

# OPERATION OF A CENTRALIZED BI-MONETARY ECONOMY UNDER A TIGHT EXTERNAL CONSTRAINT: CUBA DURING THE PANDEMIC

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This paper analyzes a bi-monetary economy with a fixed exchange rate that is subject to a tight external constraint and monetary overhang. The monetary overhang is assumed to have originated in fiscal deficit monetization, while the tight external constraint is reflected in the inability of the central bank to sterilize the overhang through foreign exchange intervention at official exchange rates; and, by limited foreign financial inflows that bind the current account to be very close to balance. This description resembles that of Cuba post currency unification. The main question the paper intends to address is whether currency unification (the so-called *reordenamiento*) altered the way the economy operates and, thus, how it reacts to a tighter external constraint compared to how it reacted to similar episodes in the past.

Di Bella et al. (2020) analyzed how the pre-unification system of a dual currency, dual exchange rate operated. They argue that the large pre-unification difference in official and unofficial exchange rates between the *Peso Cubano* (CUP) and the *Peso Cubano Convertible* (CUC) was geared at sterilizing the large CUP excess supply originated in the monetization of fiscal imbalances, and at limiting international reserve losses. The currency unification at the “unofficial but legal” parity of 24 CUP/CUC in January

2021 (i.e., the ceiling of a pre-unification imaginary band that had the official exchange rate of 1 CUP/CUC as floor), and the legalization of the use of foreign currencies as means of payment to purchase goods in specialized state-owned shops suggests that: (i) a large excess supply not only of CUPs but also of CUCs had rendered the latter inadequate to allocate scarce international reserves, a fact that is both reflected in a large parallel exchange rate premium and the absence of currency convertibility; and, (ii) the elimination of the CUC required a different instrument for the state to absorb private foreign exchange inflows (mainly official and unofficial remittances) to partially offset the decrease in external official grants and tourism inflows brought about by the pandemic. The creation, in August 2020, of specialized shops that only accept foreign currency as means of payment intended to fill this gap.<sup>2</sup>

Against this backdrop, the paper is organized as follows: After this introduction, the first section proposes a simple model to analyze the workings of a centralized bi-monetary economy that captures the main characteristics of Cuba post currency unification. The second section uses this model to analyze the impact of a decrease in external foreign currency inflows and compares the model results with the stylized

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1. The views expressed in this paper are those of the authors and do not necessarily represent those of the IMF or IMF policy.

2. Other studies that focus on the exchange rate system in Cuba include De la Torre and Ize (2013), Di Bella and Wolfe (2008), and Di Bella and Romeu (2017).

facts observed in Cuba in 2020-21, namely decreases in activity and employment, increases in inflation and the parallel exchange rate market premium, and a deterioration of income distribution for wage earners. This section also analyzes the impact of different policy actions in inflation rates, economic activity, and income distribution. Finally, the third section concludes.

## A SIMPLE MODEL

The economy is centralized in the sense that the state owns firms and the capital stock, controls external trade, and decides the composition of imports. The economy features a fixed official exchange rate, but the currency is non-convertible due to a tight external constraint. Most prices are set by the state, which also decides about production and employment. External foreign currency flows are exogenous and there is no access to external capital markets. There are two goods, one produced domestically ( $X$ ) and one imported ( $M$ ). The imported good can be used as an intermediate input in the production of the domestic good ( $M^I$ ), as a final good for consumption (both for households,  $M^C$  and the government,  $M^G$ ), and as an investment good ( $M^K$ ).

Domestic goods are produced by state-owned firms that have access to a Leontief technology,

$$X_t^S = \text{Min} \left[ \frac{L_t}{a_L}, \frac{K_t}{a_K}, \frac{M_t^I}{a_M} \right] \quad (1)$$

In expression (1),  $L_t$  is labor,  $K_t$  is capital, and  $a_i > 0$  with  $i = \{L, K, M\}$  denote technology coefficients.<sup>3</sup> The capital stock evolves according to the following familiar expression,

$$K_t = K_{t-1}(1 - \delta) + I_{t-1} \quad (2)$$

where investment  $I_{t-1} = M_{t-1}^K$ , and  $0 < \delta < 1$  denotes the depreciation rates. The state-owned firms' budget constraint is given by,

$$W_t L_t + e_t P_t^* (M_t^I + M_t^K) - p_t^X X_t^S = Tr_t^F \quad (3)$$

In expression (3),  $w_t$  is the nominal wage,  $e_t$  is the official exchange rate,  $P_t^*$  is the imported good price in foreign currency terms,  $p^X$  is the price of the domestic good and  $Tr^F$  denotes government transfers. This equation implies that the operational deficit of firms is covered by state transfers. Moreover, domestic goods can only be purchased in domestic currency.

In addition, there are specialized state-owned shops that sell imported goods to households; these shops only accept foreign currency as means of payment.<sup>4</sup> These shops operate with two accounts, one in foreign currency and the other in domestic currency. The foreign currency account is given by,

$$p_t^{D,*} M_t^S = Div_t^* \quad (4)$$

Expression (9) says that the value of domestic sales of imported goods to households is  $p_t^{D,*} M_t^S$  is transferred to the government in the form of dividends in foreign currency  $Div_t^*$ . The domestic price of imports in foreign currency is  $p_t^{D,*}$  endogenous and can be higher than the international price  $P_t^*$ , as the state monopoly on external trade constraints the ability of households to import directly from abroad.

The domestic currency account of specialized state-owned shops is given by,

$$e_t P_t^* M_t^S = Tr_t^S \quad (5)$$

Expression (7) says that shops receive government transfers ( $Tr_t^S$ ) to purchase imported goods at international prices using the official exchange rate market. In other words, these shops will have a deficit in domestic currency and a surplus in foreign currency.

Households are differentiated by the currency of their income. While most households ("wage earners") are paid in domestic currency, the income of the rest of households is in foreign currency ("remittance recipients").<sup>5</sup>

The budget constraint of wage earners is given by,

3. In what follows, the sub index  $t$  denotes time and the supra index  $*$  refers to variables expressed in foreign currency.

4. In Cuba, these are denominated MLC shops (*Tiendas de Moneda Libremente Convertible*).

5. This assumption highlights the need of households to trade in the unofficial/parallel foreign exchange market to be able to purchase domestic and imported goods.

$$w_t L_t = p_t^x X_t^{d,1} + \tilde{e}_t p_t^{D,*} M_t^{d,1} + \Delta B_t^{d,1} \quad (6)$$

In turn, the budget constraint of remittance recipients is given by,

$$\tilde{e}_t R e_t^* = p_t^x X_t^{d,2} + \tilde{e}_t p_t^{D,*} M_t^{d,2} \quad (7)$$

In expressions (6) and (7),  $R e_t^*$  denotes remittances expressed in foreign currency,  $\tilde{e}_t$  is the parallel market exchange rate,  $\Delta B_t^{d,1} = \Delta \bar{B}_t^{d,1} + \bar{B}_t^{d,1} \alpha^B \pi_t$  denotes monetary base demand by wage earners  $X_t^{d,i}$ , refers to the demand for domestic goods, and  $M_t^{d,i}$  is the demand of imported goods, where  $i = \{1,2\}$  denote wage earners and remittance recipients respectively.<sup>6</sup> Households are assumed to be foreign exchange constrained, and thus  $R e_t^*$  are fully spent. This implies that  $R e_t^* = p_t^{D,*} M_t^S$ , as specialized shops only accept foreign currency as means of payment. In turn, effective inflation  $\pi_t$  refers to the percentage change in the price level,  $P_t = \gamma_1 P_t^x + (1-\gamma_1) \tilde{e}_t p_t^{D,*}$ , where  $0 < \gamma_1 < 1$  is the weight of domestic goods.

Wage earners are assumed to maximize a single period Cobb-Douglas utility function over  $X_t^{d,1}$  and  $M_t^{d,1}$  with parameters  $0 < \rho < 1$  subject to disposable income,  $w_t L_t - \Delta B_t^{d,1}$ . Given the model's structure, this is analogous to assuming that wage earners are allocated a fixed share of domestic goods supply  $X_t^{d,1} = \rho X_t^S$ . The shares of income spent in domestic ( $\eta_t^{M,2}$ ) and imported goods ( $\eta_t^{X,2}$ ) by remittance recipients are assumed to be determined endogenously to ensure that markets clear.

The government budget constraint in domestic currency is given by,

$$e_t (P_t^* M_t^G - Gr_t^* - \Delta D_t^{w,*}) + Tr_t^F + Tr_t^S = \Delta DC_t \quad (8)$$

In expression (8)  $Gr_t^*$  denotes foreign official grants expressed in foreign currency,  $\Delta D_t^{w,*}$  refers to deposit gross withdrawals from the state's foreign currency deposits at the central bank, and  $\Delta DC_t$  denotes domestic credit from the central bank. The govern-

ment's budget constraint in foreign currency is simply given by,

$$Div_t^* = \Delta D_t^{a,*} \quad (9)$$

Where  $\Delta D_t^{a,*}$  denotes gross increases of state foreign currency deposits at the central bank. The *ex-ante* supply of monetary base  $\Delta B_t^S$  by the central bank is given by,

$$\Delta B_t^S = \Delta DC_t - e_t p_t^* \sum_i M_t^i \quad (10)$$

where in expression (10),  $i = \{s, K, I, G\}$ . *Ex-post* international reserves of the central bank will increase provided  $\Delta D_t^{w,*} < D_t^{a,*} = R e_t^*$ . The interconnection of markets through the sectors' budget constraints (*Walras Law*) is given by:

$$p_t^x (X_t^S - X_t^d) + p_t^{D,*} \tilde{e}_t (M_t^S - M_t^d) + (\Delta B_t^S - \Delta B_t^d) = 0 \quad (11)$$

Expression (11) suggests that an excess supply in the monetary base market will have as counterpart an aggregate excess demand in the market for goods. Given values for the parameters and the exogenous variables over time ( $P_t^*$ ,  $-Gr$ ,  $R e_t^*$ ,  $\bar{B}_t^{d,1}$ ), solving the model requires assigning values to the policy variable ( $M_t^i$  for  $i = \{s, K, I, G\}$ ),  $e_t$ ,  $p_t^x$ ,  $L_t$ ,  $L_t$ ,  $W_t$  and  $\Delta D_t^{w,*}$ , so endogenous variables ( $X_t^S$ ,  $K_t$ ,  $X_t^{d,1}$ ,  $M_t^{d,1}$ ,  $\eta_t^{X,2}$ ,  $\eta_t^{M,2}$ ,  $X_t^{d,2}$ ,  $M_t^{d,2}$ ,  $\Delta B_t^S$ ,  $\Delta B_t^d$ ,  $p_t^{D,*}$ ,  $Div_t^*$ ,  $\Delta D_t^{a,*}$ ,  $\tilde{e}_t$ ,  $P_t$ , and  $\pi_t$ ) are determined.<sup>7</sup>

## EFFECTS OF A TIGHTER EXTERNAL CONSTRAINT

We define the external constraint to be tight when (i) the stock of foreign currency reserves is insufficient to sterilize a given excess supply of monetary base; (ii) the external current account is constrained to be close to a balanced position; and (iii) the trade deficit is completely determined by inflows of external grants and remittances. Using this definition, this section uses the model described above to analyze the effect of a decrease in official external grants  $-Gr$  assuming that the level of international reserves is con-

6. In addition,  $\bar{B}_t^{d,1}$  denoted exogenous monetary base demand  $\bar{B}_t^{d,1} = B_{t-1}^{d,1} + \Delta \bar{B}_t^{d,1}$  and  $\alpha^B$  is the inflation elasticity of monetary base demand.

7. The paths for the exogenous variables are assumed to follow AR(1) processes, e.g.,  $Gr_t^* = gr + \beta Gr_{t-1}^* + \epsilon_t$  where  $gr > 0$  and the error term ( $\epsilon_t$ ) is normally distributed with mean zero and variance  $\sigma^{\epsilon^2}$ .

strained to remain unchanged at a given lower bound, i.e., that the state sets  $\Delta D_t^{w,*} = Re_t^*$ .<sup>8</sup>

Figure 1 shows the impact of a temporary decrease in  $-Gr$  under unchanged state policies.<sup>9</sup> The decrease in  $-Gr$  leads to temporal and proportional decreases of imports of all types. Lower intermediate goods imports ( $M_t^I$ ) result in a decrease of domestic goods output ( $X_t^Y$ ), and in lower effective employment. Lower imports of capital goods ( $M_t^K$ ) affect capital accumulation, while lower imports of final consumption goods, ( $M_t^S$ ) affect their domestic supply. Lower  $X_t^S$  and unchanged  $p_t^X$  and  $L_t$  (both policy determined) lead to an increase in budgetary transfers to state owned firms ( $Tr_t^F$ ), and thus of the fiscal deficit and of monetary base supply ( $\Delta B_t^S$ ). In turn, lower ( $M_t^S$ ) and unchanged remittances  $Re_t^*$  lead to an increase in the domestic foreign currency price of imports  $p_t^{D,*}$ . The excess supply of monetary base results in a depreciation of the parallel exchange rate ( $\bar{\epsilon}_t$ ) that overshoots the increase in inflation, and in an increase of the parallel exchange rate premium.

The increase in  $p_t^{D,*}$  and  $\bar{\epsilon}_t$  push inflation ( $\pi_t$ ) upwards to restore equilibrium in the goods and monetary base markets. Wage earners see their real income eroded as the increase in  $\pi_t$  negatively affects the purchasing power of their income to a larger extent than that of remittance recipients. Given the temporary nature of the shock, imports, production and effective employment gradually recover, and as this occurs inflation decreases; however, in the absence of policy changes, the negative impact on the wage earners' share in total income becomes permanent.

In turn Figure 2 shows the impact of a permanent (or persistent) decrease in  $-Gr$ . In this case the negative impact on imports, production and employment described above is permanent rather than temporary. Effective employment decreases and unemployment (either hidden or open) increases. Capacity utilization decreases at first but after some time it bottoms

out and then increases as the capital stock declines towards a lower new steady state. In particular, inflation and the parallel exchange market premium are higher and more persistent, as well as the negative impact on the real income of wage earners, in part because of the permanent increase in the domestic foreign currency of imports. Importantly, the permanent decrease in investment that brings about a long-term transition towards a lower level of capital stock deteriorates the capital-labor ratio.

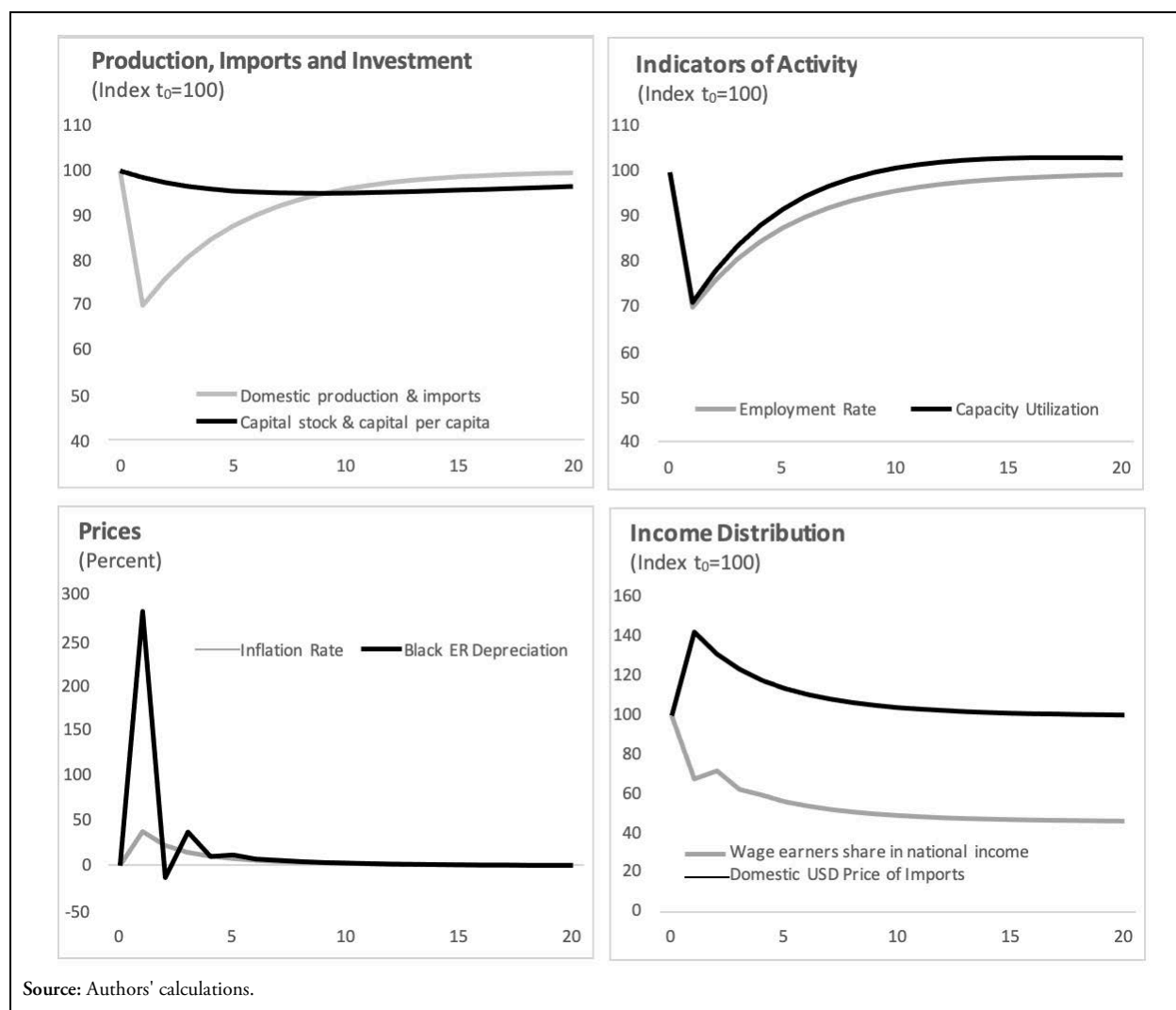
The description of the impact of a tighter external constraint is in line with that observed in Cuba in 2020-21, but also with that of previous episodes of different intensity, including in the early 1990s, 2001-02, and 2009-11. Except for the current episode where the negative shock to foreign inflows is still ongoing, in all other episodes external foreign inflows recovered to some extent, leading to rebounds in activity similar to those highlighted in Figure 1. However, Cuba never fully recovered the pre-1990s level of external foreign inflows. Thus, the observed rebounds in economic activity are usually to a new, but lower, steady state. This is particularly noticeable for the capital stock, that has been undergoing a secular deterioration, similar to that highlighted in Figure 2. In addition, the fact that the economy's response to a tighter external constraint is alike to that of previous episodes suggests that currency unification has not materially affected how the economy operates. Indeed, the exchange rate parity for the unified currency continues to be only an instrument for the allocation of scarce foreign currency by the state and does not play a role in resource allocation.

To conclude the analysis of this section, Figure 3 shows the sensitivity of a few variables to different policy choices in response to a permanent decrease in  $-Gr$  and compares them to a baseline with no policy change. The policy choices analyzed are (i) a partial indexation of nominal wages to lagged inflation; (ii) a larger decrease in non-government imports in order to allow government imports to remain unchanged

8. Palacios Cívico (2019) analyzes the effect of the external constraint on Cuba's recent economic developments. Agénor (1992) analyzes the determinants of parallel exchange rates.

9. While Figure 1 assumes a temporary one standard deviation decrease, in Figure 2 such decrease is assumed to be permanent.

Figure 1. Impact of a temporary decrease of foreign official grants



in the face of lower external flows; and, (iii) a partial indexation of domestic good prices to lagged inflation. Of the three policy actions, only option (ii) results in lower production, employment, and investment, while options (i) and (iii) result in similar economic activity and factor utilization than in the baseline.

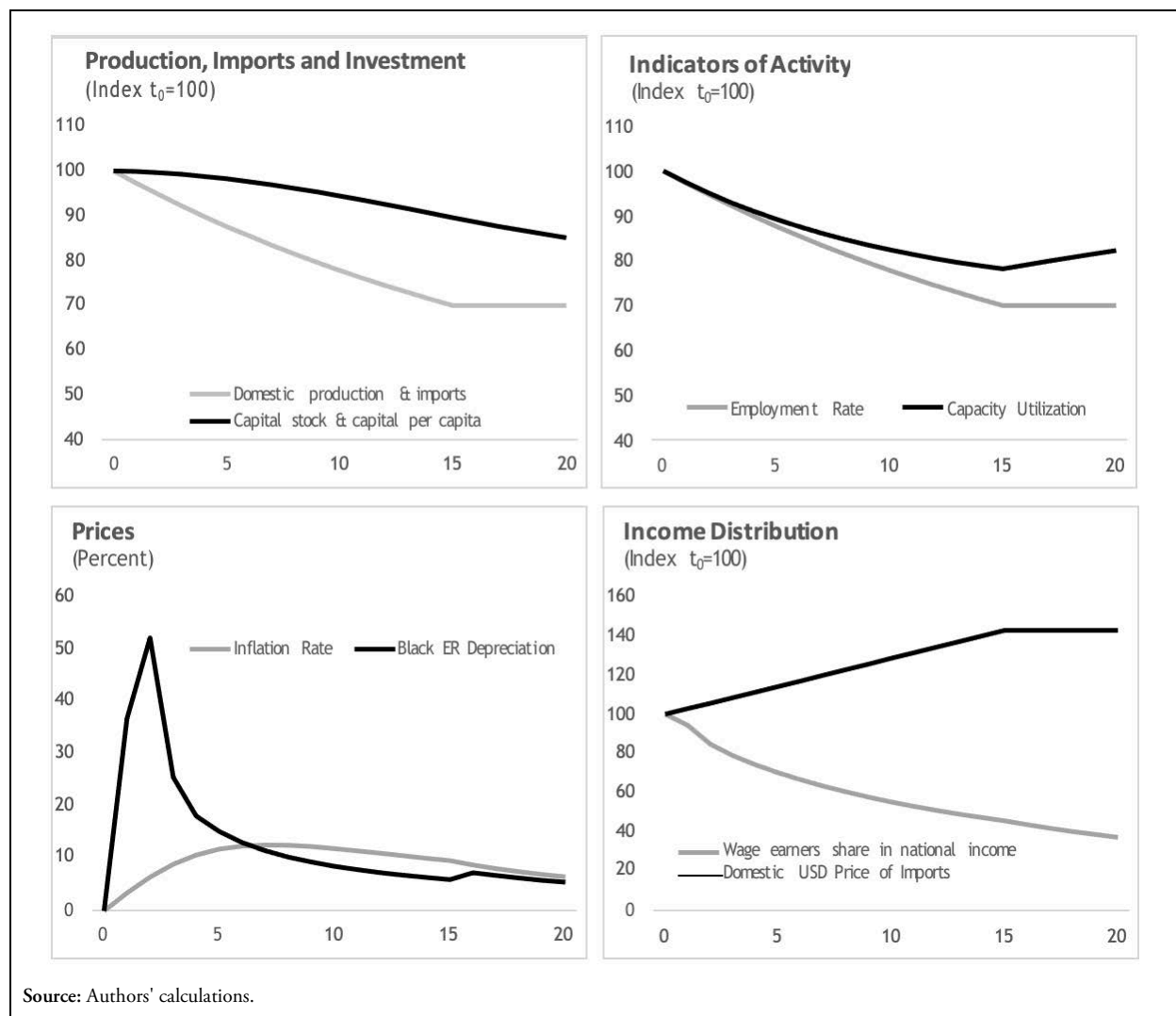
That said, the impact on inflation is largest when the policy decision is to index wages to inflation, and quite interestingly, this is also the option that results in the largest exchange rate depreciation and the worse deterioration of income distribution for wage earners. Also, counter-intuitively, policy option (iii) leads to lower inflation and exchange rate depreciation, and in a milder deterioration in income distribution

for wage earners. This is the case as the policy option (i) leads to a larger fiscal deficit and excess monetary base supply than in the baseline, while the excess monetary base supply is lower than in the baseline for option (iii). The behavior of inflation, exchange rate depreciation and income distribution for policy option (ii) is worse than in the baseline as the lower domestic goods production also results in a higher fiscal deficit, but not as large as for policy option (i).

#### FINAL REMARKS

Despite that it had been an objective for long, the timing for currency unification was catalyzed by the pandemic, which severely constrained tourism and remittance flows, compounding a persistent long-

Figure 2. Impact of a permanent decrease of foreign official grants



term decrease of foreign official grants. These factors led to an increase in the structural excess supply in the CUC monetary base market and shortages in CUC-only stores, which ended eroding the use of the CUC as an instrument to allocate scarce foreign reserve currency by the state.

In line with this, the behavior of the Cuban economy post currency unification has so far resembled the behavior in other periods characterized by a more binding external constraint, i.e., lower economic activity, higher inflation, longer queues, higher hidden unemployment, higher domestic foreign exchange prices for imported goods and a secular deterioration of the capital stock in all its forms. While income distribution worsened for wage earners (*vis-a-vis* households

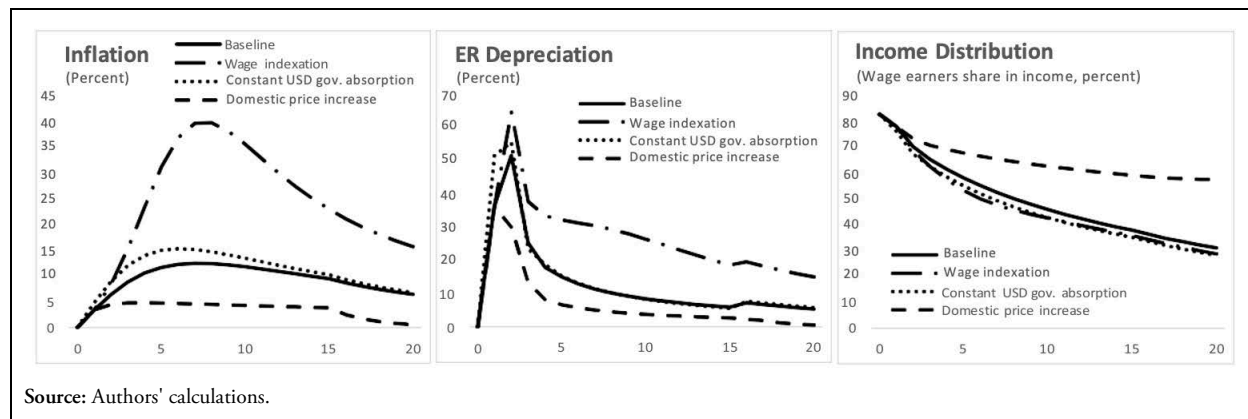
with access to foreign currency), per capita real income has decreased for all.

This suggests that currency unification has not materially changed how the Cuban economy operates. Most prices continue to be managed and many resource allocation decisions continue to be administrative. The CUC account (that operated in the previous monetary regime) was replaced by a system based in specialized state-owned shops that only accept foreign currencies for payment. While currency unification at 24 CUP/USD aimed at vacuuming as much CUP overhang as possible (as emphasized in Di Bella and Wolfe, 2008 and Di Bella et al., 2020) the significant parallel exchange rate premium reflects a still-large CUP excess supply. All this sug-

gests that, as before, the post currency unification exchange rate system (characterized by currency inconvertibility and foreign exchange controls) con-

tinues to operate as an administrative mechanism to allocate scarce international reserves, rather than as a signal for resource allocation.

Figure 3. Sensitivity to different policy choices



## REFERENCES

- Agénor, Pierre-Richard (1992). "Parallel Currency Markets in Developing Countries: Theory, Evidence, and Policy Implications". In: *Essays in International Finance* No. 188, Princeton University.
- De la Torre, Augusto and Alain Ize (2013). "Exchange Rate Unification: The Cuban Case". Washington: Brookings Institution.
- Di Bella, Gabriel and Rafael Romeu (2017). "Operational Issues Of Currency Unification In Cuba: A Note". In: *Annual Proceedings, The Association for the Study of the Cuban Economy* 27.
- Di Bella, Gabriel, Rafael Romeu, and Francesco Grigoli (2020). "A note on the algebra of multiple exchange rates". In: *Economics Bulletin* 40.
- Di Bella, Gabriel and Andy Wolfe (2008). "A Primer on Currency Unification and Exchange Rate Policy in Cuba: Lessons from Exchange Rate Unification in Transition Economies". In: *Annual Proceedings, The Association for the Study of the Cuban Economy* 18.
- Palacios Cívico, Juan Carlos (2019). "Análisis de la restricción externa de la economía de Cuba en el actual contexto de incertidumbre". In: *Revista CEPAL* 127.