

CUBA: ECONOMIC GROWTH, AGING, AND LONG-TERM FISCAL SUSTAINABILITY

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Social security is at the center of the economic debate in most of the world. The intense population aging occurring in many advanced countries of Europe and Asia is causing social security finances to be under severe pressure, threatening fiscal sustainability. In Latin America and the Caribbean, the presence of relative young populations has shaped the debate around the type of social security system (with the discussion focusing on the advantages or disadvantages of pure pay-as-you-go, pure capitalization, or a mixed social security systems), rather than on the imminent problems associated with population aging. Cuba, however, constitutes an exception in this regard: while the policy discussions in the island have included elements associated with how to manage and finance social security, the core of the debate appears to be around how to cope with the consequences of population aging.

With sustained increases in life expectancy, net negative migration flows, and low birth rates, Cuba's population has begun to decrease in absolute numbers, while the working-age population is projected to decline during the next 15 years. As a consequence, the share of people 65 years or older is expected to grow to about 1/3 of total population (from less than 1/5 nowadays) by 2050, turning

Cuba in one of the 11 countries with the oldest population in the world (United Nations, 2011).

Recognizing this problem, the social security reform of 2008–09 increased the legal retirement age for both women and men by 5 years, avoiding what would otherwise had been a 2.9 percent annual increase in the number of social security beneficiaries during 2011–20. The reform also resulted in a significant decrease of the present value of future social security obligations.

In spite of the reform, however, current demographic projections still result in increasingly large social security spending, while there will be fewer workers contributing to the system. Concretely, the number of social security beneficiaries is expected to increase by 75 percent during the next 40 years to reach slightly less than 3 million by 2050, an increase of 1.4 percent per year. If long term GDP does not grow to offset the combined increase in the number of beneficiaries and the average pension, social security spending will increase as percentage of real GDP, threatening fiscal sustainability. Alternatively, higher long-term economic growth will result in larger social security contributions and will reduce the net present value of future social security spending flows. Thus, an accurate assessment of factors contributing to long-term growth is essential for evaluating the

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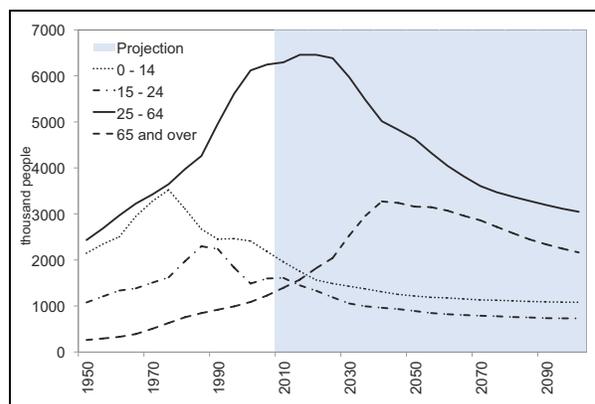
solvency of entitlement programs, and more generally, the sustainability of fiscal policy (Gordon, 2003).

This paper analyzes the interaction between population aging, long-term economic growth, and fiscal sustainability in Cuba. Although the problem of social security in Cuba has been analyzed in the literature (e.g., Mesa-Lago 2008), this paper constitutes a first effort in quantifying the impact of its future imbalances on fiscal sustainability. The first section describes Cuban demographic trends and their implications for labor supply and social security spending. The second calibrates a simple general equilibrium model using macroeconomic data for the last 40 years together with population and labor market projections, with a view to assess Cuba's sources of long-term economic growth and the challenges that population aging brings about. The next section assesses Cuba's social security spending trends and evaluates long-term fiscal sustainability for a number of scenarios that consider alternative long-term economic growth rates; levels of social security benefits in real terms; levels of foreign transfers; and, tax rates. The results presented in this section allow arguing that the process of economic reforms recently launched (including the recent social security reform), is likely related to the need to increase long-term productivity and output growth, save government resources, and improve long-term fiscal dynamics in the context of an intense population aging, and still large, dependence on foreign transfers. The last section concludes.

CUBAN DEMOGRAPHIC TRENDS ²

Cuba witnessed a continuous decrease in fecundity rates during the last 60 years. The number of daughters per woman decreased below the key value of one

Figure 1. Cuba: Population Trends



(consistent with a zero growth population) by the mid-1980s; it is projected to reach a minimum of less than 0.7 by 2020, and to slowly return to one thereafter, in a process that would take decades. Against this backdrop, the Cuban population has begun decreasing in absolute numbers, and aging pressures are expected to accelerate during the current decade. The lower fecundity rate is reflected in cohorts of newborns that are of a lower size than those that preceded them.³

Together with the lower fecundity rates, the median age of the Cuban population is increasing. It went from less than 25 years in the 1950s to about 40 years by 2010, and it is projected to reach 50 years by 2040. Contributing to this increase, the life expectancy at birth went from less than 60 years in the 1950s, to 78 in 2010. It is projected to reach 81 years by 2030. In particular, the life expectancy of those reaching 65 years of age is also increasing, which has a direct bearing on social security expenses.⁴ Reflecting population aging, the country's age structure is changing (Figure 1). The number of people 65 years

2. The analysis in this section is based on the projections published by the United Nations (World Population Prospects 2011), and the Cuban National Statistics Office (ONE, 2009), both of which are similar in spite of some level differences (e.g., the share of people 65 years and older as of 2010 is higher in ONE, 2009). Although ONE (2009) acknowledges that Cuban population will start decreasing faster than previously envisaged, the absolute decrease that is projected is a bit lower than that in United Nations (2011). The lower population decrease is the result of assuming a slight increase in total children per women and a decrease in net negative migration. United Nations (2011) includes three population projections, a "high" variant, a "medium" variant, and a "low" variant, each associated with different assumptions regarding the net birth rate. The one used in this paper corresponds to the "medium" variant.

3. Population aged between zero and 14 years old, peaked at 3.5 million in the mid-1970s, decreased to about 2 million by 2010, and is projected to continue decreasing before stabilizing at about 1.1 million by the end of the century.

4. See Peñate and Gutiérrez (2000), and United Nations (2011).

or older are projected to pass from about 1.4 million in 2010 (12 percent of population), to 2.5 million by 2030, and to more than 3 million by 2050 (30 percent of population). This intense population aging would turn Cuba in one of the 11 countries with the oldest populations by 2050, and that with the oldest population in Latin America and the Caribbean (United Nations, 2011).

Population aging will also affect labor supply, as the (legal) working-age population is projected to peak sometime during 2020–25.⁵ In particular, people between 25 and 64 years old are projected to decrease from about 8 million in 2010, to about 7 million in 2030, and further to 5.5 million by 2050. Assuming people continue to retire at legal ages, and barring a further increase in the legal retirement age, the decrease in the working-age population (and thus of the number of people contributing to social security) will occur simultaneously with the increase in social security beneficiaries.

Net negative migration rates have contributed both to the increase in the median age of the population and to a lower growth rate of the labor force. United Nations (2011) estimates suggest that net migration rates have been above the world median (among immigrant sending countries) for the most part of the last 50 years, and are projected to remain negative (but decreasing) during the next few decades.⁶ While migration during the first few years after 1959 included a significant number of elderly people, migrants during the last 20–30 years are mostly of working age (Pérez, 1986; Orozco, 2009).

The expected changes in the age structure will create policy challenges and demand difficult decisions. In particular, population aging will change the composition of the typical household and the functions within the family; produce an increase in the depen-

dependency ratio; put pressure on health and social security systems; require an increase in the supply of geriatric services, and a strengthening of health services aimed at the elderly; demand an adaptation of the working environment to allow for the working elderly; decrease the labor supply; and demand an analysis of the incentives behind the low fecundity rate (ONE 2009).⁷

ASSESSING TREND GROWTH USING A SIMPLE GENERAL EQUILIBRIUM MODEL

Assessing long-term growth is essential to analyze the sustainability of fiscal accounts, and in particular, of social security entitlements. Economic growth feeds into the value of marginal pension benefits, which together with the number of beneficiaries determine social security spending; the value of tax receipts and contributions that finance social security spending; and the (net) present value of future flows of social security obligations.

With that in mind, this section calibrates a general equilibrium model with Cuban macroeconomic and demographic data, in order to assess long-term economic growth; such assessment will be later used to evaluate the sustainability of fiscal and social security policies.

The Model

The economy is deterministic and is populated by a representative household, a representative firm and a government, and is composed by two planners. The economy is open in the sense that external trade in goods in services is allowed, though the size of any trade deficit ($-TB_t$) is bound by the sum of exogenous and known levels of foreign transfers (FT_t) and, zero-interest, real external public debt net flows (B_t), which are centrally managed by the first planner, so $-TB_t = FT_t + B_t$. The first planner also de-

5. The (legal) working-age population would have peaked before 2020, if not for the increase in the legal retirement age by 5 years for both men and women approved in 2008. Working-age population includes people aged 15–64 years.

6. United Nations (2011) projects that net negative migration in Cuba will slowly decrease in the coming decades, similar to what is assumed for Puerto Rico. Net negative migration flows for Jamaica and the Dominican Republic are projected to be negative for a longer period.

7. The dependency ratio expresses inactive population as percent of working population. According to ONE (2009), it will increase swiftly beginning in 2020.

defines the level of government spending (G_t), and given the exogenously determined path for foreign transfers and real external public debt net flows, it defines the average (net) tax rate (t_t) on total aggregate output (Y_t), so the following condition holds, $G_t = \tau_t \cdot Y_t + FT_t + B_t$.⁸ Inflows from foreign transfers need to be spent during the period they are received, as there is no technology to convert them into savings.

The second planner, taking the decisions of the first planner as given, maximizes the household's (discounted) utility derived from consumption of goods and basic services:

$$\sum_{t=0}^{\infty} \beta^t N_t \cdot U\left(\frac{C_t}{N_t}\right) \quad (1)$$

For computational purposes, it will be assumed that the utility function $U(x)$ is of the form,

$$U(x) = \frac{x^{1-\sigma}}{1-\sigma} \quad \text{with} \quad \lim_{\sigma \rightarrow 1} U(x) = \ln(x).$$

Aggregate consumption is denoted by C_t , $0 < \beta' \leq 1$ is the discount factor, and N_t denotes, the exogenous and known, non-sleeping hours of the (working age) population. This formulation implies that aggregate utility depends on the utility of consumption per available hour for the representative agent times the number of available hours of the population. The economy has access to a constant return to scale Cobb-Douglas technology:

$$Y_t = z_t \cdot F(u_{k,t} K_t, H_t L_t) = z_t \cdot (u_{k,t} K_t)^\alpha (H_t L_t)^{1-\alpha} \quad (2)$$

where, z_t is a measure of total-factor, or neutral productivity. α is a production function parameter that in a competitive equilibrium denotes the gross share of output allocated to capital, with $0 < \alpha < 1$. Aggregate labor effort (in hours) is denoted by $L_t = N_t \cdot \eta_t \cdot (1 - \mu_t) \cdot h_t$, where η_t is the (exogenous

and known) labor participation rate, μ_t is the (exogenous and known) unemployment rate, and h_t denotes the (exogenous and known) hours worked per year for the average worker as a ratio of available non-sleeping hours.⁹ There are two types of capital, physical capital, K_t , whose (exogenous and known) utilization rate is denoted by $u_{k,t}$, and human capital, H_t , which is assumed to linearly augment labor input. Effective working hours are thus defined as $H_t \cdot L_t$. Without loss of generality, it is assumed that $z_t = \gamma_z^t$, $H_t = \gamma_H^t$, $N_t = \gamma_N^t$ where γ_z denotes the (gross) growth rate of neutral productivity, γ_H the (gross) growth rate of human capital, and γ_N , the (gross) growth rate of the working-age population.

Disposable income (which by construction is equivalent to output of goods and basic services), $Y_t^D = (1 - \tau_t) \cdot Y_t$, can be used for either consumption or (gross, non-housing) investment, I_t :

$$Y_t^D = C_t + I_t \quad (3)$$

The stock of physical capital evolves according to,

$$K_{t+1} = K_t(1 - \delta_t) + I_t \quad (4)$$

where δ_t is the depreciation rate. The second planner's problem then involves picking paths for consumption and investment, so that (1) is maximized, subject to (3) and (4), and the usual non-negativity constraints, which in the current model are satisfied by the assumed functional forms. All labor force variables are exogenous. To complete the model, the following transversality condition (TVC) must be satisfied for the saddle path equilibrium, $\lim_{T \rightarrow \infty} \beta^T \lambda_T K_{T+1} = 0$, where $\beta^T \lambda_T$ denotes the Lagrange multiplier for the feasibility constraint (3), at time $t = T$.

8. Taxes are understood to be net of domestic transfers, and to include all forms used by the government to extract resources from productive activities to finance public spending. Although the model is non-monetary, taxation is meant to capture, e.g., the real transfers from the "inflation tax." The two-planner model is based on a model by R. Manuelli (Chapter 14, Ljungqvist and Sargent, 2004).

9. It is assumed 16 hours per day are non-sleeping.

Balanced Growth Path Conditions

Through an appropriate change of variables, the problem in (1)–(4) can be transformed into one in which all endogenous variables are stationary in steady state. This can be done by applying the transformation $\tilde{x}_t = X_t / \gamma_Y^t$ to $X_t = \{C_t, I_t, K_t, Y_t\}$, where $\gamma_Y = \gamma_z^{1/(1-\alpha)} \gamma_{H,N}$ is the (gross) rate of output growth, and $\gamma_{H,N} = \gamma_H \cdot \gamma_N$.¹⁰ Moreover, the production function (2) implies that output per effective hour will grow, along a balanced growth path, at a (gross) rate equal to:

$$\gamma_y = \gamma_z^{1/(1-\alpha)} \quad (5)$$

In turn, if one is interested in output per hour, equation (5) should be modified to incorporate the rate of growth of human capital, as follows:

$$\bar{\gamma}_y = \gamma_z^{1/(1-\alpha)} \gamma_H \quad (6)$$

Applying the change of variables to problem (1)–(4), finding the Steady State from the Kuhn-Tucker conditions, and dividing by \tilde{y} , results in the following Balanced Growth Path conditions:

$$1 = (\beta / \gamma_Y) [(1 - \tau) \cdot \alpha \cdot (\tilde{k} / \tilde{y})^{-1} + (1 - \delta)] \quad (7)$$

$$\tilde{i} / \tilde{y} = \tilde{k} / \tilde{y} [\gamma_Y - (1 - \delta)] \quad (8)$$

$$\tilde{c} / \tilde{y} + \tilde{i} / \tilde{y} = (1 - \tau) \quad (9)$$

In (7)–(9) above, \tilde{c} / \tilde{y} denotes the steady-state private consumption ratio, \tilde{i} / \tilde{y} is the steady-state investment ratio, and \tilde{k} / \tilde{y} is the steady state value for the non-housing capital stock as percent output. These ratios represent how the economy would evolve in the absence of major disruptions to the deep underlying structural parameters in Cuba.

Data and Calibration

The calibration of the model presents some challenges. A first challenge is related with the quality of Cuban historical data, including for the sample period

used in this paper (1970–2010). National accounts data through 1985 corresponds to estimates produced and published by the United Nations, as official Cuban data was compiled using the “Material Product System” (MPS), a technique developed in the former Soviet Union and used by most centrally planned economies (Mesa-Lago and Pérez-López, 1985). From 1985 onwards, national accounts compiled following the United Nations’ National Accounts Manual are available from a variety of sources (the United Nations Economic Commission for Latin America—ECLAC—and the Cuban National Statistics Office—ONE). However, even for the period post-1985, a number of methodological breaks introduce some noise to the time series (Pérez-López and Mesa-Lago, 2009). The dual monetary and exchange rate system that is in place since the second half of the 1990s creates some additional problems. In particular, the use of official exchange rates in the compilation of official national accounts may be biasing upwards the share of wages in national income and downwards the share corresponding to the remuneration of capital (Di Bella and Wolfe, 2008). Annex I describes the data series used for calibration and their definitions.

A second challenge is that Cuba is in the middle of a population transition. The working force’s growth rates have steadily decreased during the last 60 years, are projected to continue decreasing during the next 15 years and turn negative thereafter during a number of decades before reaching a non-growth steady state (United Nations, 2011). This implies that calibrating the steady state value of γ_N so it coincides with its observed average value during the historical sample period (as in Kydland and Prescott, 1982) would be unwarranted, as it would not reflect actual population trends. This calls for a calibration procedure that incorporates expected population trends into the analysis.

A third challenge is to analyze potentially unsustainable fiscal dynamics within an optimizing general equilibrium model. To go around this problem, the

10. This transformation is similar to that in Greenwood, Hercowitz, and Krusell (1997).

maximization occurs only after the first planner has “picked” government spending and the tax rate, given exogenously determined paths for foreign transfers and real external public debt net flows. The model rules out the possibility for the second planner to optimally pick a path for consumption consistent with increasingly unsustainable private debt levels.

A fourth challenge is that the historical period considered includes the economic adjustment that followed the collapse of the Soviet Union. The calibration needs to take this into consideration. In this connection, Popov (1999, 2007) analyzes the experience of a large number of former socialist economies and finds that a significant part of the Soviet-era capital became effectively unusable during the transition; Izyumov and Vahaly (2008) argue that as much as 30 percent of the capital stock was destroyed.

A final challenge is related with the fact that the (unobserved) path for z_t depends on the assumed value for the initial capital stock, K_{1970} . This is important as γ_z , determines the long-term growth rate of output per effective hour along a balanced growth path, as specified in (5).

Concretely, the balanced growth path conditions (7)–(9) define a system that includes 8 unknowns γ_Y , β , δ , α , τ , \tilde{c}/\tilde{y} , \tilde{i}/\tilde{y} , and \tilde{k}/\tilde{y} , so the solution requires calibrating 5 parameters. The parameters chosen for calibration are γ_Y , β , δ , α , and τ , what allows obtaining \tilde{k}/\tilde{y} from (7); \tilde{i}/\tilde{y} from (8); and, \tilde{c}/\tilde{y} from (9).

Calibration Period. To address the challenge caused by the ongoing population transition, the data used for calibration includes both historical data for 1970–2010, and going forward, United Nations (2011) population projections. Historical data is “cleaned” of its short-term fluctuations to recover

long-term trends.¹¹ This approach implies that the macroeconomic dynamics post-2010 resulting from the model will be shaped by projected demographic trends. In particular, for the period post-2010, it is assumed that the factors of production are fully employed (though with varying levels of productivity, see below), as the endogenous variables (k/y , i/y , and, c/y) converge to their steady states, which occurs only after population stabilizes. In other words, the historical time series for each variable is considered as part of a longer-term path, where each such variable eventually reaches its steady state.

Output growth rate. The calibration of γ_Y is done in two stages. First, the observed cumulated real output growth rate for 1970–2010, is decomposed into its observed and unobserved components. To obtain the unobserved cumulated growth rate for total neutral productivity ($\gamma_{z,1970-2010}$), it is assumed that the unobserved cumulated growth rate for the capital stock is about equal to the cumulated real output growth.¹² This allows recovering the initial capital stock (K_{1970}) given the observed path for real investment rates and the calibrated path for depreciation rates. In turn, K_{1970} allows recovering the initial level for total neutral productivity, given the observed output levels, labor market data, and human capital, whose gross growth rate is assumed equivalent to that of the years of education of the average worker. The cumulated rate $\gamma_{z,1970-2010}$ allows obtaining the (average) annual gross growth rate, γ_z . Second, the average annual productivity growth rate for 1970–2010 is assumed to remain unchanged post-2010. The same is assumed for the growth rate of human capital. The working force’s growth rates post-2010 are taken from United Nations (2011), which slowly converge to $\gamma_N = 1$. These allow obtaining

$$\gamma_Y = \gamma_z^{1/(1-\alpha)} \gamma_{H,N}$$

11. The capital stock utilization rate was approximated by the ratio between observed electricity consumption by productive activities and its long-term trend; such trend was estimated by filtering the original series with a Hodrick-Prescott filter ($\lambda = 100$) as in Di Bella, Romeu and Wolfe (2011). See Annex I for more details.

12. The rate $\gamma_{K,1970-2010}$ is unobserved because it depends on K_{1970} , which is also unobserved.

Production function parameter. The value for α is chosen so it coincides with the average gross share of output allocated to capital observed during 1970–2010. This value is assumed to remain unchanged post-2010.

Depreciation Rate. There is no official information on depreciation rates. The calibration assumes that equipment depreciates in 11.25 years, while engineering works and structures depreciate in 50 years (as in Aguilar and Collinao, 2001). However, to account for the capital destruction after the collapse of the Soviet Union, it is assumed that depreciation rates increased by 0.15 above their “normal time” values during 1992–1993 (i.e., at the outset of the “Special Period”), in line with the experience in other transition economies.

Net effective tax rate, foreign transfers, and real external public debt net flows. The tax rates for 1970–2010 are approximated so $G_t = \tau_t \cdot Y_t + FT_t + B_t$ holds, i.e., τ_t mirrors the behavior of FT_t , as the real value of any external public debt net flows during this period was assumed to be *de facto* real foreign transfers.¹³ In other words, when foreign transfers decrease, the tax rate increases, given a level of government spending. For instance, after the collapse of the Soviet Union foreign transfers virtually disappeared, so effective tax rates increased in order to finance government spending (which decreased but a rate lower than that of GDP). In turn, the net effective tax rates decreased during the last few years with the increase of Venezuelan purchases of Cuban services (that the model treats as foreign transfers). For the period post-2010, the average tax rate is calibrated so it remains constant at its 2010 value. In turn, foreign transfers are assumed to remain constant in real Cuban pesos during the period post-2010, i.e., a gradual decrease as a percent of GDP. Any fiscal disequilibrium going

forward is assumed to be financed by zero-interest, real external public debt net flows.

Utility discount rate. The discount rate β is chosen so the endogenously determined level for K_{2011} does not “jump too much” with respect to that of 2010. In other words, the endogenously determined growth rate for K in 2011 cannot be significantly different from the annual average growth rate observed for the period for which there is data available. The intuition behind this calibration procedure is that if β is too high, \tilde{k} / \tilde{y} will also be too high, and thus, it would require a discrete jump in investment rates in 2011, and a non-smooth transition in the capital-output ratio. The opposite would happen if β is too low.

Table 1. Calibration Results

	Historical	$\gamma_z=1.008$	$\gamma_z=1.015$	$\gamma_z=1.017$
β	0.790	0.790	0.790	0.790
δ	0.048	0.048	0.048	0.048
τ	0.224	0.333	0.333	0.333
α	0.533	0.533	0.533	0.533
γ	1.009	1.025	1.040	1.045
γ_z	1.001	1.008	1.015	1.017
γ_H	1.008	1.008	1.008	1.008
γ_N	1.000	1.000	1.000	1.000
K/Y	1.269	1.198	1.136	1.116
C/Y	0.703	0.689	0.677	0.673
I/Y	0.073	0.087	0.099	0.103

Source: Authors' calculations.

Calibration Results. Table 1 shows the calibration results. The calibrated long-term growth rates for neutral productivity (0.1 percent per year) and human capital (0.8 percent per year), determine the long-term output growth rate (0.9 percent per year).¹⁴ The long-term growth rate of the working force is zero, consistent with population trends. The tax rate for post-2010 is calibrated at about 22.5 percent of GDP (i.e., its estimated value for 2010). The utility discount factor is calibrated at about 0.8, which reflects a clear preference for consumption in

13. Much of the external debt contracted by Cuba previously to 1990 was never repaid, including debt with the former Soviet Union, former CMEA members, and other official bilateral debt.

14. The growth rate in the years of education of the average worker during 1970–2010 is higher than those observed in, for instance, Canada, Chile or Costa Rica. However, among tertiary/university graduates, there is a predominance of non-technical degrees. This suggests that $\gamma_H = 1.008$ might represent a higher bound.

the present, as opposed to future consumption. The endogenously determined steady states for the private consumption rate is about 70 percent of GDP; for the non-housing investment rate is slightly below 7.5 percent GDP; and the non-housing capital stock is about 1.27 times the GDP level.

“Historical” and Alternative Output Growth Rates

The long-term output gross growth rate of $\gamma_Y = 1.009$ is consistent with the historical data for 1970–2010, so it will be referred thereafter as the “historical” rate. The low output growth rate suggests that an important part of the headline growth observed since the 1970s was caused by the growth in the working age population, which averaged about 1.6 percent annually during 1970–2010. The low (and negative) net birth rates expected going forward suggest that this demographic bonus is already over.

As it was pointed out, one of the challenges of calibrating the model was that the value for neutral factor productivity growth depends on the value assumed for K_{1970} . To address this challenge, the model is calibrated for three alternative neutral factor productivity gross growth rates ($\gamma_z = 1.008$, $\gamma_z = 1.015$, and $\gamma_z = 1.017$), which result in long-term output gross growth rates of $\gamma_z = 1.025$, $\gamma_z = 1.04$, and $\gamma_z = 1.045$ respectively (Table 1). As a result, the endogenous steady state values for \tilde{k} / \tilde{y} , \tilde{i} / \tilde{y} and, \tilde{c} / \tilde{y} all change (as well as the value for β , which is affected only marginally). The calibrated values for all other parameters (δ , α and τ), remain unchanged. Figure 2 shows the forecast long-term dynamics for a number of selected variables. In the convergence to their steady states, the output growth rates are projected to be higher than steady state growth rates in the next few years, and then decrease below them, reflecting the shrinking working force.

These four output growth rates (i.e., the historical and the three alternative rates) will be used to assess fiscal sustainability in what follows.

SOCIAL SECURITY TRENDS, LONG-TERM ECONOMIC GROWTH AND FISCAL SUSTAINABILITY

This section presents social security spending projections that take into consideration the characteristics of the Cuban Social Security System. In turn, these projections are evaluated together with macroeconomic projections and demographic trends to make an assessment of long term fiscal sustainability.

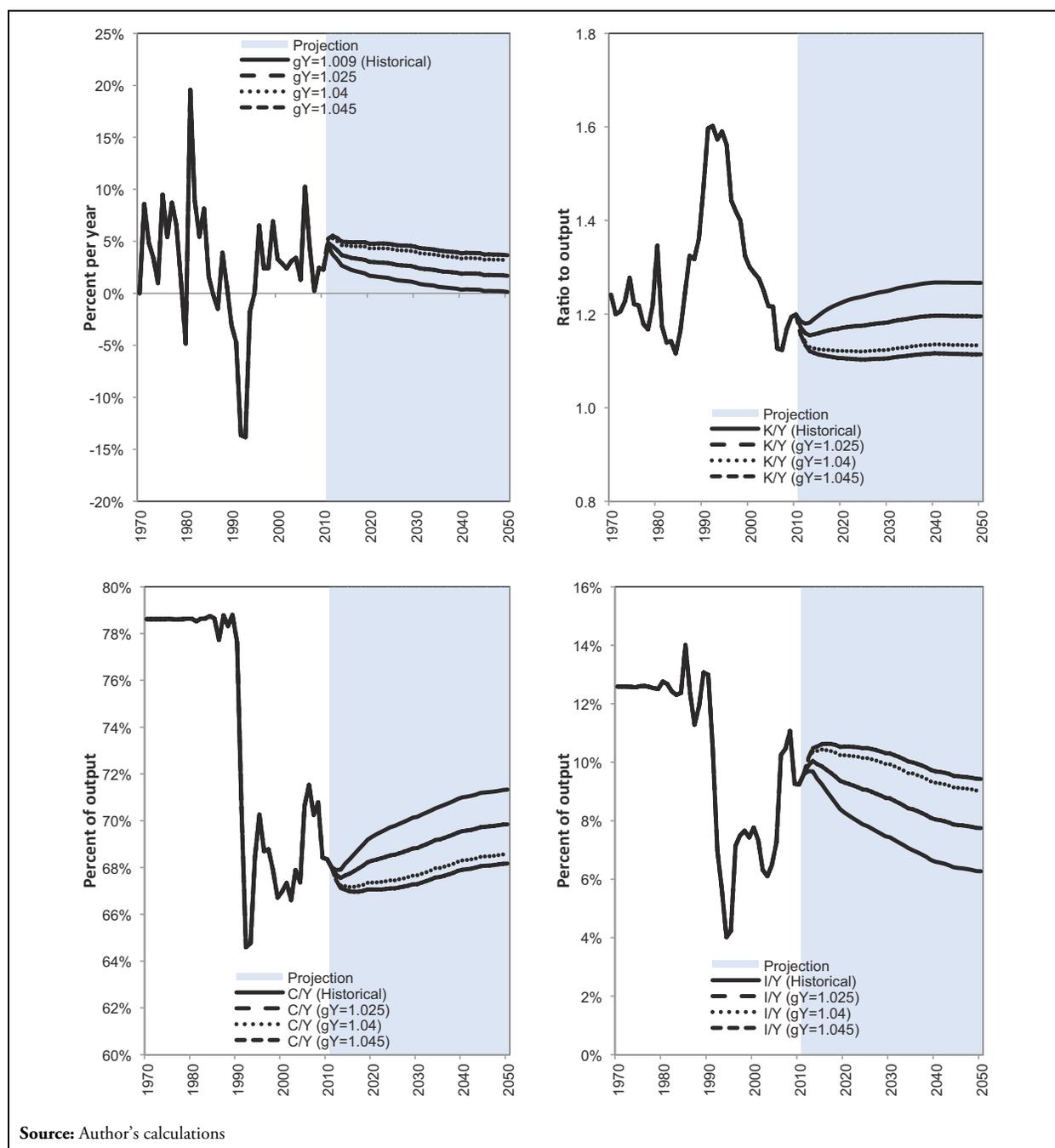
Social security beneficiaries in Cuba reached about 1.6 million in 2010 (from about 1.1 million in 1990); age-related pensioners represented 1 million while survivors’ benefits and disability beneficiaries represented about 0.6 million. The large increase during the last 20 years is explained by population aging and by an increase in the number of people that apply for a pension at the minimum legal age (Izquierdo and Gutiérrez, 2003). Social security expenditures represented about 10 percent of real GDP in 2010; about 65 percent of this corresponded to age-related pensions, 20 percent to survivors’ benefits, and the rest to disability benefits. The average age-related pension was about equal to 1/3 of real output per worker in 2010 (a significant increase from the ratios observed at the beginning of the decade).¹⁵

Fiscal Sustainability for Alternative Long-Term Growth Rates

The reform of the social security law of 2008–09 increased the legal retirement age from 55 to 60 years old for women and from 60 to 65 years old for men, reducing considerably the present value of social security obligations, and postponing to 2020 the increase in beneficiaries resulting from population aging. Indeed, absent such reform, the number of

15. Disability benefits and survivors’ benefits were about 90 percent and 85 percent of age-related pensions, respectively. Social Security expenses as percent of real GDP were larger in the mid-1990s than that at the beginning of that decade, as GDP decreased faster than social security spending during the “special period”. The average monthly pension in 2010 was 248 Cuban pesos (183 Cuban pesos at 1997 prices), or about US\$10 at “unofficial but legal” exchange rates. Pensions are mostly spent in the “rationed” system at below market prices. The marginal pension granted in 2010, at 1997 prices, was 223 Cuban pesos, what appeared to be lower than that established by law.

Figure 2. Cuba: Forecast Long-Term Dynamics



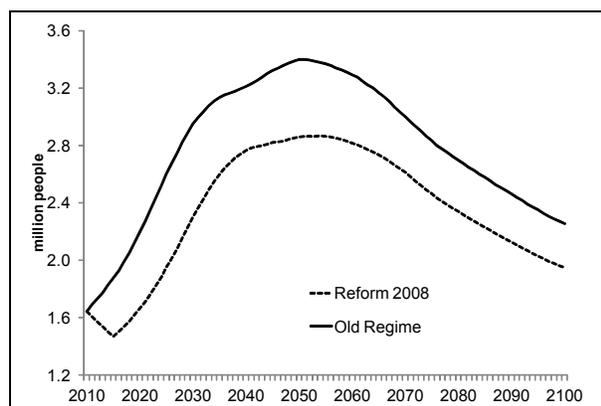
beneficiaries would have increased by about 35 percent by 2020 vis-à-vis 2010 (Figure 3). As a consequence of the reform, any increase in social security spending during this decade will only be the result of increases in the real value of social security benefits.

In spite of the reform, current demographic trends result nonetheless in a strong increase in social securi-

ty beneficiaries in the medium and long-terms. Indeed, beneficiaries are projected to peak at about 2.9 million by 2050 (a 1.4 percent annual increase), as the result of both an increase in the number of people 65 years or older, and of their life expectancy.

In turn, the growth rate of social security (marginal) benefits will depend on the growth rate of real wages,

Figure 3. Cuba: Projection of Social Security Beneficiaries



which ultimately depend on real output growth. For instance, if long-term output growth was $\gamma_Y = 1.009$, (and assuming that the ratio of observed to legal pensions remains constant at their 2010 value), the (average) marginal pension (in real terms) would increase by 1.4 percent annually during the next 40 years; if, in turn, output growth was $\gamma_Y = 1.025$, the increase would be 2.7 percent annually. Clearly, the differences in the well-being of the marginal pensioners resulting from alternative output growth rates would be significant.¹⁶

The increase in both the number of beneficiaries and of real marginal benefits will result in an increase in social security spending as percentage of real GDP, if the long-term output growth rate is similar to that implied by historical trends (i.e., $\gamma_Y = 1.009$). In such a case, social security spending would double, peaking at about 20 percent of GDP by the 2060s. If instead, long-term output growth rates were higher, social security spending would increase less, or even decrease, in GDP terms. For instance, if long-term output growth were $\gamma_Y = 1.025$ social security spending would peak at only 12 percent of real GDP.

To assess the sustainability of the long-term fiscal position associated with alternative social security projections, it is necessary to make a few additional assumptions. In particular foreign transfers post-2010 are assumed to remain constant in real terms at their 2010 value, (i.e., to gradually decrease as percentage of real GDP); higher long-term output growth rates would thus result in larger decreases in foreign transfers in GDP terms. Unless otherwise noted, tax revenues, including social security contributions, are assumed to remain constant in GDP terms at their 2010 value (what given the expected decrease in the working age population, may imply an increase in social security contributions or in some other tax rate). Non-social security government spending is assumed to remain constant as percentage of GDP at the value observed for 2010. The rationale behind this (conservative) assumption is that population aging will at least require an increase in health spending per capita.

These assumptions would result in fiscal dynamics consistent with significant increases in public debt in the medium and long-term, in case output growth was $\gamma_Y = 1.009$. Concretely, while fiscal deficits would remain manageable during the next few years, they will increase significantly afterwards, with cumulative deficits reaching 140 percent of GDP by 2040 and 250 percent by 2050. The fiscal picture would not be significantly affected in the next few years if output growth was higher, though in the long-term cumulated deficits in GDP terms would be lower for larger output growth rates (Table 2).¹⁷

These results suggest that social security entitlements may not be sustainable if long-term growth stabilizes at a rate similar to that implied by historical data. In such a case, balancing the fiscal accounts would require that benefits grow at a lower rate, that social security contributions (or other taxes) increase, or that

16. Social security benefits' projections are expressed in 1997 Cuban pesos. See Annex II.

17. The cumulative fiscal disequilibrium is calculated as the sum of fiscal imbalances year after year. As pointed out above the solvency problem would be worse if financing would occur with interest-bearing debt. For instance, if $\gamma_Y = 1.009$ and the real interest rate on debt was 1 percent, the cumulated cost through 2050 would be 30 percentage points of GDP; if the real interest rate was instead 2 percent, the cost would climb to more than 60 percent of GDP. Debt service charges could potentially create liquidity problems in addition to the solvency problem highlighted.

Table 2. Cuba: Fiscal Sustainability under Alternative Scenarios (new debt as percent of real GDP)

	$\gamma_z=1.009$ (Historical)	$\gamma_z=1.025$	$\gamma_z=1.04$	$g\gamma_z Y=1.045$	$\gamma_z=1.009$ (Historical)	$\gamma_z=1.025$	$\gamma_z=1.04$	$\gamma_z=1.045$
	Baseline: Sustainability under alternative long-term output growth rates				Scenario 1: Increase in benefits to 50 percent of real output per worker			
2015	2	2	3	3	3	3	3	3
2020	8	10	11	11	10	12	13	13
2025	22	25	28	28	27	30	32	33
2030	49	52	55	55	59	61	63	63
2040	137	133	130	129	161	154	148	146
2050	246	228	214	210	288	263	244	238
	Scenario 2: Decrease of foreign transfers to zero by 2020				Scenario 3: Decrease of foreign transfers to zero and increase in the tax rate by 2020			
2015	20	20	20	20	2	2	2	2
2020	69	66	65	64	7	9	10	11
2025	131	124	118	116	21	22	22	24
2030	236	188	175	171	61	42	40	41
2040	377	331	296	286	135	104	82	82
2050	568	477	413	395	246	169	121	117

Source: Authors' calculations.

non-social security public spending decreases in GDP terms.¹⁸

Fiscal Sustainability for a Number of Alternatives

Fiscal sustainability can be affected by changes in policies or in the external environment. The analysis below presents a set of scenarios, each of which reflects an alternative calibration that includes a change in an exogenous or policy variable (Table 2). Each scenario results in 4 fiscal paths, as the change in the exogenous or policy variable is analyzed together with the four long-term output growth rates presented so far ($\gamma_Y = 1.009$, $\gamma_Y = 1.025$, $\gamma_Y = 1.04$, and $\gamma_Y = 1.045$).

Scenario 1. This scenario considers a linear increase in marginal social security benefits from a level equal to about 40 percent of real output per worker (as observed in 2010) to 50 percent in 2020, so as to bring them closer to that in the legal framework (i.e., 60 percent of output per worker). Such a policy change would result in an increase in the cumulated fiscal cost (at zero interest rates) of about 30 to 40 percentage points of GDP through 2050, depending on

whether long-term output growth picks up or remains at that observed historically.

Scenario 2. This scenario considers a linear decrease in foreign transfers from 13 percent of real GDP (as estimated for 2010), to zero in 2020, in order to assess the vulnerability of fiscal accounts to a negative external shock. The resulting fiscal dynamics are the worst of all the scenarios considered. Cumulated fiscal deficits (financed with zero-real interest debt) would reach about 70 percent of GDP by 2020 for all long-term growth rates, and would continue growing in what appears an unsustainable fashion going forward. Unsurprisingly, these results suggest that a sudden decrease in foreign transfers constitute the largest vulnerability of the Cuban economy. If this risk materialized, the resulting macroeconomic imbalances would require of strong compensatory policy measures.

Scenario 3. This scenario considers a linear decrease of foreign transfers to zero in 2020, with simultaneous offsetting increases in tax rates, in order to assess the impact on fiscal sustainability of a negative exter-

18. As social security benefits are denominated in legal domestic currency, a devaluation of the Cuban peso (and the resulting inflation) would also result in a decrease in the real value of benefits in real terms.

nal shock that is compensated by active fiscal policy. Although fiscal dynamics in this case would be similar to those in Scenario 1, the underlying macroeconomic dynamics would be significantly different. In particular, the compensatory increases in tax rates would result in lower consumption and investment rates (both in the transition to their steady states, and in steady state), lower capital-output ratios, and lower output growth rates in the transition to steady state (i.e., a downward move for the real output path for every growth rate). In the very long-term, however, the debt to output ratios are lower than in Scenario 1, as the increase in tax rates is assumed to be permanent, while foreign transfers in such scenario were assumed to slowly decrease in GDP terms. For instance, in case long-term output growth was $\gamma_Y = 1.009$, the increase in the tax rate needed to compensate the decrease in foreign transfers would be about 11 percentage points; steady state consumption rates (as percent of GDP) would decrease by about 10 percentage points, while steady state investment rates (as percent of GDP) would decrease by about 1 percentage point. In turn, real annual output growth post-2010 (and through 2050) would be (on average) about 2/3 that in Scenario 1 (Table 3).¹⁹

Table 3. Impact of an external shock compensated by fiscal policy ($\gamma_Z=1.009$)

	Scenario 1	Scenario 3
Tax rate (percent of output)	22.4	33.3
SS Consumption (percent of output)	70.4	60.5
SS Investment (percent of output)	7.2	6.2
Output Growth 2010-50 (percent per year)	1.2	0.8

Source: Authors' calculations.

These results suggest that if a decrease in foreign transfers materialized, the downward adjustment in private consumption needed to avoid an immediately unsustainable fiscal dynamics would be significant.

Historical data suggest that during the 1990s the economy undertook precisely the type of adjustment that is illustrated by this scenario. In the 1990s, however, the adjustment occurred in a matter of a couple of years, as the external shock (namely the decrease of Soviet transfers to zero) was sudden, unlike what is considered in this scenario, where transfers are assumed to decrease gradually over a 10-year period.

Implications for Macroeconomic Policy

Cuba's external financing includes short-term trade and official bilateral financing; the country does not have access to voluntary credit markets. Most bilateral financing continues to be concentrated in a limited number of countries (the Soviet Union in the past, Venezuela currently), making Cuba vulnerable to changes in their policies or economic conditions. Domestic financing includes domestic credit from the Cuban Central Bank (BCC), and the domestic banking system, which is of insufficient depth.

In this context (and barring structural changes in economic policies), any unsustainable financing gaps are bound to be dealt with further capital controls, exchange rate devaluations, further scarcity of goods in the rationed system, and decreases in the supply of tradable goods through the public services (e.g., medicines and complex procedures that require imported inputs by the health system), among other.²⁰ The unsustainable fiscal dynamics that may arise if entitlements remain unchanged and long-term growth does not pick up, will likely be dealt with a *de facto* reduction in the purchasing power of benefits (for instance through a devaluation of the legal tender), including those provided in the form of services.

CONCLUDING REMARKS

Low long-term growth and population aging are among the main policy challenges facing Cuba going forward. Historical data is consistent with very low productivity growth, high economic volatility, capi-

19. The model only allows analyzing the effect of increases in income taxes. Future research could explore using a more refined model that allows for consumption taxes, and for the incorporation of leisure in the utility function.

20. Given the dual exchange rate, dual currency system currently applied in Cuba, unsustainable domestic financing results in hard currency rationing, and potentially in exchange rate devaluations (of either domestic currency against reserve currencies, and of the exchange rate between both domestic currencies (the CUP and the Convertible Cuba Peso, CUC). The elimination of the dual currency system will be challenging in the presence of unsustainable fiscal dynamics.

tal destruction (following the collapse of the Soviet Union), and significant external vulnerability. Moreover, while total population is estimated to be decreasing already, working-age population is forecast to begin decreasing as early as next decade, and the number of pensioners is forecast to grow from about 1.6 million in 2010, to about 3 million during the next 40 years. This implies that the demographic bonus that fueled economic growth during the past few decades is already over. Higher than projected negative net migration rates of people of working age could worsen the situation further. Alternatively, the situation may improve if workers continue in the labor market beyond the legal retirement age.

Increasing long-term economic growth, decreasing government spending and employment, and increasing non-state employment are among the main objectives of economic policy in Cuba, as reflected in the “principles” announced after the conclusion of the sixth congress of the Communist Party (GoC, 2011). This suggests that policy makers are aware of the need to increase the dynamism of the economy; it also hints that the low productivity growth may be related to large increases in government employment, which explained most job creation during the last decade. In particular, with respect to social security, GoC (2011) establishes that the role of the government in the financing of social security benefits should decrease, and be gradually replaced by contributions of the non-state sector. The principles also recognize the economic policy challenges associated

with population aging, in particular the increase in the number of pensioners.

This paper suggests that unless Cuba attains a higher long-term economic growth, social security entitlements may result in an unsustainable fiscal dynamics in the medium to long term. Fiscal accounts will be further compromised if marginal social security benefits are increased to align them with those established in the regulatory framework. Most importantly, the paper suggests that Cuba’s vulnerability to a decrease in foreign transfers is very high, and that even a gradual decrease in transfers could cause fiscal dynamics to worsen very fast, even for long-term output growth rates that are many times as high as that observed historically. Tax increases to compensate for decreases in foreign transfers, would result in better fiscal dynamics during the next few years, but at a heavy cost in terms of output and private consumption losses, and would not alter significantly the fiscal picture in the long-term. This further stresses the need to increase productivity growth, including through the incorporation of modern technology and better forms of organization of production. If higher productivity and long-term growth rates are not attained, the alternatives to achieve sustainability are limited to an increase in taxes and contributions, or a decrease in public expenditure growth rates (both in social security and non-social security spending). Tax increases may be de facto implemented through higher inflation rates.

REFERENCES

- Aguilar, X., and M. Collinao, 2001, “Cálculo del Stock de Capital para Chile 1985–2000,” Working Paper No. 133, Banco Central de Chile, Santiago.
- Di Bella, G., and A. Wolfe, 2008, “A Primer on Currency Unification and Exchange Rate Policy in Cuba: Lessons from Exchange Rate Unification in Transition Economies,” *Cuba in Transition*, Vol. 18.
- Di Bella, G., R. Romeu, and A. Wolfe, 2011, “External Vulnerabilities and Economic Fluctuations: An Approximation to Cuba’s Output Gap,” mimeo.
- Greenwood, J., Z. Hercowitz, and P. Krusell, 1997, “Long-Run Implications of Investment-Specific Technological Change,” *American Economic Review*, Vol. 87, No. 3, pp. 342–62.

- Gordon, R., 2003, "Exploding Productivity Growth: Context, Causes and Implications," *Brookings Papers on Economic Activity*, Vol. 2003, No. 2, pp. 207–279.
- Government of Cuba (GoC), 2008, Ley No. 105 de Seguridad Social, La Habana, Cuba.
- Government of Cuba (GoC), 2009, Decreto No. 283 del Consejo de Ministros, La Habana, Cuba.
- Government of Cuba (GoC), 2011, *Lineamientos de la Política Económica y Social*, La Habana, Cuba.
- Izyumov, A., and J. Vahaly, 2008, "Old Capital vs. New Investment in Post-Soviet Economies: Conceptual Issues and Estimates," *Comparative Economic Studies*, Vol. 50, pp. 79–110.
- Izquierdo, V., and Y. Gutiérrez, 2003, "La Seguridad Social en Cuba en el Nuevo Milenio," mimeo, La Habana, Cuba.
- Kydland, F., and E. Prescott, 1982, "Time to build and aggregate fluctuations," *Econometrica*, Vol. 50, pp. 1345–1371.
- Ljungqvist, L., and T. Sargent, 2004, *Recursive Macroeconomic Theory*, Second Edition. The MIT Press, Cambridge, Massachusetts.
- Mesa-Lago, C., 1985, "El Desarrollo de la Seguridad Social en América Latina," *Revista de la CEPAL*, No. 60.
- Mesa-Lago, C., 2008, "Envejecimiento y pensiones en Cuba: la carga creciente," *Nueva Sociedad* No.216, julio-agosto de 2008.
- Mesa-Lago, C., and J. Pérez-López, 1985, "A study of Cuba's material product system, its conversion to the system of national accounts, and estimation of gross domestic product per capita and growth rates," World Bank.
- Oficina Nacional de Estadística (ONE), 2009, "Proyecciones de la Población Cubana 2010–2030," Publicaciones Ocasionales, La Habana, Cuba.
- Oficina Nacional de Estadística (ONE), 2011, "Seguridad Social. Seguridad Social. Indicadores Seleccionados Enero - Junio 2012", Publicaciones Semestrales, La Habana, Cuba.
- Orozco, M., 2009, "The Cuban Condition: Migration, Remittances and its Diaspora," mimeo, Inter-American Dialogue, Washington, DC.
- Peñate Rivero, O., and L. Gutiérrez Urdaneta, 2000, *La Reforma de los Sistemas de Pensiones en América Latina. La Alternativa Cubana*, Ed. Ciencias Sociales, La Habana, Cuba.
- Pérez, L., 1986, "Cubans in the United States," *The Annals of the American Academy of Political and Social Science*, No. 487, September.
- Pérez-López, J., and C. Mesa-Lago (2009), "Cuban GDP Statistics Under the Special Period: Discontinuities, Obfuscation, and Puzzles," *Cuba in Transition*, Vol. 19.
- Popov, V., 2000, "Shock Therapy versus Gradualism Reconsidered: The End of the Debate (explaining the magnitude of the transformational recession)," *Comparative Economic Studies*, Vol. 42, pp. 1–57.
- Popov, V., 2007, "Shock Therapy versus Gradualism Reconsidered: Lessons from Transition Economies after 15 Years of Reforms," *Comparative Economic Studies*, Vol. 49, pp. 1–31.
- United Nations, 2011, *World Population Prospects, the 2010 Revision*, United Nations' Department of Economic and Social Affairs, New York (<http://esa.un.org/wpp/>)

ANNEX I: Macroeconomic Data

This annex describes the data used in this paper, as well as their sources and definitions.

Gross Domestic Product (GDP). Growth rates for headline real GDP for the period 1971–1985 correspond to data published by UNDP at 2005 constant prices; growth rates for the period 1986–1996, correspond to data published by ECLAC at 1981 constant prices; data (in levels) for the period 1996 to 2010, correspond to that published by the National Statistical Office (ONE), in 1997 constant prices. The series for 1970–2010 in constant prices was obtained by chaining real growth rates. Headline GDP was first netted out of property income (assumed to be equal to 3 percent of GDP); the change in stocks (which also includes errors and omissions); and, beginning in 2000, the estimated value of Venezuela-related purchases of Cuban services (i.e., non-tourism service exports), that the model treats as foreign transfers. In order to obtain private disposable income the resulting GDP series is multiplied by the calibrated tax rate.

Gross Fixed Capital Formation (GFCF), Government Spending and Imports of Goods and Non-Factor Services. Growth rates for the period 1971–1985 correspond to data published by UNDP at 2005 constant prices; growth rates for the period 1986–1996, correspond to data published by ECLAC at 1981 constant prices; data (in levels) for the period 1996 to 2009, correspond that published by the National Statistical Office (ONE), in 1997 constant prices. Data for 2010 is estimated using information from ONE. The series for 1970–2010 in constant prices was assembled by chaining real growth rates.

Machinery and Equipment and Investment in Structures. Growth rates for the period 1971–1990 were assumed equal to that for GFCF; growth rates for the period 1990–1996, correspond to data published by ECLAC at 1981 constant prices; data (in levels) for the period 1996 to 2009, corresponds that published by the National Statistical Office (ONE), in 1997 constant prices. Data for 2010 is estimated using information from ONE. The series for 1970–

2010 in constant prices was assembled by chaining real growth rates. In particular with respect to Structures, it was assumed that 65 percent of investment corresponds to housing structures, and the rest to non-housing construction.

Exports of Goods and Non-Factor Services. Growth rates for the period 1971–1985 correspond to data published by UNDP at 2005 constant prices; growth rates for the period 1986–1996, corresponds to data published by ECLAC at 1981 constant prices; data (in levels) for the period 1996 to 1999, corresponds that published by the National Statistical Office (ONE), in 1997 constant prices. Data for 2000–2010 results from netting out from the data published by ONE, the purchases of non-tourism services by Venezuela, estimated by subtracting exports and tourism receipts (in real terms) from the series of exports of goods and non-factor services. Purchases of non-tourism services by Venezuela are estimated by subtracting from the non-tourism services series, the average non-tourism exports for the period 1990–1999.

Labor and Population Statistics. Labor market statistics (hours worked per week, the labor participation rate and the open unemployment rate) were obtained from the National Statistical Office, and from the United Nations. Some data (including the unemployment rate) were estimated through simple econometric analysis, as there were years for which labor market data was unavailable. Historical population data was also obtained from ONE and the United Nations, as well as the years of education of the average worker. The long-term population forecast corresponds to the medium-variant published by the United Nations Population Division and available online.

Labor's share on output. Partial information for the period 1971–1985 corresponds to data published by UNDP at 2005 constant prices; partial information 1985–2010 corresponds to that published by the National Statistical Office (ONE), in 1997 constant prices.

Electricity Consumption. Data for electricity consumption is available annually online from 1957 onwards from the National Statistics Office. This data was used to approximate the utilization rate of the capital stock.

Exchange Rate System. The available (official) fiscal statistics are compiled in current Cuban pesos (CUPs, the Cuban legal tender); income and expenditures denominated in currencies other than the CUP are converted into CUPs at legal exchange

rates. Social security benefits are denominated and paid in CUPs, and spent in the “rationed” system. Goods sold in the rationed system include tradable goods, whose actual (market) prices are higher than the controlled prices for which they are sold. This implies that social security costs at market prices are higher than those reported by official statistics, and from the point of view of the pensioners, that the purchasing power of benefits is higher than their value in current US dollars.

ANNEX II:

Social Security in Cuba and Forecasts

Cuba was among the first countries in Latin America to enact social security legislation, together with Argentina, Chile and Uruguay (Izquierdo and Gutiérrez, 2003). Before 1958 there were a large number of autonomous pension schemes that served specific occupations both in the private and public sectors, each of which had its own legislation, administration, financing and benefits (Mesa-Lago, 1985). After 1959, the different pension schemes were unified, and in 1963 the Social Security System was established, under the principle of universal coverage, and “pay as you go” financing (Izquierdo and Gutiérrez, 2003). Social security financing is the responsibility of the state through the budget. Resources come from employers’ contributions and from the state transfers to fill the gap between resources and expenditures. The social security system does not accumulate financial reserves or capital, and its expenses and income are treated as an independent budget within the state’s budget.

In 1979 the system was reformed to formally separate the social security system from the social assistance system. In 1994, a new reform aimed at strengthening social security financing (Law 73, “Tax System Law”) opened the possibility for workers to also contribute to the system; and increased employers’ contribution from 12 to 14 percent in the case of firms

with foreign capital participation, or privately managed cooperatives. Workers’ contributions (established at 5 percent of gross wages), were only applied to a small number of firms. In 2003, the Social Security Institute was created to improve the management of social security’s resources and provide a better service.

In 2008 a new Social Security Law (Law 105) was passed, that increased the retirement age by 5 years for both women and men (from 60 to 65 years for men, and from 55 to 60 years for women).²¹ The law further established that to be eligible to receive a pension, a worker should have at least 30 years of service. Regular pensions are defined as the equivalent to 60 percent of the average of the 5 better wages received during the last 15 years of work. For each year in excess of 30 years of service, the pension is to be increased by 2 percentage points. Disability pensions were established in proportion of the years of service (50 percent of the average wage for those that worked at least 20 years, increasing by one percentage point for each year in excess of 20, and by two percentage point for each year of service in excess of 30). Survivors’ benefits are calculated in relation to the dependents of the person that had received the original pension.²² Social security benefits include, monetary benefits (i.e., paid in Cuban legal tender); service

21. A transitory regime through 2015 was established for the workers that turn 60 (men) or 55 (women), during the first 7 years after the approval of law (GoC 2008, 2009).

benefits (medical assistance); and in-kind benefits (medicines and medical supplies provided free of charge).²³

Social Security Beneficiaries Forecast

Beneficiaries as of 2010 and their life expectancy.

The number of beneficiaries per type of benefit corresponds to those reported in ONE (2011); the age composition of beneficiaries is assumed to correspond to that of the general population, as reported by ONE (2009). Their life expectancy is line with that in United Nations (2011).

New beneficiaries each year (in gross terms) from 2011 onwards.

Beyond the transition period (which ends in 2020), they are calculated as the sum of the annual net increase of men 65 years and older, and of women 60 years and older; annual cohorts of women and men through 2100 are interpolated from United Nations (2011), from original projections in 5-year cohorts. The number of social security beneficiaries (including regular pensioners and those receiving survivors' benefits) as percentage of people of legal retirement age is assumed to evolve with labor participation rates lagged 40 years. Disability beneficiaries are assumed to remain constant as a proportion of the working-age population for 2010, as reported by ONE (2009, and 2011). The forecast for the working-age population from 2010 onwards is that in United Nations (2011).

Social Security Compensation and Expenditure Forecasts

Compensation for the existing beneficiaries. It is assumed to be equal to the average benefit in real terms existing in 2010, per type of benefit. To obtain benefits in 1997 Cuban pesos, the benefits in nominal terms as reported in ONE (2011), are deflated by the GDP deflator.

Marginal compensation for new beneficiaries beginning in 2011. They are calculated as the average of the best 5 years of per capita GDP out of the last 15 years, as required by law (GoC, 2008, and 2009). The resulting average is multiplied by the ratio between the marginal benefit in real terms calculated from information in ONE (2011) and per capita GDP in 2010 (about 40 percent). Survivors' benefits and disability benefits are calculated from pensions, by keeping the ratios of the former and latter with respect to pensions observed as of 2010 (all in real terms), calculated from information in ONE (2011).

Social Security Expenditure. The forecast for each type of benefit is calculated as the sum of the product of existing beneficiaries and their respective annual compensation. The forecast for aggregate social security expenditures is the sum of the expenditures for each type of benefit. As benefits depend on the long-term GDP growth rate, social security expenditures (both in levels, and as percentage of GDP), will vary together with long-term GDP growth.

22. In case of 1 dependent, the benefits are set at 70 percent of the original pension; in the case of two dependents, the benefits are set at 85 percent of the original pension; and for 3 or more dependents, the benefits are set to be equivalent to the original pension.

23. Monetary pensions are classified into ordinary and extraordinary pensions. Ordinary are those granted for jobs not associated with any specific risks; extraordinary are granted for risky jobs. Monetary pensions are further divided between short and long-term; short-term are those granted only temporarily, for instance those granted to mothers right before and after giving birth (for a total of 18 months). Since 1986, short-term pensions are responsibility of the entities in which workers labor. There are special pension regimes for independent workers, the members of the armed forces, the employees of the ministry of interior, members of independent agricultural cooperatives and artists.