.02	-0.06	-0.05	0.00	0.04	0.00	-0.01	0.01	-0.03
Peru	0.00	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	0.00
Uruguay	0.01	-0.03	-0.03	0.00	0.02	0.00	0.00	0.01	-0.02
Venezuela	0.01	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	-0.01
Average	0.01	-0.03	-0.02	0.00	0.02	0.00	0.00	0.01	-0.02
Weighted Average	0.01	-0.03	-0.02	0.00	0.02	0.00	0.00	0.01	-0.02