1. INTRODUCTION

The objective of this paper is to calculate a Monetary Conditions Index (MCI) for the Portuguese economy. MCIs are summary indicators of the effects of monetary variables on economic activity growth and on inflation. The idea is to aggregate monetary variables in a simple way in order to build an overall indicator for the prevailing monetary conditions. The most usual formulation can be stated as

\[ MCI_t = \alpha_i \left( r_i - r_{t_0} \right) + \left( 1 - \alpha_i \right) \ln \left( \frac{e_i}{e_{t_0}} \right) \]  

where \( r \) measures the short-term interest rate, \( e \) represents the exchange rate (an increase represents an appreciation), \( t_0 \) is the base period and \( \alpha \) and \( 1 - \alpha \) are the aggregating weights. Sometimes these weights are presented as a ratio \( \alpha / (1 - \alpha) \), interpreted as the amount of depreciation necessary to balance a change of 100 basis points in the short-term interest rate. The fact that the weights are indexed by \( i \) (for GDP growth or inflation) reflects the fact that the relative effects of interest and exchange rates changes depend obviously on the variable that is being considered.

An important caveat of this kind of indicators is that they cannot deliver indications about the adequacy of the monetary policy, since they do not depend on the specific conditions of the economy (ongoing business cycle position, inflation level or fiscal policy stance) and are usually interpreted using rates of change.

2. SOME METHODOLOGICAL ISSUES

This is not the place for a survey of the literature on the MCIs, (see e.g., Costa (2000b)). However some issues are worth clarifying at the outset.

2.1. Additional variables

Some additional variables are sometimes included in the computation of MCIs. The long-term interest rate, the housing prices and the stock prices are the most common examples. However, for several reasons, the only variables considered in the paper are the short-term interest rate and the exchange rate. The role of the long-term interest rate in the Portuguese economy is rather limited, as the relevant interest rates for the private non-financial sector (bank loans and security debt rates) are typically indexed to money market rates. Moreover, there is a high level of uncertainty about the way in which housing prices and stock prices impact on the economy.

2.2. Aggregation coefficients

The choice of the aggregation coefficients is the crucial problem in the construction of MCIs. We shall consider two alternatives, called static and dynamic MCI respectively. In both cases the aggregation coefficients are based on an annual model for the Portuguese economy developed at Banco de Portugal.

(i) The static MCI corresponds to the direct application of equation 1. The interest and the exchange rates are aggregated using fixed weights according to the accumulated impacts of exchange and interest rates on GDP growth and inflation at the end of a 3-year horizon.
(ii) The dynamic MCI follows Batini and Turnbull (2000). Now, the weights are not imposed to sum to one, and represent the impact of each variable on GDP growth or inflation in each period of a 3-year horizon. This indicator tries to quantify the effects of past and present changes of monetary conditions on the current behaviour of the economy rather than just giving a qualitative picture of those conditions. The paper devotes special attention to this dynamic MCI.

2.3. Real vs nominal

Another general discussion surrounding the MCIs for GDP is related to the choice between nominal and real indicators. The paper computes the dynamic MCI both in nominal and real terms. Neither is, however, immune to criticism.

The nominal MCI assumes that the nominal changes in interest and exchange rates are the ones relevant to explain GDP fluctuations. Obviously, this assumption is particularly restrictive and misleading for periods where inflation registered pronounced changes.

The major problem in the MCI in real terms concerns the exchange rate. It is well known that the Balassa-Samuelson type effects explain the coexistence of a high GDP growth and real exchange rate appreciation. Thus, the assumption that any fluctuation of the real exchange rate tends to produce effects on competitiveness and, therefore, on economic activity is particularly strong, specially for an analysis over long time spans.

3. THE PORTUGUESE DATA FOR INTEREST AND EXCHANGE RATES

This section presents the annual data used to construct the MCIs from 1986 onwards\(^{(1)}\). The effective exchange rate for the Portuguese economy (Chart 1) is computed considering the most important trade partners, using export and import flows; the short-term interest rate considered (Chart 2) is the 3-months money market rates\(^{(2)}\).

In this period, there was a clear trend of nominal depreciation of the Portuguese escudo that was gradually interrupted during the 90’s, reflecting the participation of Portugal in the European Monetary Union. The interest rate, has also registered a downward trend, particularly steep between 1986 and 1988 and, again, between 1993 and 1998.

This evolution is, of course, quite different when the variables are measured in real terms. The decline of the interest rate adjusted for the observed inflation was not as pronounced, and the real exchange rate appreciated until the early 90s.

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\(^{(1)}\) Before 1986 monetary policy was particularly based on capital controls, credit ceilings and administratively fixed interest, and, therefore, the interest rate probably will not reflect the true monetary conditions. See OECD (1999) for a description of the gradual liberalization process that started in the second half of the 80s.

\(^{(2)}\) For the second half of the 80s, this series was extended using the banking deposits rate.
This section presents the simulations of a model used in the forecasting exercises at the Banco de Portugal. These outputs were in turn used to compute both the static and dynamic MCI weights for interest and exchange rates.

It is important to remark that this model is of a backward looking nature and is mainly used for short and medium term forecasting. Consequently, it does not account for forward-looking expectations, which may play an important role when economic agents respond to monetary policy changes. Additionally, in the simulations presented, no constraints were imposed in order to assure financial equilibrium of both public and private sectors or to ensure the equilibrium of external accounts. Therefore, the MCI should be considered as an indicator measuring only the short-run effects of the prevailing monetary conditions.

Chart 3 presents the GDP and consumer prices annual multipliers delivered for two kinds of shocks: (i) a permanent appreciation of the Portuguese effective exchange rate of 1 per cent; (ii) an increase of the short-run interest rate of 100 basis points lasting for three years, that is fully transmitted to all the other interest rates.

The appreciation of the exchange rate is transmitted to domestic prices very quickly – more than half of the shock is transmitted to prices after two
years\(^3\). However, as this transmission is not instantaneous, the real exchange rate suffers a temporary appreciation. This explains a temporary decline of competitiveness both on the import and export fronts, leading to a short-run decline in GDP. As the exchange rate shock gets fully transmitted to prices, those effects on activity start to fade away (after two years).

With regard to the short-run interest rate shock, two initial remarks should be made. First, the shock is temporary. The implementation of a permanent shock on interest rate with all other variables fixed would produce misleading results. In fact, a permanent shift of interest rate would come about attached with simultaneous changes in other variables (namely exchange rate and inflation expectations). As the models that are normally used are not capable of capturing these features and as the objective is just to measure the short-run effects of interest rate changes, this shock considers that the increase in the interest rate is sustained only during three years\(^4\). Secondly, as the model reacts not only to the absolute changes but also to the percentage changes of the interest rate, the reactions of GDP and prices depend on the initial level of interest rate. The shadowed area in Chart 3 illustrates this point, considering GDP and consumer prices multipliers for different initial levels of the interest rates (between 2.5 and 5 per cent).

As regards the simulations results, the increase of interest rate tends to produce negative effects on activity, in particular on investment and durable consumption, leading to an increase in unemployment and, consequently, to lower wages. The evolution of the output and labour markets will exert downward pressures on prices.

### Table 1

**MCI WEIGHTS**

<table>
<thead>
<tr>
<th></th>
<th>GDP</th>
<th>Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Exchange</td>
<td>Interest</td>
</tr>
<tr>
<td>Current estimate</td>
<td>0.06</td>
<td>0.94</td>
</tr>
<tr>
<td>Mayes and Virén (2000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>0.40</td>
<td>0.60</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.29</td>
<td>0.71</td>
</tr>
<tr>
<td>Finland</td>
<td>0.12</td>
<td>0.88</td>
</tr>
<tr>
<td>France</td>
<td>0.17</td>
<td>0.83</td>
</tr>
<tr>
<td>Germany</td>
<td>0.18</td>
<td>0.82</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.15</td>
<td>0.85</td>
</tr>
<tr>
<td>Italy</td>
<td>0.13</td>
<td>0.88</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.30</td>
<td>0.70</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.14</td>
<td>0.86</td>
</tr>
<tr>
<td>Spain</td>
<td>0.30</td>
<td>0.70</td>
</tr>
<tr>
<td>Average</td>
<td>0.21</td>
<td>0.78</td>
</tr>
</tbody>
</table>

5. MONETARY CONDITIONS INDICES

5.1. Static MCI

This approach corresponds to a direct application of equation 1. The weights are based on the accumulated impacts of exchange and interest rates on GDP and prices at the end of a 3-year horizon. Table 1 compares these results with the ones presented in Mayes and Virén (2000) for several euro area countries, including Portugal. In order to increase the comparability between the results, the multipliers of exchange rate are reduced to 1/3, reflecting the maintenance of fixed exchange rates between Portugal and the other euro area countries\(^5\). The interest rate multipliers correspond to a level of 5 per cent – a value which is close to the historical average for the euro area countries.

The results for Portugal are not very different from the ones presented in Mayes and Virén (2000). The interest rate seems to be more effective in explaining the short-run dynamics of GDP whereas the exchange rate plays the major role in the inflation behaviour. Moreover, the relative importance of the euro exchange rate in explaining GDP is lower in Portugal than in the other euro area countries\(^6\).

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\(^3\) This indicator is usually known as the “half-life”. As the models tend to produce asymptotic adjustment towards their long-run solutions, this sort of indicator is frequently used to measure the speed of adjustment.

\(^4\) This assumption is not important for the construction of the MCIs. In fact, it is assumed that a 3-year horizon is the one relevant to measure the short-run effects of monetary policy.
The main difference concerns the weights for the inflation indicator. In the results of Mayes and Virén (2000), the exchange rate has an extremely low weight in the indicators for Portugal; in our estimates this weight is above the euro area average but, still, comparable with some other countries.

5.2. Dynamic MCI

For the dynamic MCI the relative coefficients of the interest and exchange rates are not restricted to sum to one and are no longer taken as constant over the horizon. The coefficients represent the differentiated impact of each variable on GDP growth and inflation in each period of the horizon. Therefore, it is possible to account for the different transmission mechanisms to both GDP and prices.

Considering a 3-year horizon, this index can be written as:

\[
MClx_t = \sum_{i=0}^{\infty} \alpha x_{t-i} \left( r_{t-i} - r_{t-i-1} \right) + \sum_{i=0}^{\infty} \beta x_{t-i} \ln \left( \frac{e_{t-i}}{e_{t-i-1}} \right) \]

\( x = GDP, \) prices

where the \( \alpha x_{t-i}, (\beta x_{t-i}) \) were obtained from the simulations presented above (see Chart 3), and measure the impact on the current rate of growth of the variable \( x \) triggered by a unit change in the interest rate (exchange in the rate) that took place \( i \) periods ago.

The dynamic MCI for GDP was computed both in nominal and real terms. The main difference is the benchmark chosen to compare the prevailing monetary conditions: the nominal (real) index measures the contribution to GDP growth and inflation against a benchmark where the nominal (real) interest and exchange rates were held constant at the level observed in the previous year.

Table 2 presents the correlations between these indicators and the evolution of GDP and inflation. The partial correlations are also presented, using equations where additional key variables that affect both GDP and prices are considered as well(7).

From the results presented in Table 2, two conclusions emerge. Firstly, the MCIs are more important in explaining inflation fluctuations than GDP developments. Secondly, the use of the real MCI does not seem to improve the results. The reasons underlying the differences between nominal and real MCIs for GDP are presented in the next section that assesses the contribution of monetary conditions for GDP growth and inflation in the Portuguese economy since 1986.

Table 2

<table>
<thead>
<tr>
<th>Overall correlations</th>
<th>Partial correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth</td>
<td>Inflation</td>
</tr>
<tr>
<td>Dynamic MCI (nominal)</td>
<td>0.47 0.59 0.68 0.89</td>
</tr>
<tr>
<td>Dynamic MCI (real)</td>
<td>0.30 - 0.49</td>
</tr>
</tbody>
</table>

(5) Considering the trade shares with the other euro area countries (around 2/3), a unitary change of the euro exchange rate corresponds to 1/3 change in the Portuguese effective exchange rate. Therefore, the reduction of the exchange rate multipliers allows interpreting the weights as measuring the effect of the euro exchange rate.

In Mayes and Virén (2000), the results were derived using the NIGEM model to simulate shocks of the nominal interest rate and the bilateral exchange rate against the US dollar, considering a 3-year horizon.

The comparison with those results is just made for illustrative purposes, as alternative estimations point to very different weights. The structure of each model as well as of the additional assumptions underlying the simulations influence substantially the results (see Costa (2000) for a set of alternative estimates).

(6) As commodities prices are traditionally fixed in USD, a depreciation of the euro represents also a negative shock on the terms of trade, which tends to reduce the effect on activity related to the increase on competitiveness.

(7) Those partial correlations are based on the regressions for GDP (\( y \)) and prices (\( p \)), on the external demand (\( dx \)), on the public expenditure in consumption and investment, in real terms, (\( g \)), on the foreign prices (\( p^* \)) and on the MCIs:

\[
\Delta y_t = \alpha_y + \alpha_1 \Delta x_t + \alpha_2 \Delta x_{t-1} + \alpha_3 \Delta x_{t-2} + \alpha_4 \Delta x_{t-3} + \phi \Delta MCIy_t
\]

\[
\Delta p_t = \beta_p + \beta_1 \Delta p_t + \beta_2 \Delta p_{t-1} + \phi \Delta MCIp_t
\]
6. MONETARY CONDITIONS SINCE 1986

As already mentioned, the dynamic MCI has the important feature of allowing for the estimation of the short-run effects of monetary conditions on GDP growth and inflation. Charts 4 and 5 describe these effects, presenting estimates of the short-run contributions of monetary conditions both for GDP growth and inflation since 1986. For a detailed analysis of the Portuguese monetary policy during this period see Abreu (2001).

The role played by the exchange rate in the behaviour of inflation in Portugal is clear. In 1986, the high inflation was supported by a depreciation of the Portuguese currency (Chart 4). Those effects, however, declined remarkably during the second half of the 80s, reflecting the lower pace of depreciation registered then. The reduction of the exchange rate contribution to inflation became particularly evident after the end of the crawling peg in 1990 and the increasing stability of the Portuguese currency due to its participation in the European Monetary Union. The contribution of the exchange rate to the annual inflation rate decreased from 7.5 percentage points in the second half of the 80s, to 1.1 percentage points in the 90s and to 0.9 percentage points in the last three years.

For GDP (Chart 5), the results depend crucially on using the MCI in nominal or real terms. As expected, the real version points to a lower contribution of monetary conditions to GDP growth, because the expansionary effects associated with the decline of the interest rate were balanced by the reduction of the inflation rate. Also, given the persistence of higher inflation rates in Portugal, the exchange rate depreciation did not avoid a real appreciation (see Charts 1 and 2).

The real indicator suggests a contribution of monetary conditions to GDP growth close to zero (on average) in the second half of the 80s and a negative one in the early 90s. On the other hand, for the same periods the nominal MCI indicates respectively a very strong and a negligible contribution. However, since 1997, given the stability of the inflation rate, the nominal and real indicators produce very similar indications.

As already mentioned, both the nominal and the real versions are not immune to criticism. The
nominal indicator overestimates the impact on the GDP, since the changes in the nominal interest and exchange rates were partially offset by inflation rate developments. But the effects captured by the real MCI are underestimated. First, the real appreciation of the Portuguese currency should not be necessarily considered as a deterioration of competitiveness, because part of this appreciation is related to the economic growth process itself, (Brito and Correia (2000) and Costa (2000a)). Second, the effects of the decline of the interest rate are probably higher than the ones implied by considering the evolution of the interest rate adjusted by the observed inflation. Indeed, the nominal interest rate may produce direct effects on real economic activity, namely through the financial constraints faced by firms and households. Moreover, the downward path of the inflation rate in Portugal was probably anticipated given the necessary nominal convergence required for the Portuguese participation in the European Monetary Union. Thus, the use of a medium-run inflation expectation instead of the observed inflation rate would produce a more pronounced decline of the real interest rate.

In this sense, the true contribution of monetary conditions to short-run GDP growth was probably somewhere between the bounds provided by these two indicators. Fortunately, these limitations seem to be less relevant today.

7. MAIN CONCLUSIONS

Despite all the simplifying assumptions underlying its construction, the dynamic versions of the Monetary Conditions Index may be helpful in explaining the contribution of monetary conditions to the evolution of the Portuguese economy especially in the more recent past.

These indicators can also play another important role. As they can be easily extended into the near future assuming scenarios for interest and exchange rates, they may be useful for forecasting and simulation purposes. An application of these features is considered in the text presenting the projections for the Portuguese economy in 2003 and 2004. The text includes a box that presents the estimated contribution of the monetary conditions to GDP and inflation developments both in the recent years and over the projection horizon.

REFERENCES


Mayes, David and Matti Virén (2000), The Exchange Rate and Monetary Conditions in Euro Area, Review of World Economics, 136(2).