NOMINAL GDP IN PORTUGAL

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1. Introduction

Macroeconomic theory and policy has devoted an increased attention in recent years to the potential benefits of fixing a nominal GDP growth rule. This increased interest has to some extent been stimulated by the recognition in the earlier 80's that shocks to velocity could be sufficiently important in empirical terms to undermine the desired effects of money growth targeting. Several authors (B. Friedman(1988), Gordon (1983)) pointed out the collapse in that period of a stable relationship between money and nominal income. The need to take account of velocity shocks suggested the use of a nominal GDP growth rule. This rule, by compensating for such type of shocks, would thus potentially offer a superior policy alternative to a crude monetary growth rule, when the ultimate purpose is to stabilize the evolution of nominal demand along some growth pattern.

The objective of fixing such a rule, if accepted, poses however a new set of problems. In particular, successful use of a nominal demand growth rule requires the availability of instruments able to influence such variable.

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Take the case where the monetary authorities can control with enough accuracy the growth of a given monetary aggregate such as, for instance, the money base. In this case, unless they are able to predict base velocity changes, the control of nominal demand might prove difficult or impossible with this instrument, and search for a different one might be required.

This paper intends to examine the potential interest in fixing a nominal GDP growth rule in the context of the Portuguese economy and to analyze the instruments which, in that case, should ideally be used.

2. Explaining Nominal GDP changes.

We start by considering a set of potential instruments to control nominal demand growth. We first take a group of monetary aggregates including the money base, $M_1$, $M_2$ and $M_{2-}$.

We additionally consider a group of alternative credit instruments including Total Domestic Credit, Credit to the Productive sector and Credit to the Public Sector. We use annual data from 1966 to 1987 as published in the Bank of Portugal monetary statistics. For nominal GDP we use national account data as published in the Annual Report of the Bank of Portugal. The following Table 1 indicates the regression results for these alternative instruments. Growth rates were obtained as first differences on log levels. In all equations the dependent variable is the growth rate in nominal GDP. Besides a constant, a trend and a lagged dependent variable term we have included as explanatory variable a four-year distributed lag of the growth rate of the selected instrument.

We first may note that not all of the indicated financial aggregates pose the same control difficulties to the monetary authorities. One would expect, for instance, that the latter could control more accurately the evolution of the monetary base than the evolution of $M_1$ or $M_2$. Credit instruments, if we exclude perhaps the credit channeled to the public sector, would apparently pose less difficulties on this account. In fact, we may note that both Total Domestic Credit and Credit to the Productive Sector have, to greater or lesser extent, been typically used as instruments in the stabilization programs advanced by the IMF.
### Table 1

Regression Equations Explaining Nominal GDP Growth, 1970-1987

<table>
<thead>
<tr>
<th>Control Instrument</th>
<th>Monetary Base</th>
<th>M1</th>
<th>M2</th>
<th>M2-</th>
<th>Total Domestic Credit</th>
<th>Credit to Productive Sector</th>
<th>Credit to Public Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.091</td>
<td>0.076</td>
<td>0.043</td>
<td>0.036</td>
<td>-0.096</td>
<td>-0.076</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>(1.92)</td>
<td>(1.5)</td>
<td>(0.78)</td>
<td>(0.74)</td>
<td>(-2.08)</td>
<td>(-1.04)</td>
<td>(2.28)</td>
</tr>
<tr>
<td>Trend</td>
<td>0.0</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003</td>
<td>0.005</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.59)</td>
<td>(0.51)</td>
<td>(0.74)</td>
<td>(1.42)</td>
<td>(1.79)</td>
<td>(0.58)</td>
</tr>
<tr>
<td>Lagged dependent variable</td>
<td>0.542</td>
<td>0.414</td>
<td>0.54</td>
<td>0.386</td>
<td>0.266</td>
<td>0.355</td>
<td>0.142</td>
</tr>
<tr>
<td></td>
<td>(1.78)</td>
<td>(1.47)</td>
<td>(2.11)</td>
<td>(1.35)</td>
<td>(1.01)</td>
<td>(1.23)</td>
<td>(0.42)</td>
</tr>
<tr>
<td>Control Instrument</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contemporaneous</td>
<td>-0.202</td>
<td>0.106</td>
<td>0.249</td>
<td>0.306</td>
<td>0.348</td>
<td>0.589</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(-1.44)</td>
<td>(0.70)</td>
<td>(1.47)</td>
<td>(1.55)</td>
<td>(3.53)</td>
<td>(3.47)</td>
<td>(-0.09)</td>
</tr>
<tr>
<td>One year lag</td>
<td>0.044</td>
<td>-0.06</td>
<td>0.239</td>
<td>0.153</td>
<td>0.446</td>
<td>-0.041</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>(0.32)</td>
<td>(-0.43)</td>
<td>(1.25)</td>
<td>(0.57)</td>
<td>(3.29)</td>
<td>(-0.16)</td>
<td>(1.74)</td>
</tr>
<tr>
<td>Two year lag</td>
<td>0.112</td>
<td>-0.177</td>
<td>-0.492</td>
<td>-0.607</td>
<td>-0.162</td>
<td>0.07</td>
<td>0.048</td>
</tr>
<tr>
<td></td>
<td>(0.82)</td>
<td>(-1.18)</td>
<td>(-2.4)</td>
<td>(-2.34)</td>
<td>(-1.02)</td>
<td>(0.39)</td>
<td>(1.51)</td>
</tr>
<tr>
<td>Three year lag</td>
<td>0.031</td>
<td>0.144</td>
<td>0.104</td>
<td>0.322</td>
<td>0.202</td>
<td>0.025</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(0.85)</td>
<td>(0.52)</td>
<td>(1.27)</td>
<td>(2.12)</td>
<td>(0.134)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.339</td>
<td>0.167</td>
<td>0.519</td>
<td>0.457</td>
<td>0.788</td>
<td>0.605</td>
<td>0.311</td>
</tr>
<tr>
<td>SEE</td>
<td>0.039</td>
<td>0.044</td>
<td>0.033</td>
<td>0.035</td>
<td>0.022</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Q</td>
<td>6.66</td>
<td>4.46</td>
<td>4.45</td>
<td>3.94</td>
<td>7.05</td>
<td>4.39</td>
<td>4.02</td>
</tr>
</tbody>
</table>

Note: t-values in parenthesis.
Inspection of Table 1 suggests that Total Domestic Credit is the aggregate that performs better in terms of influencing the evolution of nominal demand growth\(^{(1)}\). Note that the contemporaneous growth rate of credit together with the one-year and three-year lagged rates significantly affect demand. Credit to the Productive Sector ranks next as a potential instrument to influence demand. However, this influence seems to be exerted through a contemporaneous effect only. On the other hand, Credit to the Public Sector seems not to be an adequate instrument to control demand. Among the monetary aggregates, there seems to be no easily exploitable relationship with demand growth. The money base growth which is perhaps comparatively less difficult to control bears a weak relationship with nominal GDP growth. On the other hand, the M2 aggregate which reveals a closer association with demand, raises the question of controllability. Also, the coefficients of the respective distributed lags and corresponding standard errors do not suggest a clear interpretation and way of exploitation.

Returning to the aggregate which seems more suitable to control demand, we exhibit, in Figure 1, the evolution of Total Domestic Credit growth and of nominal GDP growth from 1970 to 1987. Visual inspection suggests the reasonably close link between the two variables detected through more formal methods. We may clearly note the influence of the two major IMF stabilization programs in 1977 and 1982. The sharp contraction in credit which typically characterizes such interventions is shortly accompanied by a slowdown in demand growth. These interventions followed the two more important episodes of credit accelerations in 1976 and 1981 respectively. Note also the acceleration in credit from 1970 to 1973. In the last year, which just preceded the 1974 revolution, real GDP growth attained the peak value for many years of 10%.

Finally it can be noticed that the longer period of sustained reduction in credit growth starts in 1982. In a record period length of six successive years credit growth has been squeezed. This certainly is an element to be acknowledged in interpreting the disinflation experience occurring after 1985. In fact it is usual to stress the exchange rate policy shift undertaken at that time,

\(^{(1)}\) This conclusion was maintained when we tested a filtered version of the OLS regressions, to account for possible serial correlation in the residuals.
FIGURE 1

$C = \text{Credit Growth}$  $Y = \text{Nominal GDP growth}$

MIN VALUE 0.10617  MAX VALUE 0.33038  SPACING 0.45756E-02
namely the freezing of the exchange rate level for an announced period. We can see in Figure 1 that this shift in policy has benefited from a favorable background in terms of an ongoing steady deceleration in demand growth which started some years before. On the other hand, it was subsequently validated by further reductions in the growth of nominal demand.

3. The Response of Prices and Output to Nominal GDP Changes

We know as an identity relationship, that nominal GDP growth divides itself in real output growth q and inflation p:

\[ y = p + q. \]  

(1)

It is of interest to inquire about the potential influence of y on p and q. Normally it is accepted that there is no long-run influence of nominal demand on real growth. A sustained increase in nominal demand growth will ultimately translate itself only in an increased inflation rate. This suggests the idea, often cited, that the authorities are able to set only the rate of demand growth while the productive sector, firms and workers, will strike the specific division of that rate into output growth and inflation.

In the short-run, however, even theories greatly embedded in the classical spirit admit that this neutrality might not hold. Imperfect information or rigidities in the system might allow for short-run effects of nominal demand on real output. We attempt now to investigate, the influence of demand growth on real output, for the Portuguese economy.

For this purpose we consider the following specification

\[ q_t = \alpha + \beta I + \lambda q_{t-1} + H(L)y_t + u_t \]  

(2)

where \( H(L) \) is a polynomial in the lag operator and \( u_t \) is a serially independent error term with mean zero. Besides a constant and a time trend, a lagged dependent variable term is included to capture

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(2) I am ignoring here the debate about super-neutrality of money.
inertia type effects. Also, the polynomial $H(L)$ is intended to capture some of the dynamic effects of demand impulses on real output growth. For the purpose of estimation we have included four terms in the polynomial that is

$$3 \quad H(L) = \sum_{j=0}^{3} h_j L_j.$$  

Clearly, for the long-run neutrality to apply, the sum of the $h_j$ coefficients should equal zero. That is, $H(1) = 0$.

The estimate of equation (2) gave the following results (t-values in parenthesis):

$$q_t = 0.024 + 0.001t + 0.558q_{t-1} + 0.501 y_t - 0.77 y_{t-1} + 0.191 y_{t-2} - 0.13 y_{t-3}$$  

$$R^2 = 0.28 \quad \text{SEE} = 0.03$$  

The lagged dependent variable term is significant at the 10% level but not at the 5%. Contemporaneous nominal demand growth proves to have a significant positive influence on real output growth. On the other hand, once-lagged demand growth has a significant negative influence on output. This seems to exhaust the influence of demand on output since the next two lagged terms are not significantly distinct from zero.

According to this result, there is therefore a short-run influence of nominal demand on output: a positive contemporaneous influence is followed by a sort of negative correcting influence in the next year. As with respect to long-run effects an F-test for the null hypothesis that $\sum_{j=0}^{3} h_j = 0$ gave a value of $F(1,11) = 0.43$ which is not significant even at the 10% level. This suggests that the long-run neutrality of nominal demand prevails in the Portuguese economy.
Some modern macroeconomic theories take a special view on the short-run influence of nominal demand on real output. They suggest that short-run real effects are produced only by non-anticipated changes in nominal demand. Anticipated shifts in demand growth translate into price inflation only. In order to test the new classical proposition in the Portuguese context we first split up observed changes in nominal GDP into expected and unexpected components. For this purpose we use our previous specification relating demand growth with domestic credit growth.

We implicitly assume that economic agents know this link and use it as the most efficient means of predicting nominal demand. We next estimated the following equation explaining real output growth:

$$q_t = b_0 + b_1 t + b_2 q_{t-1} + b_3 Uy_t + b_4 \dot{y}_t + u_t$$  \hspace{1cm} (3)

where $Uy$ and $y$ indicate respectively, the unanticipated and anticipated components of $y$. The $y$ component corresponds to the fitted values of the domestic credit regression equation explaining nominal income (3), while $Uy$ are the residuals from this equation. The dual to equation (3), since it is connected by the identity $y = p + q$, is an equation explaining the rate of inflation. We may write

$$p_t = d_0 + d_1 t + d_2 q_{t-1} + d_3 Uy_t + d_4 \dot{y}_t + E_t$$  \hspace{1cm} (4)

The new-classical theory would suggest that $b_3 > 0$ and $b_4 = 0$ in equation (3) while $d_4 = 1$ in equation (4). Estimates of equation (3) and (4) gave the following results (t-values in parenthesis):

$$q_t = 0.082 - 0.002t + 0.1569q_{t-1} + 0.619 Uy_t - 0.000 \dot{y}_t$$  \hspace{1cm} (5)

| $t$-value | (1.73) | (-1.09) | (0.68) | (1.95) | (-0.02) |

$R^2 = 0.157 \quad$ SEE $= 0.034$

(3) - We have, however, reestimated this equation without the contemporaneous value of domestic credit growth as an explanatory variable. It seemed reasonable to assume that information lags on credit growth would allow economic agents to use only information up to the previous year.
\[ p_t = -0.082 + 0.002_t + 0.1569q_{t-1} + 0.381 Uy_t + 1.000 \hat{\delta}_t \]  
\[ (-1.73) (1.09) (-0.68) (1.17) (3.94) \]

\[ R^2 = 0.68 \quad \text{SEE} = 0.03 \]

In the first estimate it can be seen that if there is any influence on real growth this comes through unanticipated shifts in nominal demand growth. In fact the latter is almost significant at the 5% level. On the other hand, the second estimate clearly suggests that the anticipated component of demand growth translates significantly into prices changes (t-value of 3.94). Note also that the estimated coefficient of \( y \) is unity as one would expect under this theory. On the other hand, the coefficients of \( Uy \) in the two equations suggest that a surprise change in nominal demand growth will, in the short-run, split itself into a real effect (62%) and a price effect (38%).

4. Conclusions

The foregoing analysis seems to give some support to the new classical view according to which only surprise shocks in nominal demand growth can produce real output effects. Anticipated shifts will be solely reflected on inflation. If these propositions are accepted it seems reasonable to admit that the control of nominal GDP growth through some proposed rule on credit creation could bring a rapid beneficial effect on the control of inflation. If the rule is well-defined and well understood by economic agents, it will facilitate expectations formation and could then rapidly transmit its effects to inflation.

The analysis also suggests that the variability of output growth could also conceivably benefit from the operation of such a rule. In fact it is clear from equations (3) that a reduction in the variability of the surprise term, obtainable in principle from the working of such a rule, could contribute to the reduction of the variability of output growth.
References
