Internally consistent conditioning paths for the exchange rate, economic uncertainty and country risk premium

The BCB inflation projection models seek to represent monetary policy transmission mechanisms on economic activity and inflation. In each model, some variables are endogenous, that is, their projections are generated by the model itself. Conversely for others, the projections are exogenous, external to the model. In small-scale semi-structural models\(^1\), variables such as inflation, output gap, Pre-DI swap rate, among others, are endogenous. Other variables, such as exchange rate, economic uncertainty and weather anomalies, are incorporated exogenously to the main model. The projection for these variables may involve the use of auxiliary models (satellite models), judgment, reproduction of a past episode or some predefined criterion. An example of the latter are the scenarios that use the exchange rate trajectory derived from the Focus survey\(^2\).

This box illustrates a joint modeling exercise of economic variables treated as exogenous, but whose behavior may be related to each other. Capturing these interrelations may be particularly relevant for the analysis and projection of inflation, for example, in episodes associated with changes in the degree of economic uncertainty, which in general also involve movements in the exchange rate and the country risk premium. Such episodes can simultaneously activate inflationary and disinflationary channels. Exchange rate depreciations often generate inflationary pressures. Conversely, increases in economic uncertainty, through their effects on investment and consumption decisions, discourage economic activity and, therefore, a disinflationary pressure. The net effect over the horizon will depend on the relationship between the exchange rate and economic uncertainty and its impact on inflation.

The model presented in this box allows the construction of scenarios to subsidize the balance of risks in monetary policy decisions. In the specific case, the model is used to evaluate the net effect

\(^2\) In the case of the Selic rate, the path may involve the use of a Taylor rule or the consideration of different paths, involving judgment or even the use of the Focus survey.
on the inflation of joint movements of exchange, uncertainty and country risk premium.

**Dynamic factors model (DFM)**

To illustrate the construction of internally consistent conditioning variables, a dynamic factors model (DFM)\(^3\) was estimated in order to capture the existing co-movements between economic uncertainty and other variables such as country risk premium, exchange rate, real interest rate, installed capacity utilization and yield curve risk premium\(^4\). Some examples of changes in these variables may be observed in Figures 1 and 2. Figure 1 shows an inverse relationship between the Level of Capacity Utilization (Nuci) and the Economy Uncertainty Indicator (IIE-Br), both calculated by the Fundação Getulio Vargas (FGV), while Figure 2 shows a positive evolution between the IIE-Br and the exchange rate\(^5\).

The DFM was designed for six observable variables and estimated with four latent factors, totaling 16 equations:

\[
Y_t = \beta_1 S_{1t} + \beta_2 S_{2t} + \beta_3 S_{3t} + \beta_4 S_{4t} + \epsilon_{Yt}
\]

\[
S_{ft} = \rho^f S_{f,t-1} + \nu_{ft}, f = \{1, 2, 3 \text{ and } 4\}
\]

\[
\epsilon_{Yt} = \alpha \epsilon_{Y,t-1} + \zeta_{Yt}
\]

where \(Y\) (economic uncertainty, country risk premium, exchange rate, real interest rate, installed capacity utilization and yield curve risk premium). Each \(S_{ft}\) represents a co-movement relation among variables. In all equations, \(\beta_k \neq 0\), since each equation shares at least one joint factor. Term \(\epsilon_{Yt}\) denotes the idiosyncratic component, which represents the dynamics not explained by the co-movement relations with the other variables. Figure 3 illustrates how much of the recent dynamics of the six variables is explained by the common factor \(S_{1t}\).

The DFM estimation is carried out in two steps. First, the model parameters are estimated using Principal Component Analysis (PCA). Second, the factors are iteratively re-estimated using Kalman filter. Therefore, the approach is comparable to the PCA, but it is more adequate to the exercise, because it deals with incomplete data, is more efficient for

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\(^3\) For further details on these models, see Barbar et al. (2013).

\(^4\) This premium is estimated by the difference between the 360-day Pre-DI swap rate and the average Selic rate expectations for the next 12 months, calculated from the Focus survey conducted by BCB.

\(^5\) Regarding the measurement of economic uncertainty, see Baker et al. (2016) and Ferreira et al. (2017). As for the effects of uncertainty on the decisions of economic agents, see, for example, Forbes (2016) and Redl (2017).
small samples and provides a framework that allows imposing some structure to the model, through restrictions on its parameters⁶.

**Simulation exercise**

In this box, the DFM is used to simulate internally consistent movements between the exchange rate, uncertainty and country risk premium. The trajectories resulting from these variables are then incorporated into the BCB’s semi-structural model to generate endogenous trajectories for the output gap, the Pre-DI swap rate premium and the inflation rate.

The simulations use two sets of conditioning paths for the exogenous variables. In both, there is a depreciation of 10% in the nominal exchange rate (R$/US$). For the sake of simplicity, it is assumed that this depreciation occurs integrally in the first quarter and that the exchange rate remains constant at the new level for the entire simulation horizon. In the first conditioning scenario, it is assumed that the country uncertainty and risk premium variables remain unchanged, with no direct impact on the output gap. The second conditioning scenario incorporates increases of about 7% in economic uncertainty and of 30% in the country risk premium in the quarter of the shock. These paths are in accordance with the comovements extracted from the DFM. Throughout the simulation horizon, the values of these variables decrease gradually, in accordance with the dynamics produced by the DFM. These dynamics are consistent with the hypothesis that the exchange rate remains constant at the new level.

**Results**

Figure 4 shows the accumulated inflation response in four quarters in both conditioning scenarios. It is worth noting that the simulation considers both the effects on administered and market prices and their feedback effects on the IPCA. The pass-through to administered prices occurs due to the impact of the exchange rate on the prices of gasoline, bottled gas and diesel, in addition to the effect of the increase of the inflation itself on different items of the administered prices, which have a high degree of inertia⁷.

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6/ For further details on this kind of estimation, see Banbura and Modugno (2010).

7/ See Box “Revision of the medium-term projection models for administered prices” in the September 2017 Inflation Report. The greater adherence of fuel prices to their international price levels has increased the response of these prices to the exchange rate.
Several aspects are noteworthy. First, the effect on inflation reaches values close to the maximum in the second quarter. After the fourth quarter, the impact on inflation declines.

Second, the inflationary impact of the exchange rate shock is partially mitigated by the negative impacts of rising economic uncertainty and the increase in the Pre-DI swap rate (due to the increase in the risk premium) on the output gap, especially in longer horizons.

Third, the inflationary impacts of the exchange rate tend to be more significant than the disinflationary effects of uncertainty and the risk premium that act through the output gap. At the end of the first year, prices rise by about 0.9%, but they decline by approximately 0.1% at the end of the second year.

Finally, it should be noted that the exchange rate impacts inflation more quickly inflation, while the effects of uncertainty and country risk premium operate with a greater lag. As a result, in the current simulation, inflationary effects are predominant in almost the entire horizon.

Concluding remarks

This box stressed the importance of consistently handling variables that exogenously feed the scenarios generated by models. A framework was presented to support the evaluation of alternative scenarios. The analyzes also allow to deepen the knowledge about the dynamics of economic variables of interest and their effects on inflation.

In particular, the exercise presented in this box shows the impacts of simultaneous and internally consistent changes in the exchange rate, in the degree of economic uncertainty and in the country risk premium. In the simulation, the inflationary effects of the exchange rate are only partially mitigated by the effects of the increased uncertainty and the country risk premium on the output gap over most of the horizon under consideration.

Finally, it should be emphasized that the models are instruments aimed to support decision making processes and should be complemented by more comprehensive assessments, based on a wide range of information, as well as by the exercise of judgment.
References


