Supply shocks, prices, and consumption

Successive supply shocks hit the Brazilian economy in 2021. The shortage of rainfall affected electricity and food production, increasing domestic prices. In addition, there were increases in the international prices of energy commodities and shortages of some industrial inputs on a global scale, which can be characterized as supply shocks from the point of view of the domestic economy. From a global perspective, these two phenomena are the result of both increased demand, in a scenario of expansionary policies to mitigate the effects of the pandemic, and supply constraints, arising from the unfolding of the health crisis and limitations to output expansion in the short-term. Price hikes associated with these supply shocks can have negative impacts on household consumption, through the decrease in their real purchasing power and the substitution for more affordable products.

In this context, this box assesses the effect of supply shocks on household consumption in Brazil. Specifically, it refers to the estimation of consumption response to changes in purchasing power originated from movements in the prices of fuel, electricity, and food-at-home.[1] Embedded in this analysis is the assumption that price changes in these items are associated with supply shocks.

To obtain this estimate, monthly models were used associating changes in consumption to changes in household purchasing power (derived from price variations of the items listed above). The strategy is similar to that adopted by Edelstein and Kilian (2007) and Hamilton (2009), who sought to estimate the impact on consumption of oil price shocks.

The purchasing power variation in the period t, $y_{1,t}$, was constructed by adding the contributions of the selected items to the IPCA variation,

$$y_{1,t} = \sum_{s \in S} peso_{s,t}\left(log\left(preço_{s,t}\right) - log\left(preço_{s,t-1}\right)\right),$$

where S is the set of selected items, $preço_{s,t}$ is the index number in the IPCA of the item s in the period t and $peso_{s,t}$ is its weight in the IPCA.[2] The variation in household consumption in t, $y_{2,t}$,

$$y_{2,t} = log(consumo_t) - log(consumo_{t-1}),$$

is measured by proxies of actual consumption using data from the Monthly Trade Survey (PMC). Besides the total consumption of goods, the partition between "non-durable" and "semi-durable and durable goods" was also analyzed.[3] The first group includes supermarkets, gas station, and pharmacy segments. Other segments are included in the second group.

Figure 1 compares six-month accumulated changes in purchasing power and consumption of goods. From 2003 to 2021, there is a negative albeit weak correlation between these two variables (-0.21), when the full sample is considered. If the sample is limited to the period before the pandemic, the correlation is -0.43.

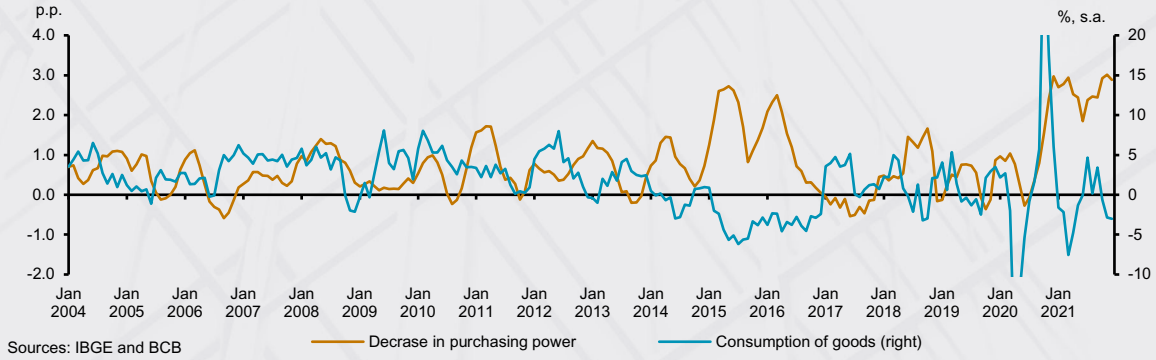
1/ The shock resulting from the shortage of industrial inputs was not included in the exercise given the impossibility of finding in the IPCA an item directly linked to it and whose historical price variation stems mainly from supply shocks.

2/ The choice for the weight of the items in the IPCA is due to the unavailability of timely estimates for the weights of items in household consumption.

3/ Further details on measures of consumption of goods obtained from the PMC data are available in the box "Consumption of goods and services during the pandemic" of the September 2021 IR.

Additionally, it is possible to observe a drop in the consumption of goods in the second half of 2021, a period when the effect of the supply shocks mentioned at the beginning of this box on prices is higher.

Figure 1 – Price shocks and consumption
Accumulated change in six months



Sources: IBGE and BCB

To test this relationship more accurately, a bivariate vector autoregressive model (VAR) of order K in the monthly frequency was estimated for each of the consumption measures, with control variables for the economic cycle, W_t, as exogenous,

$$\begin{bmatrix} y_{1,t} \\ y_{2,t} \end{bmatrix} = A + \sum_{k=1}^{K} B_k \begin{bmatrix} y_{1,t-k} \\ y_{2,t-k} \end{bmatrix} + \sum_{j=0}^{J} C_j W_{t-j} + \begin{bmatrix} u_{1,t} \\ u_{2,t} \end{bmatrix},$$

where $u_t = [u_{1,t} \quad u_{2,t}]'$ is the error vector and A, B_k and C_j are matrices of coefficients to be estimated.[4] The identification strategy was Cholesky decomposition, with the change in purchasing power ordered as the most exogenous variable. The estimation sample runs from 2003 to December 2019, so that the estimated coefficients are not affected by the additional volatility stemming from the Covid-19 pandemic.

Figure 2 presents a measure of consumption elasticity, after a given number of months, to changes in the purchasing power. The measure is the ratio between two impulse response functions (IRF). The numerator equals the cumulative response of the change in consumption to a purchasing power shock. The denominator is the cumulative response of the purchasing power measure. Both FRI's refer to the same initial purchasing power shock. Table 1 presents the value of this cumulative elasticity after six months, when most of the consumption response has already occurred (Figure 2).

The response of the volume of consumed goods to supply shocks proved to be both statistically and economically significant, stabilizing quickly around -1.5. That is, a negative supply shock (defined here as increases in fuel, electricity, and food-at-home prices) that reduces household purchasing power by 1 p.p. would reduce the volume of goods consumed by 1.5 p.p.[5] and this decrease would occur quickly, in just a few months.

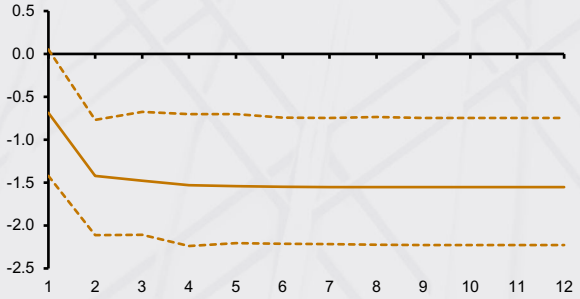
4/ For each consumption measure, the VAR order was chosen automatically according to the Akaike's criterion. The chosen orders were, respectively, 1, 1, and 3 for the models with total consumption of goods, non-durable goods, and semi-durable and durable goods. Two control variables were used for the economic cycle: the Emerging Markets Bond Index Plus (EMBI+) spread for Brazil and the average interest rate for new household non-earmarked credit operations in the total personal credit type (available at the BCB's Time Series Management System under code 20748). The first advantage of these two measures is that their long sample allows the model estimation since 2003, when the consumption proxy became available. The Brazil risk measure captures oscillations in fiscal risk and in local and global financial conditions, variables typically associated with economic fluctuations in emerging countries. The choice of the interest rate for new credit grants has two additional motivations. This variable is directly influenced by monetary policy and is affected by other changes in the credit market. The latter can play a particularly important role in the demand for durable goods, such as automobiles. The two control variables show a trend throughout the sample, as well as the Selic rate and the estimated neutral real interest rate present in the box "Revision of the small-scale aggregate model" of the December 2021 IR. Thus, the model used the cyclical components, obtained by HP filter, of these variables.

5/ Edelstein & Kilian (2007) and Hamilton (2009) discuss the role of consumer confidence and multiplier effects for achieving an elasticity greater than one.

Moreover, results suggest that the greater household response does not necessarily come from reducing consumption of items with increased price, which are classified as non-durable goods, but from reducing more strongly the consumption of less essential items, such as "semi-durable and durable goods" (elasticity of -2.9).[6] [7] A similar effect was found by Edelstein & Kilian (2007) and Hamilton (2009) when estimating the response to oil price shocks in the U. S.

Figure 2 – Consumption of goods

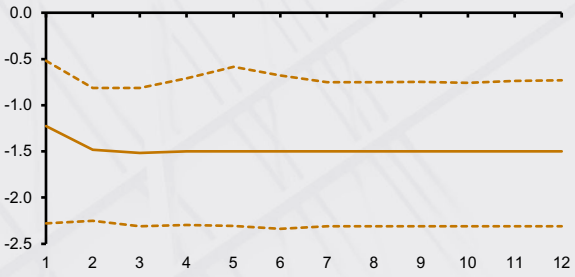
Cumulative elasticity to a negative shock in purchasing power



Obs: Dashed lines indicate the 95% confidence interval. Horizon in months.

Figure 3 – Consumption of non-durable goods

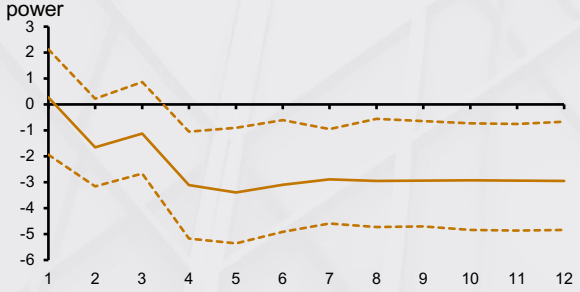
Cumulative elasticity to a negative shock in purchasing power



Obs: Dashed lines indicate the 95% confidence interval. Horizon in months.

Figure 4 – Consumption of durable and semi-durable goods

Cumulative elasticity to a negative shock in purchasing power



Obs: Dashed lines indicate the 95% confidence interval. Horizon in months.

Table 1 – Elasticity to a negative shock in purchasing power

Cumulative elasticity in the period

Itemization	Months		
	3	6	9
Goods	-1.5	-1.5	-1.6
Non-durable goods	-1.5	-1.5	-1.5
Durable and semi-durable goods	-1.1	-3.1	-2.9

In summary, the effects of supply shocks on household consumption are rapid, significant, and larger for less essential items. The dissipation of the 2021 electricity price shock, due to the increase in the level of the reservoirs of the hydroelectric plants and the expected end of the collection of the additional tariff resulting from the water shortage flag, can be a positive factor for consumption in 2022. In turn, the recent substantial increase in commodity prices in BRL – especially oil and grains, associated with the conflict in Eastern Europe and climate conditions in the south of South America, including Brazil – can contribute negatively to household consumption throughout the year.

References

Edelstein, Paul & Kilian, Lutz. 2007. Retail Energy Prices and Consumer Expenditures. Working paper. University of Michigan.

Hamilton, James. 2009. Causes and Consequences of the Oil Shock of 2007-08. Brookings Papers on Economic Activity.

6/ The elasticity of goods is not necessarily a convex combination of the elasticities of the components of their partition, since the models are estimated independently for the total and for its subgroups.

7/ The results proved robust to a number of alternative specifications, such as: setting higher orders for the VAR; using the exogenous variables in difference, with lags; using the Financial Conditions Index (FCI) calculated by the BCB as an exogenous variable (in this case, with a shorter sample due to the index's availability period). In all cases the effect of the price shock on consumption proved to be at least as important as in the baseline exercise.