The dynamic relations between capacity utilization and capital goods investment in Brazil

The capacity utilization index of the transformation industry (NUCI)\(^1\), estimated by FGV, is hovering around all-time lows\(^2\), what could imply limitations to the recovery on investment in capital goods in the medium term. Theoretically, low level of capacity utilization would mean that installed machines and equipment would be sufficient to meet an eventual increase on demand for industrial goods.

However, it is worth noting that the trajectory of NUCI and of capital goods production\(^3\) were similar between January 2002 to October 2016\(^4\) (figure 1). Indeed, the reduced level of NUCI in early 2009 did not seem to preclude the recovery of capital goods production that followed. Therefore, this box raised the issue on the influence of industrial capacity utilization on the recovery of investment in Brazil in the last couple of decades. The presence of nonlinearities between the series is also explored in this exercise.

In order to understand the connection between the transformation industry’s NUCI and capital goods output, a vector autoregressive model (VAR) was initially estimated. Variables were seasonally adjusted and used in terms of percentage changes\(^5\).

The results of the impulse-response tests, shown on figures 2 and 3, revealed that shocks of one standard-deviation in the NUCI translates into an increase of up to 0.82 percent in capital goods production after two quarters, whereas shocks in capital goods output do not essentially alter the fluctuations of NUCI\(^6\).

In addition to that, a Granger causality test was performed and statistical significance was found in

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1/ Capacity utilization/installed capacity ratio: percentage of capital and labor that companies are using in the month the survey is taken.

2/ In Brazil, the level of capacity utilization (NUCI) has stayed below 75 percent since August 2016.

3/ In this box, capital good output is used as proxy of investment.

4/ The correlation between the seasonal adjusted series is 0.66 from January 2002 to October 2016.

5/ The procedure turned the series into stationary. In level, both presented an unit root according to the Dickey-Fuller and Philips-Perron tests.

6/ Besides the constant, 4 lags were used in the VAR, as Schwarz criteria suggested. Cholesky decomposition was applied for the impulse-response tests, being necessary the ordering of the employed variables. In this box, the percentage change of the NUCI was considered more exogenous than the growth of the capital goods production.
terms of NUCI anticipating the capital goods production, while the opposite relationship was not verified.

Thereafter, it was investigated whether the fluctuations on transformation industry’s NUCI helped to understand the shifts in investment with different levels of idle capacity in the economy. Thus a threshold model\(^7\) was estimated in order to explain the variations on capital goods output. NUCI, with two-lags\(^8\), was considered as a threshold and also as an explanatory variable\(^9\).

The results pointed out that, in moments of low idle capacity (NUCI > 82 percent), the impact that oscillations in NUCI has in capital goods investment tends to be three times higher than the effect estimated in case of high level of slack\(^10\). In both cases, however, NUCI fluctuations has a positive and significant impact on capital goods output.

Non-linear models estimates are consistent with the initial expectation in case of low idle capacity (NUCI>82%). At that level, new investment would be needed to push up NUCI levels. Surprisingly, though, when idle capacity is high, increases in NUCI significantly help to forecast investment growth. This finding, particularly, may be related to the need of constant investment to avoid the obsolescence of machines and equipment; to heightened expectations of economic recovery given positive changes in NUCI, even in a situation of high level of slack; and/or on the way the capacity utilization is measured, based on qualitative questionnaires.

This box analyzed the dynamics between the investment in capital goods and the level of capacity utilization (NUCI) in transformation industry. The results obtained on this exercise revealed that positive changes in NUCI helped to forecast similar pattern of the investment in capital goods, even when the levels of capacity utilization is low, which is the case of Brazil nowadays. In that scenario, the low level of NUCI plays a role but it is not, \textit{per se}, an

\[\text{Figure 3 - Response of NUCI to shocks in production of capital goods} \]

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure3.png}
\caption{Response of NUCI to shocks in production of capital goods}
\end{figure}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|}
\hline
Quarter & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\
\hline
Response & -0.15 & -0.10 & -0.05 & 0.00 & 0.05 & 0.10 & 0.15 & 0.00 & 0.05 & 0.10 \\
\hline
\end{tabular}
\end{table}

\(7/\) Estimated through the global fixed number method. In that case, the value found as a threshold is that one which minimizes the sum of squares of the regression residuals in the considered states (In this box, equal to 2)

\(8/\) The choice of lagged NUCI instead of contemporaneous took into account the information criteria, as accomplished in the case of VAR.

\(9/\) In the equation to model the production, it were included as explanatory variables 3 lags of the dependent variable, a constant and the NUCI, with two lags. The procedure turned the residuals of the estimated model non-correlated.

\(10/\) The procedure turned the residuals of the estimated model non-correlated. The parameter found for the difference of NUCI logarithm lagged in 2 quarters in the equation of capital goods output when the NUCI is below 0.82 was 0.87, against 2.77 in the alternative state. Both estimates are significant at the level of 5 percent.
impediment to a gradual recovery of investment in the upcoming quarters.