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ECONOMIC GROWTH AND INCOME DISTRIBUTION IN CHILE: MACROECONOMIC TRADE-OFFS REVISITED*

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Abstract:

Long run sustainable development requires both sustained growth and an equitable distribution of the fruits of growth and modernization. This paper analyzes the issue of maintaining the dynamic growth momentum of the Chilean economy while at the same time reducing poverty and improving income distribution patterns. The paper identifies the major constraints on growth for the Chilean economy and develops a macro model to explore and quantify potential trade offs between growth, poverty reduction and distribution.

The model is calibrated with parameters for the Chilean economy and used to examine the effects of various macro policies with distributive content. For example the model shows that an unbalanced increase in government spending (in social sectors) of 3 percent of potential GDP, will slow down the rate of growth of GDP by 1 percent, the real exchange rate appreciates (5.4 percent) and real wages rise (4.4 percent) in a capacity constrained-growth regime. The cut in government savings is the driving force behind the deceleration in growth, given a certain current account deficit. The adverse side effect on growth of the social program can be avoided with an increase in taxation or a reduction in other public spending items in order to prevent a decline in public savings.

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The paper also explores the impact of a reduction in interest servicing abroad and a cut in mark-ups rates on the rate of GDP growth, the real wage, the real exchange rate and the inflation rate under alternative growth-regimes.

1. Introduction

The performance of the Chilean economy since the mid 1980s has been very strong, after recovering from the severe crisis of 1982-83. In fact, between 1985 and 1991 Chile's GDP grew at an average annual rate of 5.6 percent in a context of declining inflation, reduced fiscal and current account deficits and diminished external indebtedness. The strong growth performance has been driven mainly by a recovery of investment and by rapid export growth. Initially, the recovery was helped also by unused capacity and a large pool of unemployed labor, though since the late 1980s an increased effort at capital formation has been instrumental in sustaining high growth rates. However, the adjustment period and the subsequent recovery was far from costless in terms of social welfare, affecting more low income groups. Open unemployment averaged 13 percent between 1981 and 1991. Only since 1989 unemployment fell below 10 percent. Moreover, it took nearly a decade for (average) real wages to recover their level of 1981. The real minimum wage, in turn, is still below its level of 1980. Moreover, estimates of the share of population living below the poverty line by the mid to late 1980s gave a number of around 45 percent (see Torche, 1988), a figure that seems to have fallen to around 35 percent as of 1992.

In this perspective, a key policy question for the Chilean economy is how to preserve the remarkable growth momentum of the last years, while, at the same time, making progress in reducing poverty, improving the standard of living of low income groups and, in general, distributing the fruits of progress and modernization in a more equitable fashion among different groups of the population.

A consensus has developed that a crucial requisite to reduce poverty is the maintenance of high output growth. That leads to an increase in the demand for labor, reducing unemployment and sustaining a rise in real wages that benefits labor, the people who live from a salary. In addition, sustained growth generates tax revenues to the government that can be spent on health and education and other social services benefitting low income groups. In fact, the mere effect of growth, per-se, may be not enough to improve, in a reasonable period of time, the relative position of low income and vulnerable groups that live in poverty. Since the basic needs of the poor are pressing and they do not have other assets to generate income, they can hardly wait until the benefits of growth "trickles down" to them.

This paper makes the point that the relationship between growth and distribution may be more complicated than it apparently looks in a period of booming growth. In an economy vulnerable to external shocks and with inflationary biases embedded-in like the Chilean economy, protracted demand contraction can not be ruled out as a policy response to large external shocks or exacerbated inflationary pressures. Demand contraction hits more the poor through cuts in unemployment and drop in real wages. On the other hand, in a context of capacity constrained growth, the problem of saving generation is crucial. In this case, the generation of additional domestic saving may require an income re-distribution in favor of (relatively) high saving groups then

worsening income distribution. In a more favorable vein, income distribution and economic growth may go hand in hand through several mechanisms: higher education can make compatible a better distribution of income with accelerated economic growth in the long run. Also a more even distribution of income can bring "social peace" providing a more friendly environment for private capital formation and output growth. Finally, in an economy with excess capacity an increase in real wage can produce an expansion in aggregate demand and output; though this effect is of a more short-term nature.

The purpose of this paper is to examine analytically and empirically what are the main macroeconomic constraints to achieve **both** growth and a better income distribution in the Chilean economy. The paper is organized as follows. Section 2 discusses the record of adjustment, growth and distribution in the 1980s and early 1990s. It also assesses current and future (likely) constraints for growth in Chile. Section 3 presents a formal macroeconomic model that formally incorporates the major constraints (external, saving and fiscal) for growth. The model, in turn, introduces the distinction between demand constrained, capacity constrained and inflationary growth regimes under which different macroeconomic policies may have distinct effects on growth and distribution.

In Section 4, the model is numerically calibrated with parameters of the Chilean economy. This procedure allows us to parameterize the foreign, savings and fiscal constraints, or gaps, and to quantify the major trade-offs between growth and distributional variables (proxied by the real wage). Then three policy exercises are explored with the model: (i) an increase in public spending in social sectors by 3 percent of potential GDP; (ii) a reduction of interest payments abroad by 3 percent of potential GDP; and (iii) a reduction in the mark-up rate by 4 percent. Those policies are carried out under different growth regimes, though more emphasis is given to the capacity constrained-growth regime in order to reflect the limits imposed by existing productive capacities on output expansion.

In each exercise, the policies are evaluated in terms of their impact on the rate of GDP growth, the rate of capacity utilization, the real exchange rate, real wages, and the rate of inflation. Finally, the paper concludes in Section 5.

2. Adjustment, Growth and Distribution in Chile: Recent Trends and Constraints

The 1980s were a turbulent period for the Chilean economy (see Tables 1 and 2). In the early 1980s the Chilean economy went through a cycle of high growth, currency appreciation and massive capital inflows. That cycle ended in 1982. In that period, Chile accumulated a large external debt. Key relative prices like the real exchange rate and domestic real interest rates were clearly out of line with fundamentals generating large external and internal imbalances. In 1982, with the onset of the debt crisis and as a consequence of previous policy mistakes, the economy fell into a protracted recession: output declined by a cumulative 15 percent between 1982-83, investment collapsed, unemployment soared and a serious financial crises set-in. After 1984, output started to recover as a full-scale financial crash was averted and other macro imbalances corrected. From a social perspective, between 1984 and 1988, the resumption of growth benefitted low income groups mainly through an employment creation effect as the unemployment rate declined from near 19 percent in 1983 to

TABLE 1

CHILE: MACROECONOMIC INDICATORS, 1981-1991

	(1) GDP (Rate of change % per year)	(2) CPI (Rate of change % per year)	(3) Investment Rate (% of GDP)	(4) Fiscal Balance (% of GDP)	(5) Current Account (% of GDP)	(6) Real Exchange Rate a/ (1980 = 100)	(7) Terms of Trade (1980 = 100)
1981	5.7	9.5	19.5	0.3	-14.5	87.0	84.3
1982	-14.7	20.7	15.0	-4.0	-9.5	97.0	80.4
1983	-0.8	23.1	12.9	-3.3	-5.7	116.4	87.5
1984	6.3	23.0	13.2	-4.5	-10.7	121.7	83.2
1985	2.4	26.4	14.8	-2.9	-8.3	149.5	78.5
1986	5.7	17.4	15.0	-1.6	-6.5	164.5	82.0
1987	5.5	21.1	16.5	0.3	-4.8	171.5	77.0
1988	7.4	12.7	17.0	3.6	-0.7	182.9	98.0
1989	10.0	21.4	20.3	2.0	-4.4	178.6	95.0
1990	2.1	27.3	20.8	1.1	-5.2	185.4	86.0
1991	6.0	18.7	20.0		0.6	175.0	83.0

Sources: Monthly Bulletin - Central Bank of Chile (various issues). Cols. (1) – (6).
Preliminary Outlook for Latin America and the Caribbean (various issues). ECLA-UN. Col. (7).
a/ An increase in the index is a real exchange rate depreciation.

TABLE 2

CHILE: SOCIAL INDICATORS, 1981-1991

	(1) Average Real Wage (Index, 1980 = 100)	(2) Real Minimum Wage (Urban) (Index, 1980 = 100)	(3) Unemployment Rate (Percent)	(4) GDP per capita (Index, 1980 = 100)
1981	108.9	115.7	10.4	103.5
1982	108.6	117.2	19.6	88.5
1983	97.1	94.2	18.7	86.6
1984	97.2	80.7	15.9	90.3
1985	93.5	76.4	16.0	91.0
1986	95.1	73.6	13.9	94.6
1987	94.7	69.1	12.6	98.3
1988	101.0	73.9	10.2	103.9
1989	102.9	79.8	9.1	112.3
1990	104.8	86.9	9.1	112.6
1991	109.7	94.8	6.1	116.5

Sources: Preliminary Outlook for Latin American and the Caribbean. ECLA-UN. Cols. (1) – (2), (4).
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around 10 percent in 1988[1]. Real wages remained depressed until 1987; thereafter, they started to grow again, recovering by 1991, their level of a decade ago. However, the income of lower skilled workers as proxied by the real minimum wage lagged behind average real wages (see Table 2). Nevertheless, an important recovery of the real minimum wage took place in 1990-91, increasing by 15 percent with respect to 1989.

An important issue is to identify the main constraints to growth in the Chilean economy. In the 1980s, particularly after the crisis of 1982-83, and through most of the decade, the external constraint was clearly important: given the high levels of external indebtedness of Chile at the time, it was necessary to reduce the reliance on foreign savings as the main source of financing for investment and growth. Most of the savings effort relied on generating additional private and public savings. In general, that was accomplished through maintaining private and public consumption growing at a rate below the rate of growth of GDP (see Solimano, 1993). In the early 1990s, however, the external constraint has lost part of its relevance as a consequence of the strong export performance of the Chilean economy and because of the reversal of capital inflows towards Latin America in general, and Chile in particular. However, history teaches the need to be cautious in declaring the external constraint irrelevant, given the vulnerability of the Chilean economy to large external shocks and sudden changes in direction of capital inflows[2].

Towards the late 1980s, it was clear that the margins of excess capacity were exhausted and the economy had to rely on an increased pace of capital formation in order to sustain high growth rates. This is a constraint that looms important for the medium term. Between 1989 and 1991 the Chilean economy grew at an average rate of near 6 percent with a ratio of fixed capital formation to GDP of 20 percent. The implicit incremental capital output ratio of this period is much lower than the corresponding one of other historical periods, say the 1960s. Though the Chilean economy underwent deep structural changes in the last two decades that may have increased the efficiency of capital, it still remains the question on the sustainability of maintaining, over protracted periods of time, growth rates of GDP of 5.5–6.0 percent per year with investment ratios of the order of 20 percent. However, Marfán (1992) has observed that an important change in the mix between productive and residential investment has taken place in the last two decades. In the 1960s, nearly one-third of total gross capital formation corresponded to residential investment, whereas, currently, just one-fifth of total gross capital formation amounts to residential investment. The main implication of this finding is that a rate of investment of say 20 percent of GDP, today, embodies a higher level of "productive investment" than in the 1960s, therefore it is able to sustain a higher rate of growth of potential output than in that period.

The current low level of unemployment suggest that labor could become an important constraint on growth[3]. Strictly speaking, a constraint of labor will not appear as a "physical" one. It will show-up through an upward pressure on real wages as the labor market turns more tight. That upward pressure on real wages can reduce the rate of profit and through this way investment and growth. In addition, it may give rise to an inflationary bias operating through the rate of growth of nominal wages.

An important, but often overlooked issue in assessing growth perspectives comes from the side of the *demand* for investment. Standard sources of growth calculations always assume a passive investment function, where the critical factor is the availability of savings. However, this is just part of the story. No economy has remained in a high growth path without an important dosis of "animal spirits" or "Schumpeterian entrepreneurship" that drive the system towards a "higher circular

flow" of productive investment, innovation and growth. In Chile, the economic model based on free markets and an open economy seems to be the engine for this outburst of entrepreneurship.

Inflation in Chile has been moderately low during the whole adjustment and recovery process (it averaged roughly 20 percent per year between 1981 and 1991). The maintenance of moderately low inflation rates helps growth. In fact, recent econometric evidence[4] shows that inflation (particularly at high levels) hampers capital formation and growth through its adverse effects on macroeconomic stability; hence low and stable inflation is an input for growth. However, stabilization may have negative effects on short term growth. The need to avoid inflationary tendencies often leads governments to follow stop and go policies: every time the rate of growth of aggregate demand hovers around the threshold of full capacity output, the economy has to be cooled down, generating cycles of contraction and expansion.

What are the constraints on income distribution and poverty alleviation? As mentioned at length, maintaining growth is essential for poverty alleviation and redistribution. However, there are some additional constraints related to the ability of the state to carry out that process. First, there is a policy choice regarding the amount of resources to be devoted to social spending; this depends, among other things, on the political pressure of the groups to be potentially benefitted with the income transfer vis à vis those that will have to be taxed. Second, there are limits, on the ability of the state to implement social policies. Some difficulties to channel resources to health and education in Chile is an example of this. Third, at the macroeconomic level, the room for social policies and distributive initiatives is conditioned, to a great extent, by how tight (or relaxed) the external, saving and capacity constraints are and by the state of the public finances. The fiscal situation is currently in good shape to accommodate increases in government spending with a social content; however, different fiscal instruments should be used to maintain (or even increase) the current levels of public saving since they constitute an important source of financing public and aggregate investment (see next section). Fourth, there are political constraints on the amount of redistribution that can be made without jeopardizing private investment and, consequently, growth.

In the next section, we specify the macro model that will permit us to quantify some of the constraints on growth and distribution and the trade-offs between these goals.

3. A Formal Model

In this section we shall specify a simple macroeconomic model that explicitly incorporates growth into the analysis and highlights trade-off with distributive indicators like the real wage. The model used in this paper follows the recent three-gap model formulation of Bacha (1990) and Taylor (1988, 1992) that include besides the traditional savings and foreign gap a fiscal gap. However, the model formulated in this paper departs from Bacha-Taylor in that it allows for key relative prices like the real wage and the real exchange rate to play a role in the attaining of macroeconomic equilibrium and the defining of a growth path.

The analysis distinguishes between different "growth-regimes," where the regimes are classified as demand constrained, capacity constrained and inflationary growth regimes. Every regime, in turn, describes the macroeconomic environment in which the

growth process takes place. Analytically this may prove to be a useful way to link the short and the medium run and it is also intended to show how different policies can affect the rate of growth in distinct ways, depending upon the dominant regime in the economy.

The model first identifies which are the main macroeconomic constraints to growth following the traditional distinction between the external constraint (or foreign gap), the savings constraint (or internal gap) and the novel fiscal constraint whose meaning will be discussed later.

The next step is to provide a behavioral content to the main equations of the model. Then, we specify which variables endogenously adjust to bring macro equilibrium and which variables are taken as exogenously determined. The closure rule adopted is what defines the growth-regime.

Let us start, first, with the national accounts identity between investment and savings:

$$(Y - C - T) + (T - G) + (M - X) = I \tag{1}$$

where Y is output (GDP), C is private consumption, T is current revenues of the government, G is government consumption, M represents total imports, X are total exports and I is gross investment.

Introducing net factor payments abroad, R^*, (which includes interest payments on foreign debt) and assuming that a share q of the debt is owed by the private sector and a share 1–q by the government, $0 < q < 1$, equation (1) can be written as:

$$(Y - C - T - qR^*) + (T - G - (1-q)R^*) + (M - X + R^*) = I \tag{2}$$

Redefining terms, S_p is national saving equal to $Y - C - T - qR^*$, S_g is public savings equal to $T - G - (1-q)R^*$, and S_f is foreign savings, namely the deficit in the current account, $M - X + R^*$. Therefore,

$$S_p + S_g + S_f = I \tag{3}$$

Equation (3) is the saving constraint. Investment, as a share of potential GDP, (the normalizing variable of the model, that is neutral to cyclical changes in GDP), $i = I/y$, is related to the rate of potential GDP growth, $g = \delta y/y$, through the following equation:

$$g = g_o + ki \tag{4}$$

where k is an incremental output-capital ratio. Understanding equation (4) as an aggregate production function, the term g_o reflects the rate of growth of overall factor productivity and the labor force.

Private national saving is made a function of disposable national income: $YD = Y(1-t) - qR^*$. Expressing the saving function (relative to potential GDP), $s_p = S_p/y$, as a linear function of national disposable income:

$$s_p = a_o + a_1[(1-t)u - qr^*] \tag{5}$$

where $u = Y/y$ is the level of capacity utilization, t the average direct tax rate, and qr^* is the part of interest payments abroad served by the private sector, as a share of potential GDP.

Public saving, in turn, can be decomposed as S_g = (taxes + net surplus of public enterprises + net transfers) – (current consumption + interest payments on public debt). Public savings as a ratio of potential output, $s_g = S_g/y$, is made a linear function of the level of capacity utilization. Tax revenues and operational profits of public enterprises are assumed to rise with u. Hence:

$$s_g = b_o + b_1 u \tag{6}$$

Foreign saving, the current account deficit (in dollars), s_f', as a ratio of potential output, may be written as the sum of imports of capital goods, m_k, imports of intermediate goods, m_z, and imports of consumption goods, m_c minus total exports, x, plus net factor payments abroad, r^{*} (all lower-case variables are shares of potential GDP):

$$s_f' = m_k + m_z + m_c - x + r^{*} \tag{7}$$

Imports depend on relative prices and output (or its rate of growth). The imports of capital goods, are written as a function of the rate of growth of potential GDP, g, and the real exchange rate (perhaps with a low elasticity in the short run, in the case of capital goods not produced at home), defined as $e_r = ep^{*}/p$, where e is the nominal exchange rate, p^{*} is international prices and p is the price of domestic goods:

$$m_k = f_o + f_1 g + f_2 e_r \qquad f_1 > 0, f_2 < 0 \tag{8}$$

Imports of intermediate goods, normalized by y, are made a function of the real exchange rate and the level of capacity utilization:

$$m_z = h_o + h_1 e_r + h_2 u \qquad h_1 < 0, h_2 > 0 \tag{9}$$

Adopting a similar specification for the imports of consumption goods yields:

$$m_c = j_o + j_1 e_r + j_2 u \qquad j_1 < 0, j_2 > 0 \tag{10}$$

Following standard specifications of export equations, total exports will be a positive function of the real exchange rate, e_r, and the level of world demand, Y^{*}:

$$x = v_o + v_1 e_r + v_2 Y^{*} \qquad v_1 > 0, v_2 > 0 \tag{11}$$

The balance of payments (normalized by potential output) may be written as $B/y = F/y - s_f'$, where B represents the rate of accumulation of international reserves, F denotes net capital inflows and s_f' is the (normalized) current account deficit, expressed in dollar terms[5]. Plugging equations (8), (9), (10), (11) and (7) into the balance of payments definition, we obtain the **foreign exchange constraint:**

$$F/y - B/y = s_f' = c_o + c_1 e_r + c_2 u + c_3 g + r^{*} + c_4 Y^{*} \tag{12}$$

Equation (12) represents the constraint imposed by the balance of payments on the level of economic activity and the rate of growth of GDP when the availability of

foreign exchange is a binding restriction on the system. In turn, the coefficients in (12) correspond to $c_o = f_o + h_o + j_o - v_o$, $c_1 = f_2 + h_1 + j_1 - v_1$, $c_2 = h_2 + j_2$, $c_3 = f_1$ and $c_4 = v_2$.

As the current account, is denominated in dollar terms, the sign of the coefficient c_1, denoting the impact of a real depreciation on the current account deficit, is non-positive (i.e., $c_1 < 0$). Namely a real depreciation will improve (or at least not deteriorate) the dollar value of the current account of the balance of payments. Conversely, the current account in (domestic currency) could deteriorate after a real devaluation if the deficit is initially large or the trade elasticities are too low. In order to focus on the constraints to growth, we shall solve equation (12) for the rate of growth of potential GDP:

$$g_f = 1/c_3 \{s_f' - c_o - c_1 e_r - c_2 u - r^{*} + c_4 Y^{*}\} \tag{13}$$

g_f is the maximum rate of growth of potential GDP that a foreign exchange constrained economy could afford in order to satisfy the restriction imposed by the balance of payments. In this setting, an increase in interest payments abroad, a rise in r^{*}, shall reduce growth because of the lower availability of foreign exchange to finance imports of capital goods. A real depreciation, i.e $\delta e_r > 0$, allows to accelerate the rate of growth of GDP since it provides extra foreign exchange through increasing net (of capital goods) exports. Conversely an increase in the level of capacity utilization, i.e., as a consequence of following expansionary demand policies, will tend to increase the imports of current goods, for a given level of net foreign financing and exports, that amounts to a cut in imports of capital goods and growth, i.e., $\delta g_f/\delta u < 0$.

The saving constraint, in turn, includes foreign saving in domestic currency. Normalized by the level of potential output, the equation for foreign saving in domestic currency, $s_f = S_f/y$, may be written as:

$$s_f = w_o + w_1 e_r + w_2 u + w_3 g + w_4 Y^{*} \tag{14}$$

where w_o picks up the intercepts of equations (8)–(11), included the term representing net factor payments abroad in domestic currency relative to potential GDP, $r^{*} = R^{*}/y$. The coefficient w_1 will be assumed to take a value less than zero, $w_1 < 0$, namely a real depreciation of the exchange rate will **reduce** the current account deficit in domestic currency. Furthermore $w_2 > 0$ and $w_3 > 0$, $w_4 < 0$.

The condition of savings equal to investment, or the saving gap, given by equation (3), normalized by the level of potential output, can be written as:

$$i = s_p + s_g + s_f \tag{15}$$

Combining equations (4), (5), (6) and (14) and plugging them into equation (15) gives rise to the **saving constraint** expressed in terms of the rate of growth of potential output:

$$g_s = (k/1-kw_3) \{d_o + d_1 e_r + d_2 u\} \tag{16}$$

where g_s is the maximum rate of growth of potential GDP consistent with the saving constraint. In turn, $d_o = g_o/k + a_o + b_o + w_o - a_1 q r^{*}$, $d_1 = w_1 < 0$ and $d_2 = a_1(1-t) + b_1 + w_2 > 0$.

A stability condition is that $kw_3 < 1$. From our previous assumption that $w_1 < 0$, a real devaluation will **reduce** growth if the savings constraint is binding and output is at full capacity, say u = 1. This result is due to the reduction in foreign saving following the real devaluation not compensated with an increase in domestic saving (see equation (5)). Looking at it from the demand side, given Y = y (full capacity utilization), an increase in net exports following a real depreciation has to be accommodated through a reduction in investment (and potential growth) in order to maintain a constant level of output. Conversely, if output (or the rate of capacity utilization) were allowed to vary, in a keynesian fashion, a real devaluation that increases net exports and output, will **not** necessarily crowd-out investment and slow growth since domestic saving will rise along with u.

Up to this point we have stated the foreign exchange and the saving constraints, let us turn now to the **fiscal constraint**. This constraint intends to capture the impact of the availability of fiscal resources to finance public investment required to support a given rate of GDP growth, both through the direct contribution of public investment to growth and indirectly through its effects on private investment.

Another dimension of fiscal deficit lies in its effects on macroeconomic stability in particular on inflation and the balance of payments. In this perspective, the fiscal constraint may be interpreted as a "constraint of macroeconomic stability," considering a stable macro environment as a requisite for sustainable growth.

A useful way to write the fiscal constraint is in terms of Public Sector Borrowing Requirements, PSBR, since it includes public investment and then it can be linked to the GDP growth rate. Using lowercase notation to denote variables normalized by the level of potential output:

$$psbr = i_g - s_g \tag{17}$$

where psbr = PSBR/y is the ratio of public sector borrowing requirements and potential GDP; in turn, $i_g = I_g/y$ is the ratio of public investment to potential GDP and $s_g = S_g/y$ represents public sector savings as was previously defined.

To solve the fiscal constraint in terms of the rate of growth of potential GDP let us decompose total investment, relative to potential GDP, i , into the sum of private investment, i_p, and public investment, i_g:

$$i = i_p + i_g \tag{18}$$

Now, making private investment a function of the level of public investment and the level of capacity utilization[6], obtain:

$$i_p = i_o + \alpha i_g + \beta u \tag{19}$$

The sign of the coefficient α shall depend on whether public investment crowds-in or crowds-out private investment. Typically, in LDC's, government investment in infrastructure like roads, ports and the like is expected to be complementary with private investment. On the other hand, some public investment may be competitive with private investment. If the former effect is dominant α is positive, conversely if crowding-out effects were dominant β would turn negative[7]. The parameter β is expected to be positive, since an increase in the rate of capacity utilization (an indicator

of demand conditions and also of profitability) will have a stimulative effect on private investment.

Now, replacing (19) in (18) we can write:

$$i = i_o + (1 + \alpha)\, i_g + \beta u \tag{20}$$

Inserting equation (20) in (4) and solving for i_g yields:

$$i_g = 1/k\,(1 + \alpha)\,\{g - g_o - k\,(i_o + \beta u)\} \tag{21}$$

Replacing equation (21) in (17) and solving for g, we obtain:

$$g_g = k\,(1 + \alpha)\,\{psbr + b_o + (g_o/k + i_o)/1 + \alpha + (b_1 + \beta/1 + \alpha)u\} \tag{22}$$

where g_g is the maximum rate of potential GDP growth consistent with the fiscal constraint defined in terms of a certain (psbr) public sector borrowing requirement target. In this context a relaxation of the fiscal constraint, e.g., the psbr coefficient increase, channeled towards an increase in public investment will increase the rate of GDP growth (we are assuming that $1 + \alpha > 0$).

Another result is that increases in u, the rate of capacity utilization, shall accelerate g_g since net revenues and therefore public savings increase then providing more resources to finance higher public investment and support more growth.

The price level in the model is given by

$$p = (1+ \tau)\,(\mu w + \phi ep^*) \tag{23}$$

where τ is the (constant) mark up rate, μ is the labor-output coefficient, w is the nominal wage rate, ϕ is the foreign input component of a unit of output and ep^* is the domestic currency price of foreign inputs.

Dividing both sides of equation (23) by p and solving for w/p we obtain a monotonic inverse relationship between the real wage and the real exchange rate given the mark-up rate and the technical input-output coefficients:

$$w/p = 1/\mu\,\{1/1+ \tau - \phi\, ep^*/p\} \tag{24}$$

Summarizing, the model can be reduced to five equations: the foreign exchange constraint equation (13), the saving constraint equation (16), the fiscal constraint represented by equation (22), equation (24) is the relationship between the real wage and the real exchange rate. The inflation sector of the model is presented below, equations (26) and (27) and is represented in semi-reduced form by equation (28). These equations, in turn, are solved for the rate of growth of GDP, g, the level of capacity utilization, u, the real exchange rate, ep^*/p, the real wage, w/p, and the inflation rate, π.

Let us turn now to the *three regimes* defined in the model. The regimes are defined according to the dominant constraint on the macro system and they affect the nature of the equilibrium in a significant way. The first regime is a fix price-excess capacity regime where w, p, e are fixed ($\pi = 0$) and the system is solved for g and u. This regime will be labeled as a ***demand constrained-growth regime***, where growth takes

place in an economy operating with excess capacity. One way to solve the system in this regime would be through the *min.* condition, for a given u:

$$g = \min \{g_f, g_s, g_z\} \quad (25)$$

Another way to solve the system in the demand constrained regime is to obtain simultaneously a solution for g and u assuming fix the real wage, the real exchange rate and the price level. If prices are fixed, or at least sticky, in a Keynesian fashion, quantities (included now the rate of potential GDP growth), must adjust to attain macroeconomic equilibrium.

The second regime represents the case of an economy operating at full capacity, u = 1, where wages and prices are flexible (e is fixed or predetermined by the exchange rate system). This situation corresponds to the ***capacity constrained-growth regime*** where the growth process takes place in an economy operating at full capacity. In a model with different savings propensities between labor and capital, full capacity utilization and nominal wages adjusting slower than prices, this would correspond to a **forced savings regime** where changes in income distribution towards high savings groups is the adjusting mechanism to assure full capacity, see Taylor (1991) and Solimano (1987, 1988).

A third regime we explore is an ***inflationary-growth regime*** in which growth occurs in a macro setting characterized by inflation and slow adjustment in the goods market (à la Phillips curve). Inflation in this open economy, is a weighted average between the rate of growth of nominal wages and the rate of growth of the domestic price of imported inputs (the rate of devaluation plus foreign inflation). Inflationary pressures in the goods market operate through their effect on the rate of growth of nominal wages. Formally, differentiating equation (24) and assuming a constant mark up rate, yields:

$$\pi = \Omega\, \hat{w} + (1 - \Omega)\, (\hat{e} + \pi^*) \quad (26)$$

where $\pi = \delta p/p$, $\hat{w} = \delta w/w$, $\hat{e} = \delta e/e$ and $\pi^* = \delta p^*/p^*$. In turn, the parameter Ω denotes the share of labor in unitary costs and $1 - \Omega$ is the share of intermediate inputs.

The wage equation in rate of growth form is endogenous in the model and depends on current inflation and the degree of excess demand (or supply) in the goods market:

$$\hat{w} = \sigma\pi - \varepsilon\, (1 - u) \quad (27)$$

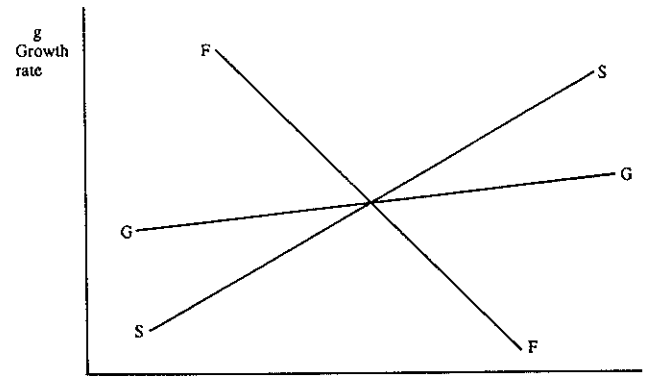
where σ is a wage indexation coefficient and ε measures the sensitivity of nominal wages growth to degree of slack or excess demand in the goods market, measured through deviations of current capacity utilization from full capacity use $1 - u$. Plugging equation (27) into (26) we arrive to the following expression for the rate of inflation:

$$\pi = 1/1 - \Omega\sigma\, \{\Omega\, \varepsilon\, (u - 1) + (1 - \Omega)\, (\hat{e} + \pi^*)\} \quad (28)$$

In general, this regime may be consistent both with a demand constrained or a capacity constrained situation in the goods market. Figures 1 to 3 show the graphical solution of the model for each growth-regime and the comparative statics are developed in the next section with an empirical application to Chile.

FIGURE 1

DEMAND CONSTRAINED–GROWTH REGIME



In Figure 1, the downward sloping FF schedule represents the external constraint, equation (13), in the space (g, u). For given values of the real exchange rate and interest payments abroad. It is negatively sloped since an increase in u raises current goods imports, reducing the resources available to import capital goods hence forcing to cut-down growth, $\delta g_f/\delta u < 0$. The SS schedule representing the saving gap, equation (16), is upward sloping since an increase in u rises domestic saving generating more resources to invest, $\delta g_s/\delta u < 0$. The GG schedule is the fiscal constraint, equation (22), is also positively sloped since an increase in the rate of capacity utilization increases net revenues of the government, thus producing more resources to finance a higher level of public investment that could support more rapid growth. On the other hand, the schedule is assumed to be flatter than the SS schedule.

The equilibrium solution for g and u arises from the intersection of the three schedules SS, FF and GG. In case these lines do not intersect at the same point, some assumption is needed with respect to which gap is not binding in the system in order to avoid an overdetermined system.

Figure 2 represents the capacity constrained-growth regime in the space g and e_r (in this regime, capacity utilization is fixed, u = 1). The FF schedule is positively sloped now, reflecting the positive effect of a real depreciation on the availability of foreign exchange that allows to finance a higher level of capital goods imports and support more rapid growth. The SS schedule is negatively sloped since a real depreciation is assumed to reduce the deficit in the current account, cutting foreign savings. Then a lower level of investment (and growth) is required to maintain savings = investment. Finally, the GG schedule is an *horizontal* line, independent of e_r.

In the bottom part of Figure 2 we draw the relationship, in level form, between real wages and the real exchange rate, equation (24). The relationship is negative, e.g., a real depreciation implies a cut in real wages, as far as the mark-up and the input-output coefficients in the price equation remain fix. An improvement in productivity or a reduction in the mark-up would allow a real depreciation of the exchange rate –again in external competitiveness– that need not to be accompanied by a squeeze in real wages.

FIGURE 2

CAPACITY CONSTRAINED-GROWTH REGIME

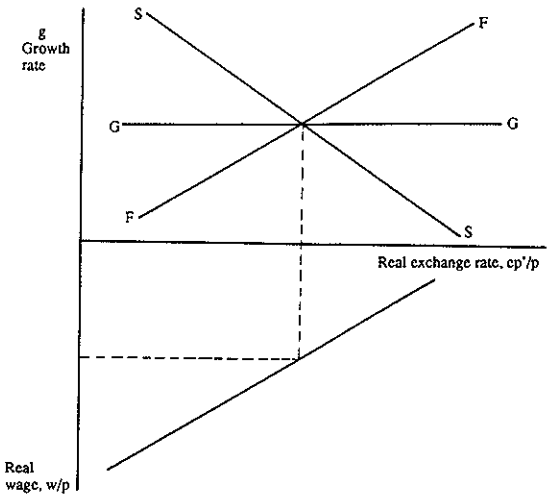


FIGURE 3

INFLATIONARY-GROWTH REGIME

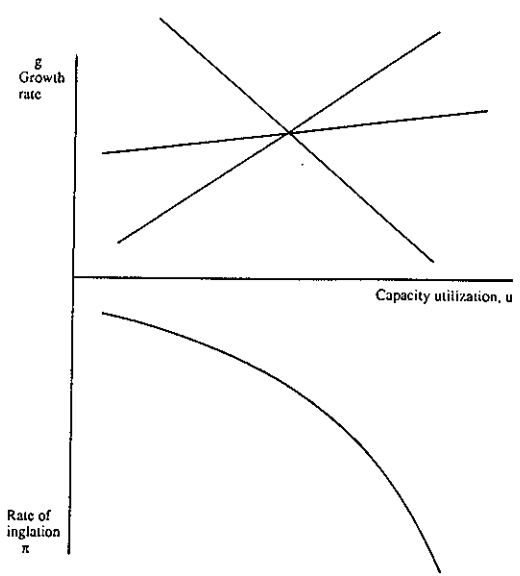


Figure 3 represents the inflationary-growth regime. The upper part of this figure corresponds to the demand constrained regime and the bottom part displays the relationship between the rate of inflation and the rate of capacity utilization, equation (28), given a rate of devaluation and foreign inflation. The slope of the schedule gets steeper (worsening the trade-off between inflation and the level of capacity utilization) as the economy approaches full capacity utilization, wage growth respond more to and increase in u and/or the degree of wage indexation increases in the economy.

4. A Numerical Calibration of the Model for Chile

In this section the model specified in the previous section is calibrated. The calibration procedure uses coefficients drawn from econometric estimates of some key functions (like import and export equations, investment equations, price equations (see appendix)) and from assumed plausible coefficient values. To assure consistency to the base year values of the variables coming from National Accounts and Balance of Payments Statistics (that base year is 1987) the constant terms of the model's equations are adjusted so as the equations replicate the actual values of the variables and the identities for that year (calibration procedure). The appendix documents the initial values of the variables of the model and some parameters used to estimate the growth constraints and other relationships of the model.

Let us turn now to the parameterization of the model. Taking 1981 as a year of "full" capacity utilization for the Chilean economy (also 1989 or 1991 could as a benchmark year) and assuming an annual rate of growth of potential output of 1.5 percent we obtain a rate of capacity utilization for 1987 of 0.946 (a little bit higher than the estimated for that year in Marfán and Artiagoitía, 1989). The incremental output-capital ratio, k, is 0.333 so the implied ICOR is 3.0. The accelerator coefficient in the investment function, β, is 0.059 and the crowding-in parameter, α, is –0.23 (Zucker, 1988[8]). The parameterization of the private sector saving rate function is $s_p = -0.087 + 0.16\ u$, for the public saving rate is $s_g = -0.046 + 0.1\ u$ (note that negative intercepts imply marginal saving rates for private saving and public sector net revenues that exceed averages propensities). The foreign saving rate function, in domestic currency, is $s_f = 0.136 + 0.34\ e_r + 0.645\ i + 0.487\ u - 0.314\ Y^*$. These equations show (recall the model is stated in terms of shares) that a 1 percent increase in the rate of capacity utilization increases private savings by 0.16 percent and public savings by 0.1 percent (a flatter GG schedule than the SS locus in the (g,u) space, Figure 1).

The foreign saving equation, in turn, shows that a real depreciation of 10 percent shall reduce the current account deficit by 3.4 percent. On the other hand, a 1 percent increase in the capacity utilization ratio will increase the current account deficit in 0.645 percent. Combining these equations (private, public and foreign saving rates) we obtain the saving constraint. Solving for the rate of growth of GDP yields:

$$g_s = 0.010 - 0.318\ e_r + 0.699\ u - 0.294\ Y^*.$$

In terms of the Figure 1 notice that a real depreciation shifts downward the SS schedule. Given u this means that a real devaluation of the exchange rate **reduces** growth when the saving gap is binding.

Turning to the foreign gap, or balance of payments constraint, the parameterized equation is $g_r = -0.064 + 0.198\, e_r - 0.251\, u + 0.161\, Y^*$.

It is downward sloping in the space g,u but the terms of the trade-off between capacity utilization and growth seem to be not too severe (–0.251) along the foreign exchange gap. A real depreciation, in turn, shifts upward the FF schedule allowing a **higher** rate of GDP growth given u. Which effect dominates? It is clear that the downward shift of the SS schedule following a real devaluation is larger than the upward shift in FF (–0.318 versus + 0.198). Then a real depreciation would be contractionary e.g. it **reduces** growth in a *demand constrained-growth regime* given the parameters values used in the calibration[9]. In this respect, the mirror image of a real devaluation, namely a ***cut in real wages***, would ***decelerate growth*** (but increase capacity utilization) in the case the saving gap shift is dominating, see Figure 4. However, if the economy were in a *foreign exchange constrained-growth regime*, in the sense that the upward shift in FF dominates, the opposite result for the rate of growth of potential GDP will be obtained; namely a ***cut in real wages*** would ***accelerate growth***. Therefore, a demand constrained-growth regime is consistent both with an accelerationist or stagnationist response of growth to a cut in real wages[10]. The final result will depend on the specific parameters values that make the saving gap or the foreign gap effect to dominate following a cut in real wages. Turning to the parameterization of the fiscal constraint we get $g_s = 0.010 + 0.049\, u$. Then, it is apparent that the trade-in coefficient between u and g along the fiscal gap is quite small.

The inflation equation is parameterized as $\pi = 0.55\, \hat{w} + 0.45\, (\hat{e} + \pi^*)$, where the mark-up rate as well as the input-output coefficients are assumed to be constant. From this equation the relationship between real wages and the real exchange rate, in log-change form, is $\hat{w} - \pi = -0.81\, (\hat{e} + \pi^* - \pi)$. Then a real devaluation of 10 percent will reduce real wages by 8.1 percent holding the mark-up and the input-output coefficients as fixed.

The wage equation is $\hat{w} = 0.7\, \pi + 0.25\, (1 - u)$. This assumes an indexation coefficient of 0.7 for nominal wages and a coefficient of response of nominal wages to the current output gap of 0.25. Combining the structural equation of inflation with the wage equation we get the following semi-reduced equation for the rate of inflation $\pi = 0.223\, (u - 1) + 0.731\, (\hat{e} + \pi^*)$[11]. It is interesting to note that the sensitivity of inflation to the output gap is rather moderate (0.223). However, we can expect that the relationship between capacity utilization and inflation to be non-linear with an increase of the coefficient as the economy is closer to full capacity. In fact, that parameter could be specified as a positive function of u, say $\delta\varepsilon/\delta u = \varepsilon\,(u)$, $\varepsilon' > 0$. This consideration may become important in the Chilean case as a high level of capacity utilization may start to generate inflationary pressures that will be underestimated if predicted with parameters corresponding to a macro regime with more slack. Pressures to change the wage indexation coefficient could also be observed if inflation accelerate, though for the current levels of inflation in Chile these pressures may not be very serious yet.

Finally, it is worth to mention that the coefficient that measures the impact of changes in the rate of devaluation on inflation (0.731) is much higher than the coefficient of the output gap (a feature appearing also in other empirical studies of inflation in Chile, Corbo (1985), Corbo and Solimano (1991), Jadresic (1985)). From a policy perspective, it is important to be aware that the exchange rate policy is bound to have a quantitatively significant effect on the rate of inflation in Chile.

5. Policy Exercises

With the model parameterized we are in conditions to carry out some policy exercises. As discussed at some length, an important message of the model is that the qualitative and quantitative effects of different policy instruments are regime-dependent; therefore we have to make some assessment on the dominant growth regime under which the policy exercises take place. The Chilean economy in 1991 operated with little excess capacity, then, the economy can be modeled as in a capacity constrained-growth regime. Then the exercises are carried out, mainly under this regime; though, for the sake of completeness, results of simulations under the demand constrained and inflationary regimes are also presented.

An Increase in Public Spending (in Social Sectors) of 3 percent of Potential GDP

The first exercise we are dealing with is an increase in current public spending of 3 percent of (potential) GDP directed to social sectors. According to Larraín's (1987) calculations this would be the approximate magnitude of the required initial internal transfer to low income groups in order to allow them (in a period of 5 years) to get above the poverty line and satisfy their basic needs requirements in terms of food, housing and basic services.

Table 3 summarizes the effect of an increase in 3 percent of potential GDP of public spending in the capacity constrained growth regime.

TABLE 3

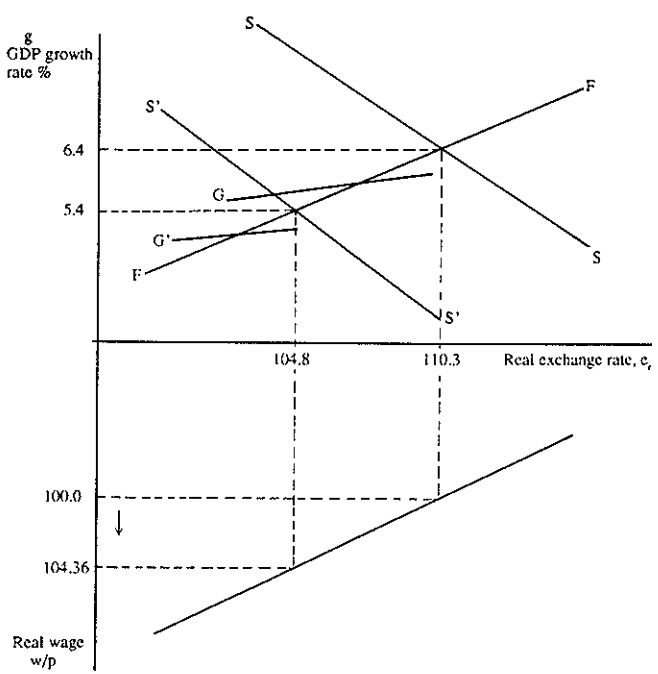
EFFECTS OF AN INCREASE IN PUBLIC SPENDING OF 3 PERCENT OF (POTENTIAL) GDP (CAPACITY CONSTRAINED-GROWTH REGIME)

	Base year solution (1)	Solution with a 3 percent increase in the government spending share (2)	Difference (2) – (1) percentage (3)
Rate of growth of GDP, percent	6.43	5.36	–1.07
Real exchange rate (index)	110.27	104.88	–5.39
Real wages (Index)	100.00	104.36	4.36
Rate of growth of GDP percent under a dominant fiscal constraint	5.90	5.26	–0.64
A balanced increase in public spending (matched by an increase in fiscal revenues of 3 points of GDP)	6.43	6.43	0.0

A main result of Table 3 is that an unbalanced (e.g. not financed by a corresponding increase in taxation) increase in the public spending share of 3 percent slows the rate of growth of GDP by 1 percent. This effect is due to the *reduction* in public saving (taxes and/or other type of public spending remain unchanged in this simulation). The fall in public saving, in turn, leads to a reduction of domestic saving that forces (given foreign saving) to cut private and public investment and decelerate growth. This result has to be qualified in the sense that it refers to the short-term. In the medium-term growth may accelerate with an increase in spending in human capital (see Lucas, (1988), Romer, (1989)). As displayed in Figure 4 the increase in government spending shifts backward the SS locus (at a given real exchange rate, the rate of growth g has to be lower to accommodate a lower level of domestic saving). Given the FF schedule the system gets a new equilibrium with both lower growth and a lower real exchange rate. The real appreciation is 5.4 percent (given a fixed nominal exchange rate, domestic prices have to increase to preserve goods market equilibrium at full capacity). On the other hand, real wages rise by 4.4 percent (see bottom part of Figure 4) and labor enjoys higher real wages but slower employment growth. In terms of income distribution, labor and low income groups are expected to benefit from higher social spending.

FIGURE 4

EFFECTS OF AN INCREASE IN PUBLIC SPENDING OF 3% OF POTENTIAL GDP
(CAPACITY CONSTRAINED-GROWTH REGIME)



In the case the fiscal gap is binding the slowdown in GDP growth is –0.6 percent, given a public sector borrowing requirements target. However, it is worth mentioning the simulation in the bottom of Table 3, that shows that a fully balanced increase in public spending; that is, an increase in expenditure matched by an equivalent increase in fiscal revenues –for example due to an increase in income taxes or the value added tax– will *not* affect the rate of growth of GDP because fiscal saving remain unchanged in a balanced fiscal expansion at full capacity.

A main lesson of this exercise is that in order to avoid the *trade-off* between better income distribution (pursued through an unbalanced increase in fiscal spending in social sectors) and slower growth in a capacity-constrained economy, it is necessary to avoid a reduction in government saving. Since the terms of the trade-off are not trivial, this will require to finance the additional public spending in social sectors with increased taxation and/or reduced government spending in other sectors.

Debt Relief: A Reduction in Interest Payments on Foreign Debt

A second policy exercise we will explore here is a reduction in interest payments abroad of 3 percent of potential GDP; either as a consequence of cutting the effective interest rate paid on existing debt and/or because the country obtains a reduction in its outstanding principal as a part of a comprehensive debt relief scheme.

In terms of our model this policy shall affect the three constraints. The external gap is relaxed in proportion to the improvement in the current account associated with the 3 percent reduction in r^*. To determine the impact of the interest payments reduction on the other two gaps we make the assumption that 2/3 of the fall in r^* is shared by the public sector (that amounts to 2 percent of potential GDP) and 1/3 (say 1 percent of potential GDP) is shared by the private sector.

The fiscal constraint is relaxed in proportion to the increase in government saving associated with the reduction in public debt servicing abroad. Given a value of the psbr (public sector borrowing requirements), this leaves room for an increase in public investment. The saving constraint improves because public saving increase, the transfer abroad is reduced and the private sector saves more. The latter in response to the perceived increase in real disposable national income as a consequence of lower interest payments serviced by the private sector. In addition, this effect could be greater if a cut in taxes is envisaged, following the reduced obligations of the public sector with foreign creditors.

As Table 4 shows, the gains in terms of acceleration in the rate of GDP growth following the 3 percent of GDP reduction in interest payments abroad are significant: 1.67 percent. On the other hand, the real exchange rate appreciates in 8.14 percent and real wages rise by 6.6 percent (the mark-up is held constant). In terms of Figure 5 both the SS and the FF schedules shift upward. The fall in the equilibrium real exchange rate is due to the relatively larger shift in FF because of the improvement in the current account following the reduction in interest payments abroad. Clearly there is an improvement in the standard of living reflected in both higher real wages and accelerated growth following a reduction in the external debt burden.

The public finances also improve, and provided the resources released from reduced public debt servicing are channeled towards an increase in public investment, the rate of growth of GDP accelerates by 0.67 percent when the fiscal gap is binding.

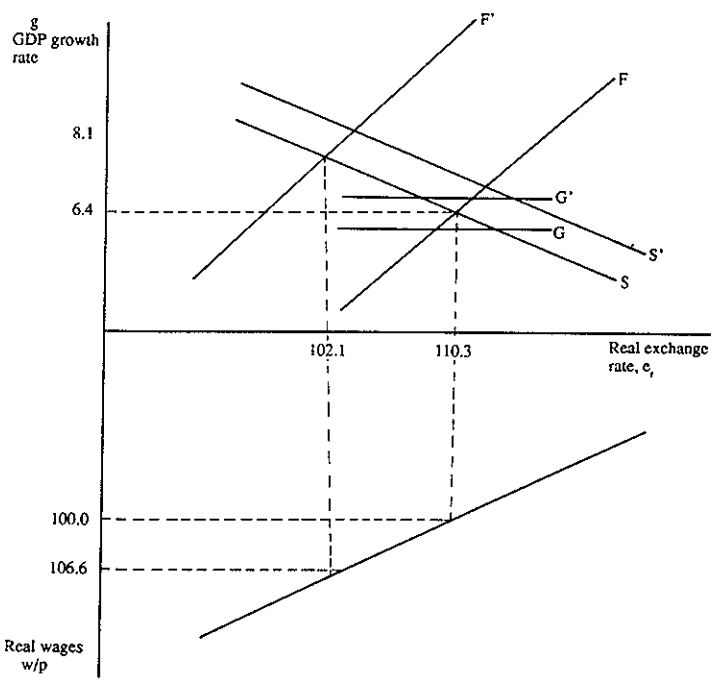
TABLE 4

EFFECTS OF A REDUCTION IN INTEREST PAYMENTS ABROAD OF 3 PERCENT OF (POTENTIAL) GDP
(CAPACITY CONSTRAINED-GROWTH REGIME)

	Base year solution (1)	Solution with a 3 percent reduction in interest payments abroad (2)	Difference (2) – (1) percentage (3)
Rate of growth of GDP (Percent)	6.43	8.1	+1.67
Real exchange rate (index)	110.27	102.13	–8.14
Real wages (Index)	100.00	106.6	+6.6
Rate of growth of GDP percent under a dominant fiscal constraint	5.9	6.55	+0.65

FIGURE 5

EFFECTS OF A REDUCTION IN INTEREST PAYMENTS ABROAD OF 3% OF POTENTIAL GDP
(CAPACITY CONSTRAINED-GROWTH REGIME)



A Reduction in the Mark-up Rate of 4 Percent

The last exercise we explore is a reduction in the mark-up rate of 4 percent. This distributive **cum** competitiveness-enhancing policy may be accomplished through a cut in tariffs or by rising profit taxes. Incidentally, a cut in mark-ups is qualitatively equivalent **in its impact on prices** to a cut in indirect taxes i.e., a reduction in the value-added tax rate, as was done in Chile in 1988. Of course, the distributive and fiscal effects may be different.

To trace out the macro effects of the reduction in the mark-up we need first to define how it is distributed between higher real wages and a higher real exchange rate. For simplicity we shall assume that both increase in the same proportion, say 4 percent. This satisfies our price equation (28) written in rate of growth form, modified to allow for a change in the mark-up, formally:

$$-\delta\,(1+\tau)/(1+\tau) = \Omega\,(w-\pi) + (1-\Omega)(\hat{e}+\pi^{*}-\pi)$$

where $w - \pi = \hat{e} + \pi^{*} - \pi = 0.04 = -\delta\,(1+\tau)/1+\tau = -(-0.04)$.

The exercise will be carried-out in a demand constrained-inflationary growth regime as depicted in Figure 6; whose numerical values (base year and policy solution) are shown in Table 5.

TABLE 5

EFFECTS OF A REDUCTION IN THE MARK-UP RATE OF 4 PERCENT
(DEMAND CONSTRAINED-INFLATIONARY GROWTH REGIME)

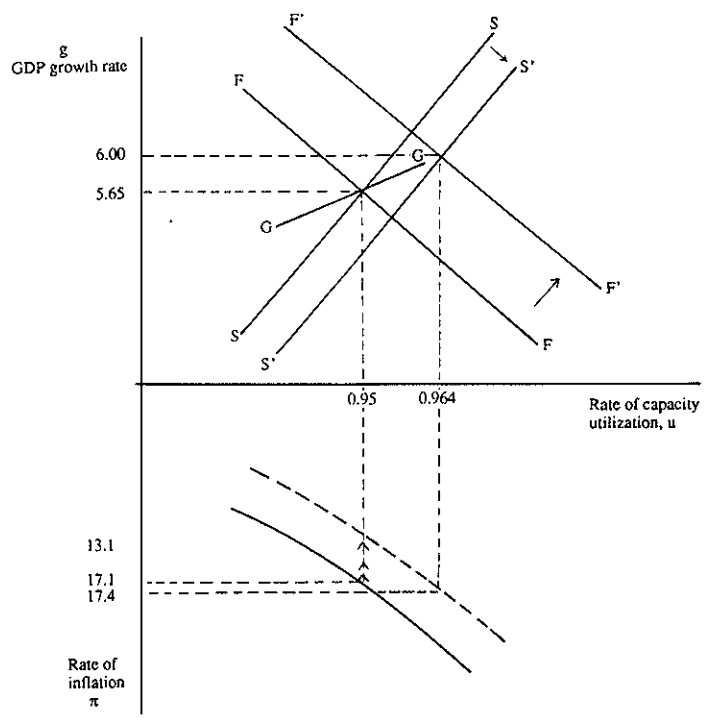
	Base year solution (1)	Solution with a 4 percent reduction in the mark-up rate (2)	Difference (2) – (1) percentage (3)
Rate of growth of potential GDP (Percent)	5.65	6.0	0.35
Rate of capacity utilization (index)	95.00	96.4	1.4
Real exchange rate (index)	100.0	104.0	4.0
Real wages (Index)	100.00	104.0	4.0
Rate of inflation on impact	17.1	13.1	–4.0
"permanent"	17.1	17.4	0.3

As Table 5 shows a reduction in the mark-up by 4 percent increases moderately the rate of growth of potential GDP, 0.35 percent, and increases the rate of capacity utilization by 1.4 percent. Growth accelerates because of the positive effect of the induced real depreciation on foreign exchange availability and imports of capital goods, dominates over the negative effect of the lower current account deficit on aggregate savings. In terms of Figure 6, the outward shift in FF, the foreign gap locus, outweighs the downward shift in the SS schedule or savings gap. On the other hand, the expansionary effect of the cut in the mark-up –the rate of capacity utilization rise in 1.4 percent– is due to the positive effect of increased investment and net exports (external competitiveness rises) on aggregate demand and output.

What happens with inflation following the reduction in the mark-up? The base year model solution for inflation is $\pi = 0.223\ (u - 1) + 0.731\ (\hat{e} + \pi^*)$ equal to 17.1 percent for $u = 0.95$, $\hat{e} = 0.20$ and $\pi^* = 0.05$. Maintaining the same rate of devaluation and foreign inflation, the "permanent" increase in inflation is 0.3 percent ($\pi = 17.4$ percent) and is associated to the new (higher) rate of capacity utilization.

FIGURE 6

EFFECTS OF A REDUCTION IN THE MARK-UP RATE OF 4 PERCENT
(DEMAND CONSTRAINED-INFLATIONARY GROWTH REGIME)



However, inflation is reduced "on impact" (given the initial rates of capacity utilization, devaluation and foreign inflation) due to the cut in the mark-up rate; inflation being equal to $\pi = 17.1 - 4.0 = 13.1$ percent.

6. Conclusions

The preceding analysis provides a framework to examine the macroeconomic constraints for sustained growth and the potential trade-offs between economic growth and an improvement in income distribution in Chile. A macro model that distinguishes between demand constrained, capacity constrained and inflationary-growth regimes is the framework used for that purpose.

The model is calibrated with parameters for the Chilean economy and used to examine the effects of various macro policies with some distributive content. The main results can be summarized as follows:

(i) An unbalanced increase in government spending (in social sectors) of 3 percent of potential GDP, will slowdown the rate of growth in GDP by 1 percent in a capacity constrained-growth regime. The cut in government saving is the driving force behind this result, given a certain current account deficit. In turn the real exchange rate appreciates (5.4 percent) and real wages rise (4.4 percent) after the increase in public spending. The adverse side effect on growth of this transfer program could be *avoided* by an increase in taxation or a reduction in other public spending items so to avoid that the social program will reduce public saving.

(ii) A reduction of interest payments abroad of 3 percent of GDP, in a capacity constrained situation, would accelerate the rate of GDP growth by 1.7 percent, reduce the real exchange rate by 8.1 percent and increase real wages by 6.6 percent. An improvement in the current account, along with a relaxation of the fiscal and saving gaps, gives rise to the acceleration in growth. The new equilibrium in the goods market and the balance of payments requires a lower real exchange rate therefore allowing a higher real wage.

(iii) A cut in the mark-up rate of 4 percent will increase external competitiveness and real wages simultaneously, allowing a higher rate of capacity utilization, which increases by 1.4 percent and growth of potential GDP to accelerate by 0.35 percent (demand constrained regime). Finally, inflation "on impact" would be reduced by 4 percent.

Finally, the maintenance of the current growth momentum of the Chilean economy needs to preserve the current upsurge of entrepreneurship of the private sector reflected in increased investment, export dynamism and a willingness to innovate. A policy commitment to maintain a stable market economy integrated to the world economy has contributed, in an important way, to that dynamism. However, in a country with a still considerable part of its population living in poverty, and with a historical sensitivity to social equity, sustainable growth requires poverty alleviation and an improvement in income distribution. Ultimately, growth and a better distribution of the fruits of progress and modernization will have to go hand in hand to make the development model sustainable in the long run.

Appendix

In this appendix we present the initial values of some key variables as ratios of potential GDP of the base year, 1987. We include also the parameterized form of some relationships of the model that are not included in the main text (constant terms correspond to adjusted values for the calibration year).

GDP growth rate: 0.055
Rate of capacity utilization: 0.946
Total consumption: 0.757
Gross investment rate: 0.16
Total exports: 0.31
Total imports: 0.284
Consumption goods imports: 0.096
Intermediate goods imports: 0.13
Capital goods imports: 0.059
Resource surplus: 0.03
Net factor payments abroad: 0.081
Net current transfers: 0.0057
Current account deficit: 0.045
National savings: 0.114
National private savings: 0.064
Current government spending : 0.296
Current government spending: 0.246
Public savings: 0.05
Public investment: 0.069
Fiscal deficit : 0.019
(Public sector borrowing requirements)

Growth-investment relationship **(Equation 4)**

$$g = 0.0017 + 0.333\ i$$

Imports of consumption goods **(Equation 10)**

$$m_c = 0.035 - 0.146\ e_r + 0.218\ u$$

Imports of intermediate goods **(Equation 9)**

$$m_z = -0.0958 - 0.0286\ e_r + 0.269\ u$$

Imports of capital goods **(Equation 8)**

$$m_k = 0.079 - 0.02\ e_r + 0.645\ i$$

Total exports **(Equation 1)**

$$x = -0.191 + 0.191\ e_r + 0.319\ Y^*$$

Private investment rate **(Equation 20)**

$$i_p = 0.051 - 0.23\ i_s + 0.059\ u$$

Average direct tax rate = 0.2
Marginal saving rate = 0.2

Notes:

1 References on the behavior of the Chilean economy in the 1980s, are Corbo and Solimano (1991), Arellano (1988), Fontaine (1989). Analyses on poverty and income distribution in that period are Pollack and Uthoff (1986) and Rodríguez (1985), Raczynski and Romaguera (1992).

2 Simulations with macro models for Chile oriented to assess the impact of external shocks and the constraints imposed by the balance of payments are performed by Schmidt-Hebbel (1988), Celedón (1991), and Serven and Solimano (1991).

3 Marfán (1992) brings the issue in the discussion emphasizing the behavior of labor productivity.

4 See Serven and Solimano (1992) and Fischer (1991).

5 The term s_i' is a share, but to make units of measure compatible, it is a share of potential GDP in dollars.

6 This is a very simple specification of the equation of private investment that omits the direct effect of profitability and uncertainty on investment. However, the term u may also affect profitability and in this way investment. A more sophisticated model of investment for Chile appears in Solimano (1992).

7 See Serven and Solimano (1992) for a survey of different estimates of the impact of public investment on private investment in developing countries.

8 The negative coefficient of the public investment variable coming from the Zucker study reflects his sample covering the 1970s and part of the 1980s when public and private investment moved in opposite directions.

9 Solimano (1986) obtains a short-term contraction of output followed by an expansion in the medium run after a real currency devaluation.

10 See Taylor (1991) for a fuller discussion of stagnationist and exhilarationists responses of output to changes in real wages.

11 Serven and Solimano (1991) found a similar coefficient for the one-period lagged output gap variable in the inflation equation, using a full macro-econometric model for Chile.

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INTERTEMPORAL RESOURCE ALLOCATION AND INCOME TAX EVASION

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Abstract:

The discrimination against saving, in favour of present consumption, due to the income tax has been studied, at least, since the late thirties and was mentioned by John Stuart Mill more than a century ago.
This paper is concerned with the effect of evading such a tax on the discrimination against savings and capital accumulation. In particular, we want to study a situation in which the probability of detecting an evader is an increasing function of his accumulated evasion in the past. This is consistent with the tax authorities being stricter in the control of tax payers with a relatively high net wealth, with respect to the incomes declared.

1. Introduction

The discrimination against savings, in favour of present consumption, due to the income tax has been studied, at least, since the late thirties and was mentioned by John Stuart Mill more than a century ago[1].

Moreover, it is well known that such a tax distorts the labor market, as it reduces the equilibrium quantity below what it would have been in the presence of a lump sum tax of equal revenue[2]. The possibility of evading the income tax could compensate this substitution effect on the labor supply and demand, thus improving resource allocation and welfare[3].

This paper is concerned with the effect of the possibility of evasion on the discrimination against savings and capital accumulation due to the income tax. In

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