APPENDIX B

Sudden Stops and Debt Dynamics

The model of Calvo, Izquierdo, and Talvi (2004) may underestimate the short-term impact of a sudden stop on debt levels and on the overall fiscal balance, because in the short-term, depreciation also causes an increase in the payment of interest in foreign currency and an increase in debt service when debt is rolled over. To overcome this limitation, a dynamic approach is used to analyze the impact of shocks to the real exchange, interest, and growth rates on the debt-to-GDP ratio projected for 2019–2023.¹

This approach estimates the debt-to-GDP ratio \(b_t\) as follows:

\[
b_t = b_{t-1} \left[ \alpha_t \gamma_t \right] + \left( 1 - \alpha_t \right) \left( 1 + \Delta F_t \right) - ps_t
\]

Where \(\gamma\) is the rate of growth of nominal GDP, \(\alpha\) is the percentage of total debt denominated in domestic currency, \(i_d\) and \(i_e\) are the nominal interest rates in domestic and foreign currency, \(\Delta F\) is the annual variation of the exchange rate, \(ps\) and is the fiscal primary surplus. In this exercise, this equation is adjusted with a measurement error so that the baseline scenario matches the debt-to-GDP projections of IMF (2018). From equation (1), interest payments (as a percentage of GDP) are:

\[
int_t = \frac{b_{t-1} \alpha_t \gamma_t \gamma_t}{1+\gamma_t} + \left( 1 - \alpha_t \right) \left( 1 + \Delta F_t \right)
\]

Then, using equations (1) and (2) it is possible to show that the change in the debt-to-GDP ratio between \(t\) and \(t-1\) equals:

\[
b_t - b_{t-1} = \left[ int_t - ps_t \right] + \frac{\Delta F_t (1 - \alpha_t)}{1+\gamma_t} b_{t-1} + b_{t-1} \left( \frac{-\gamma_t}{1+\gamma_t} \right) + error
\]

The first summand of equation (3) corresponds to the overall fiscal deficit (interest payment minus primary surplus). The second summand corresponds to the balance sheet effect of the exchange rate depreciation.

¹ That is, an increase in the 2019 exchange rate which closes the current account deficit, an increase of 200 basis points in interest rates, and a reduction of 2 percentage points in real GDP growth in 2019 and 2020.
The third summand $bt_{-1} - \gamma_t + \gamma_t (bt_{-1})$ is the effect of nominal GDP growth on debt in $t-1$, that is, if debt levels are kept constant, the debt-to-GDP ratio will decrease from one year to the next as a result of GDP growth. Lastly, the final summand is a measurement error (or changes in other sources of debt not included in the equation).

Results show that on average, a sharp depreciation would increase the debt-to-GDP ratio, shifting it away from the downward trajectory projected for the coming years (see Figure B.1). Moreover, the increase in debt levels in 2019 would be close to 5.9 percentage points (pp) of GDP due to the real exchange rate shock, 7 pp if including the interest rate shock and 8.3 pp when adding the growth shock as well. As shown in Figure B.2, the balance sheet effect of the exchange rate depreciation is the largest component of debt variation between 2019 and 2020 for the three scenarios. However, as the overall fiscal deficit increases (due to higher interest payments), debt levels rise by an additional 2.8 pp. In the most extreme cases—countries in the 75th percentile—the effect of the real depreciation and interest payments may cause an increase in debt levels of around 16 pp.
FIGURE B.2  ▶ Distribution of Components of Debt Variation (% of GDP) (cumulative 2019–2020)

[Box plot diagram showing the distribution of components of debt variation (% of GDP) for FX depreciation shock, FX + r shock, and FX + r + growth shock.

Source: IDB staff estimates based on national sources and IMF (2018).]
References
