German monetary unification and the stability of the German M3 money demand function

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Abstract

This paper employs quarterly data from the whole of Germany to test the stability of M3 demand for money. The methodology is based on an application of the CUSUM and CUSUMSQ in the context of error-correction modeling and cointegration. The results reveal some instability in M3 money demand function.

Keywords: CUSUM; CUSUMSQ; Cointegration; M3; Germany

JEL classification: E41

1. Introduction

The German Monetary Unification (GMU) in 1990 has resulted in a lively debate over the existence of a stable whole-German money demand function. If unification causes instability in the money demand function, then Deutsche Bundesbank would lose one of the fundamental preconditions for an effective implementation of its anti-inflationary monetary policy. Thus, it is important to establish the stability of the whole-German money demand function.


Issing and Todter (1995) investigated the stability of only M3 money demand function using quarterly data over the 1975I–1993II period. Their empirical findings reveal the existence of a cointegrating relation, and the Chow forecast test shows no instability of M3 money demand function due to unification. The same result is confirmed by Clostermann et al. (1997) when they apply the Johansen (1988) cointegration technique and the Hansen (1992) SupF, MeanF and LMP tests. The stability is confirmed by showing minor fluctuation of the eigenvalues without any statistical test and elaboration.

In this paper we try to investigate the stability of the M3 money demand function for the whole of Germany by incorporating the short-run dynamics in testing for the long-run income and interest elasticities. Section 2 introduces the testing procedure and empirical results. Section 3 concludes. Finally, data definition and sources are cited in Appendix A.

2. The method and the results

Following the literature, we assume that income and interest rate are the main determinants of the demand for M3. Thus, the following formulation in log linear form is adopted:

\[ \ln M3_t = a + b \ln Y_t + c \ln i_t + \epsilon_t \]  

(1)

where M3 is the real monetary aggregate (M3); Y is the real income with expected positive elasticity and i is a measure of opportunity cost of holding money, i.e., long-run interest rate with expected negative elasticity.

We first try to estimate Eq. (1) for the whole of Germany using seasonally adjusted quarterly data over the 1969I–1995IV period. We begin with 1969 because seasonally adjusted M3 begins with that date, and 1995IV was the last date for which seasonally adjusted data was available. Since the estimation procedure is based on the cointegration technique of Johansen and Juselius (1990), we first determine the degree of integration of each variable in (1). To this end, we employ the Kwiatkowski et al. (1992) test, known as the KPSS test. The KPSS test is formulated in Bahmani-Oskooee (1998) and needs no repeat here. The results are reported in Table 1.

It is clear from Panel A of Table 1 that at the 10% level of significance, the null of level stationarity is rejected for all variables at all truncation lags except \( \ln i \). The null is rejected for \( \ln i \) as long as the truncation lag is less than 4. Panel B shows that at the 10% level of significance, the null of trend stationarity is also rejected for all variables at all truncation lags except for \( \ln i \). This time, the null is rejected for \( \ln i \) when truncation lag is less than 2. We also experimented with the ADF test which showed that indeed all variables are non-stationary (with and without trend) and they become stationary after differencing once. Thus, we shall assume that all variables are integrated of order one.
Table 1
The KPSS test results (Panel A) the KPSS statistics for null of level stationary (the 5 and 10% critical values are 0.463 and
0.347 respectively) and (Panel B) the KPSS statistics for null of trend stationary (the 5 and 10% critical values are 0.146 and
0.119, respectively)

<table>
<thead>
<tr>
<th>Variable</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln M3</td>
<td>10.52</td>
<td>5.337</td>
<td>3.598</td>
<td>2.727</td>
<td>2.204</td>
<td>1.856</td>
<td>1.608</td>
<td>1.422</td>
<td>1.279</td>
</tr>
<tr>
<td>ln Y</td>
<td>10.15</td>
<td>5.169</td>
<td>3.493</td>
<td>2.653</td>
<td>2.148</td>
<td>1.812</td>
<td>1.572</td>
<td>1.392</td>
<td>1.253</td>
</tr>
<tr>
<td>ln i</td>
<td>1.340</td>
<td>0.696</td>
<td>0.483</td>
<td>0.378</td>
<td>0.316</td>
<td>0.277</td>
<td>0.250</td>
<td>0.231</td>
<td>0.217</td>
</tr>
<tr>
<td>Panel B:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ln M3</td>
<td>0.903</td>
<td>0.477</td>
<td>0.333</td>
<td>0.261</td>
<td>0.218</td>
<td>0.189</td>
<td>0.169</td>
<td>0.154</td>
<td>0.143</td>
</tr>
<tr>
<td>ln Y</td>
<td>1.327</td>
<td>0.689</td>
<td>0.470</td>
<td>0.361</td>
<td>0.295</td>
<td>0.252</td>
<td>0.222</td>
<td>0.200</td>
<td>0.183</td>
</tr>
<tr>
<td>ln i</td>
<td>0.249</td>
<td>0.130</td>
<td>0.091</td>
<td>0.071</td>
<td>0.060</td>
<td>0.053</td>
<td>0.048</td>
<td>0.045</td>
<td>0.042</td>
</tr>
</tbody>
</table>

We are now in a position to apply Johansen and Juselius (1990) cointegration analysis which is based on the maximum-likelihood estimation technique. They introduce two test statistics known as $\lambda_{max}$ and trace to identify number of cointegrating vectors. These two statistics are reported in Panel A of Table 2. Note that in selecting the order of VAR, we employed AIC criterion which selected two lags.

From Panel A of Table 2 it is clear that the null of no cointegration is rejected by both statistics because either statistic is larger than the critical value (indicated by *). However, the null of at most one vector cannot be rejected in favor of $r=2$. Thus, there is only one cointegrating vector. The estimate of this vector normalized on ln M3 is reported in Panel B of Table 2.

We now turn to the stability of the long-run coefficient estimates by taking into consideration the short-run dynamics. To this end, following Pesaran and Pesaran (1997) we form an EC term using the long-run coefficient estimates from panel B of Table 2 and employ its lagged value in the following EC model:

Table 2
Johansen’s maximum likelihood results for ln M3 function when the order of VAR=2 (Panel A) the results of $\lambda_{max}$ and trace tests and (Panel B) estimates of cointegrating vectors

<table>
<thead>
<tr>
<th>Null</th>
<th>Alternative</th>
<th>$\lambda_{max}$ statistic</th>
<th>90% Critical value</th>
<th>Trace statistic</th>
<th>90% Critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A:</td>
<td>$r=0^*$</td>
<td>$r=1$</td>
<td>27.96*</td>
<td>19.86</td>
<td>40.95*</td>
</tr>
<tr>
<td></td>
<td>$r=1$</td>
<td>$r=2$</td>
<td>9.65</td>
<td>13.81</td>
<td>12.98</td>
</tr>
<tr>
<td></td>
<td>$r=2$</td>
<td>$r=3$</td>
<td>3.33</td>
<td>7.53</td>
<td>3.33</td>
</tr>
<tr>
<td>Panel B:</td>
<td>ln M3</td>
<td>ln Y</td>
<td>ln i</td>
<td>Constant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>−1.00</td>
<td>1.3847</td>
<td>−0.210</td>
<td>−5.7816</td>
<td></td>
</tr>
</tbody>
</table>

$^*$ $r$, number of cointegrating vectors.
Pesaran and Pesaran (1997) then suggest employing CUSUM or CUSUMSQ tests proposed by Brown et al. (1975). The CUSUM and CUSUMSQ statistics are updated recursively and are plotted against the break points. If the plot of CUSUM or CUSUMSQ stay within 5% significance level (portrayed by two straight lines whose equations are given in Brown et al., 1975, Section 2.3), then the coefficient estimates are said to be stable. A graphical presentation of the tests are provided in Fig. 1.

It is clear from Fig. 1 that at least the plots of CUSUMSQ statistic crosses the critical bounds, indicating that short-run and long-run elasticities are unstable.\footnote{We also tested the stability of M1 and M2 money demand function. The results were no different.}

\[
\Delta \ln M_3 = a + \sum_{j=1}^{n} b_j \Delta \ln M_{3,-j} + \sum_{j=1}^{n} c_j \Delta \ln Y_{t-j} + \sum_{j=1}^{n} d_j \Delta i_{t-j} + \lambda EC_{t-1} + \epsilon_t
\] (2)
3. Summary and conclusion

The stability of the money demand function in any country is of great importance for a successful monetary policy. The unification of the West and East German states in 1990 has been considered as a new factor that may result in instability of the money demand in unified Germany. There are few studies that have considered stability of German money demand after unification, with mixed results. In this paper we investigated the stability of German money demand. The paper differs from previous studies in that it incorporates the short-run dynamics in testing for the stability of long-run M3 money demand function. This is done by testing for the stability of all estimated coefficients in an EC model. The results obtained from applying the CUSUMSQ test revealed instability in the whole German M3 money demand function.

Appendix A

A.1. Data definitions and sources

All data are quarterly over the period 1969I–1995IV and obtained from the following sources:

(a) main Economic Indicators of OECD;
(b) International Financial Statistics of IMF;
(c) Saisonbereinigte Wirtschaftszahlen of the Deutsche Bundesbank;
(d) Kapitalmarkstatistik of the Bundesbank;

A.2. Variables

M1 = real M1. Seasonally adjusted nominal M1 figures from source (a) are deflated by seasonally adjusted GDP deflator (1991 = 100) from source (c) to obtain this measure.

M2 = real M2. Seasonally adjusted nominal M2 figures from source (a) are deflated by seasonally adjusted GDP deflator (1991 = 100) from source (c).

M3 = real M3. Seasonally adjusted nominal M3 figures from source (b) are updated from source (c). They are then deflated by seasonally adjusted GDP deflator (1991 = 100) from source (c).

Y = real GDP. Seasonally adjusted real GDP (in 1991 prices) comes from source (c). \( i \) = long-term government bond yield obtained from source (d).

References