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Measures of excess liquidity

by Thorsten Polleit and Dieter Gerdesmeier

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HfB - Business School of Finance & Management

Sonnemannstr. 9 – 11 60314 Frankfurt an Main, Germany
Phone: +49 (0) 69 154 008 0 Fax: +49 (0) 69 154 008 728
Internet: *www.hfb.de*

Abstract

The aim of this note is to provide an overview of various measures of "excess liquidity", which can be defined as the deviation of the actual stock of money from an estimated equilibrium level. Given their dynamic nature, the excess liquidity measures under review are - in the light of long and variable lags of monetary policy - very useful tools to quantify future price pressures. In addition, excess liquidity measures consider inflation as a purely monetary phenomenon: neither the "output gap" nor "liquidity gap" – although both form an integral part of the concepts – can be held responsible for inducing a persistent rise in the price level. Despite strong theoretical support, the usefulness of excess liquidity measures depends on the stability of money demand, a question which has of course to be answered in the realm of empirical research.

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Contact:

Thorsten Polleit
European Economics Barclays Capital
Bockenheimer Landstrasse 38 – 40
60323 Frankfurt
HfB – Business School of Finance & Management, Frankfurt
Sonnemannstrasse 9 – 11
60314 Frankfurt
Germany
Tel.: ++49 (0) 69 – 7161 1757
Fax: ++49 (0) 69 – 7161 15 99
E-mail: *thorsten.polleit@barclayscapital.com*

Dieter Gerdesmeier
European Central Bank
Kaiserstrasse 29
60006 Frankfurt
HfB – Business School of Finance & Management, Frankfurt
Sonnemannstrasse 9 – 11
60314 Frankfurt
Germany
Tel.: ++49 (0) 69 – 1344 7928
Fax: ++49 (0) 69 – 1344 5757
E-mail: *dieter.gerdesmeier@ecb.int*

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Content

1 Introduction

In the last years, a great deal of monetary policy analyses has been based on New Keynesian model frameworks, in which money does not play a role in the determination of inflation and monetary policy impulses are spread solely via the real demand for goods. The "economy-without-money" approach is, however, neither satisfactory from a theoretical point of view, nor does it reflect the empirical evidence of the role of money as a leading indicator for inflation for a number of countries such as, for instance, the euro area. The reluctance to assign a prominent role to money when analysing monetary policy impacts on output and prices is actually quite surprising given that there is hardly any disagreement among economists as far as Milton Friedman's famous dictum is concerned, namely that "inflation is always and everywhere a monetary phenomenon".[1]

Among the very few central banks, the European Central Bank (ECB) has explicitly assigned a prominent role to money in its two pillar strategy.[2] The bank has set a reference value against which actual money expansion shall be measured. Continued deviations of money growth from the reference value should raise questions and should, at the least, require a careful reassessment of whether the prevailing monetary policy is consistent with the ECB's definition of price stability. Against this background, the ECB has advocated some "measures of excess liquidity" measures, which can be defined as the deviation of the actual stock of money from an estimated equilibrium level. Most prominent among them ranks the so-called "real money gap".[3]

The objective of this article is to provide an overview on the theoretical underpinning and calculation of various measures of excess liquidity. The article has been structured as follows. In Section 2, we set out the relation between money, output and prices using the well-known transaction equation. In Section 3, we outline the crucial role of the stability of money demand for changes in money supply having a predictable impact on (future) inflation. In the subsequent Section 4. we present four measures of excess liquidity, namely the "price gap", or "P-star", the "real money gap", the "nominal money gap" and the "monetary overhang". We provide a comparison between the excess liquidity measures in Section 5. Section 6 concludes with a summary.

[1] Milton Friedman's and his associates' "monetarism" emphasised the importance of assigning an important role to monetary developments for prices and the economy more broadly (*Friedman* (1956, 1960); *Brunner* (1968); *Brunner and Meltzer* (1972)).

[2] See ECB (1999a, 1999b and 2000).

[3] See, ECB (2004), p. 45. To our knowledge, the ECB introduced the real money gap in its June 2001 Bulletin, pp. 8. For the results of the latest strategy revision see ECB (2003).

2 Quantity equation as a starting point

In order to derive some basic relationships, the well-known quantity equation relationship can serve as a starting point:

(1) $M \cdot V = Y \cdot P$,

where M denotes the stock of money, V represents the velocity of money, whereas Y and P stand for real output and the price level, respectively. Equation (1) is simply an identity; it states that the stock of money, multiplied by the number of times a money unit is used for financing purposes, equals real output multiplied with the price level. In this sense, the monetary side of the economy is in line with the real side of the economy.

To calculate a money supply which is consistent with the economy's inflation and output objectives, equation (1) can be transformed as follows:

(2) $\Delta m + \Delta v = \Delta y + \Delta p$

where small case letters represent logarithms and Δ represent first differences.[4] Solving equation (2) for Δm yields:

(3) $\Delta m = \Delta y + \Delta p - \Delta v$.

According to equation (3), money supply growth equals real income growth plus the rise in the price level, that is inflation, minus the trend change in the income velocity of the stock of money.

The ECB, for instance, uses the formula presented above to derive its reference value for the growth of the stock of M3. By assuming an average annual growth rate of output (or potential) of between 2.0 to 2.5%, the ECB's definition of price stability and an annual trend decline in the velocity of money of between 0.5 and 1.0%, the bank's reference value of to 4½% could be derived:

$$\Delta m^{reference} = \Delta y^{potential} + \Delta p^{envisaged} - \Delta v^{trend} \approx 2.25\% + 1.5\% - (-0.75\%) \approx 4.5\%,$$

Persistent deviations in M3 growth from the reference value shall, under normal circumstances, signal to the ECB risks to future price stability and, consequently, a need for policy action.

[4] The calculus-minded reader knows that $d(\ln X)dX = 1/X$ or $d(\ln X) = dX/X$, that is for infinitesimal small changes a change in $\ln X$ is equal to the relative or proportional change in X.

3 The role of the stability of money demand

In view of the considerations outlined above it becomes clear that the demand for money – which is simply the reciprocal of the income velocity of money – plays a crucial role for money to have a reliable impact on (future) inflation. Expressed in other words: An erratic behaviour of velocity can obscure the impact of changes in money on changes in prices.

The (trend) change in velocity can be derived from approximating the behaviour of the ratio between nominal output and the stock of money by various trend measures. Alternatively, the trend in velocity of money can be estimated by using long-run money demand functions, which usually represent the demand for real money holdings as depending on variables such as, for instance, a transaction variable and various interest rates.[5]

In this context, attention usually focuses on the long-run money demand relationship, which – together with the assumption on real trend growth – can be viewed as capturing the long-run velocity of money which is actually relevant for determining money growth compatible with price stability over the medium term. A simple money demand relationship (which shall be homogenous in terms of prices) can be represented by:

(4) $$m - p = b_0 + b_y y + gi + e ,$$

where m represents the logarithm of money, p is the logarithm of the price level, y is the logarithm of real GDP, i is the interest rate and e is the (i.i.d) error term ("white noise").

The change in the income velocity of money is:

(5a) $$\Delta v = \Delta y + \Delta p - \Delta m$$ or

(5b) $$\Delta v = (1 - b_y)\Delta y ,$$

if we assume an environment of price stability, stationarity of interest rates and $e = 0$. Equation (5b) shows that in this case the change in velocity would be solely driven by real output; neither interest rates nor inflation would have an impact on trend velocity. Moreover, with income elasticity exceeding 1, the income velocity of money would show a declining trend over time.[6]

Assuming a stable money demand equation, monetary policy can calculate a money growth – a steady-state rate of monetary growth – that is consistent with price stability and the assumed trend behaviour of real output. Using the equation (4), taking first differ-

[5] See, for instance, *Brand, Gerdesmeier, Roffia* (2002).

[6] This can be explained by the „omitted wealth effect": As market agents do not only demand real balances for financing actual output but also already existing wealth, nominal money growth might exceed nominal output growth. See *Gerdesmeier* (1996) for more details.

ences and substituting the inflation rate consistent with price stability ($p^{envisaged}$) and the assumption for trend real output growth gives:

(6) $$\Delta m_t^{reference} = p^{envisaged} + b_y \Delta y_t^{potential}.$$

When comparing actual money growth against the reference value, it should be taken into account, however, that the interpretation also needs to take into account the monetary expansion in former periods, which could in the medium term translate into inflationary pressures, even though money growth rates close to the reference value might be observed in the recent period.[7]

4 Measures of excess liquidity

In view of the conceptual shortcomings of a constant annual money expansion rate, various measures of excess liquidity have been put forward in the literature in recent years.[8] In the following, we highlight four of these concepts, namely (i) the price gap, or P-star, (ii) the real money gap, (iii) the nominal money gap and (iv) the money overhang.

4.1 The price gap

Presumably the most prominent measure of excess liquidity stems from the work of Hallman, Porter and Small (1991).[9] To start with, the authors define a short-run and long-run (equilibrium) price level as follows:

(7) $$p_t = m_t + v_t - y_t \text{ and}$$

(8) $$p_t^* = m_t + v_t^{trend} - y_t^{potential},$$

where p_t^* represent the long-run or equilibrium price level. The difference between equation (8) and (7) is the so-called price gap:

(9) $$p_t^* - p_t = (v_t^{trend} - v_t) + (y_t - y_t^{potential}).$$

If the actual price level is below (above) the long-term level, upwards (downward) pressure on the (future) price level can be expected. According to the representation above, the price gap can be decomposed into the "liquidity gap" $(v_t^{trend} - v_t)$ and the "output gap" $(y_t - y_t^{potential})$.

[7] See *Leschke, Polleit* (2003).

[8] According to *Laidler* (1997), these models have a "disequilibrium character".

[9] See *Hallman, Porter, Small* (1991) for more details. At roughly the same time, *Suntum* (1990) published the "inflation potential", which was developed along the lines of the transaction equation and actually corresponds to the P-star model.

However, when analysing the "forces driving inflation" in this concept it is important to note that an increase in real output above potential will not necessarily cause a change of the price gap as equation (9) suggests.[10] This is because *v* will rise as *y* increases, so that any increase in the output gap is compensated by a decline in the liquidity gap. It is therefore recommendable to use an alternative representation which shows that the price gap is actually independent from the output gap: that the price gap is simply the difference between real money (adjusted by the trend velocity) and real potential output:

$$(10) \qquad (p_t^* - p_t) = (m_t + v_t^{trend} - p_t) - y_t^{potential}.$$

That said, inflation – a persistent rise in the price level – can only occur when "too much money chasing too few goods" or, to put it differently, money is always and everywhere a monetary phenomenon in this concept.[11]

Alternatively, the equilibrium price level can also be defined as the price level that would emerge (given the current holdings of money) if both the goods and money market were in equilibrium:

$$(11) \qquad p_t^* = m_t - b_y y_t^{potential} - g i_t^*,$$

where i_t^* is the equilibrium interest rate. The equilibrium price level is an indicator for the level of goods prices that would, given the stock of money, emerge if the all disequilibria – that is the output gap $y_t - y_t^{potential}$, the interest rate gap $i_t - i_t^*$ and e_t would be zero. That said, the price gap would be:

$$(12) \qquad p_t^* - p_t = b_y (y_t - y_t^{potential}) + g (i_t - i_t^*) + e_t.$$

However, like in equation (10), an increase in the actual price level can only be brought about when "too much money is chasing too few goods"; neither the output nor the interest rate gap will cause inflation. If, for instance, the actual interest rate would fall below its equilibrium level ($i_t < i_t^*$), actual output would exceed potential output ($y_t > y_t^{potential}$), leaving the price gap unaffected.

[10] This finding was outlined by *Leschke* (1999), pp. 125.

[11] An empirically testable inflation forecasting model using the price gap as inflation indicator could look as follows: $p_{t+1} = b_0 + b_1(p_t * - p_t) + \sum_{i=1}^{n} b_i p_{t-i} + N_t + e_t$ where p_{t+1} is future inflation. If the actual price level is lower (higher) than the equilibrium level, future inflation will accelerate (slow down) to close the "gap". As a result, one would expect the parameter b_1 to be positive. Given the "stickiness" of inflation, one may also take into account past inflation as shown by $\sum_{i=1}^{n} b_i p_{t-i}$. N_t represents a vector of non-monetary "cost push" variables (oil, wages, exchange rate, unemployment etc.).

4.2 The real money gap

More recently, an alternative version of the price gap concept, namely the "real money gap" has been proposed.[12] In this context, real money is defined as actual money supply less actual price level:

(13) $m_{real,t} = m_t - p_t$.

whereas the real equilibrium real money holding can be modelled as follows:

(14) $m^*_{real,t} = m_t - p_t *$.

The difference between equation (17) und (16) can be referred to as "the real money gap". It thus follows:

(15) $m^*_{real,\,t} - m_{real,\,t} = (m_t - p^*_t) - (m_t - p_t) = -p^*_t + p_t$.

Against this background, it is easy to see that the real money gap and the price gap represent the same concept, but simply express it using different variables and with the sign reversed:

(16) $p^*_t - p_t = -(p_t - p^*_t)$.

Alternatively, the nominal equilibrium money stock, m_t , can be defined as the money stock demanded given the prevailing price level if the goods and money market are in equilibrium:

(17) $m^*_t = b_0 + p_t + b_y y^{trend}_t + g i^*_t$,

The difference between the actual stock of money and m^*_t is the price gap:

(18) $m_t - m^*_t = b_y (y_t - y^{trend}_t) + g (i_t - i^*_t) + e_t$.

In this context, the relationship between the price gap according to Orphanides and Porter (2001) and traditional P-star approach can be demonstrated in equations (19a) through (19c):

(19a) $m_t = p_t + y_t - v_t$ and

(19b) $m^*_t = p_t + y^{potential}_t - v^{trend}_t$,

(19c) $m_t - m^*_t = -(v_t - v^{trend}_t) + (y_t - y^{potential}_t) = -(p_t - p^*_t)$,

which, again, represents the price gap with a negative sign.

[12] See, for instance, *Gerlach, Svensson* (2003).

Against the background of these findings, it can be easily shown that a comparison between actual stock of money growth rate and a constant stock of money growth, or reference, rate might give misleading policy signals as monetary expansions, which occurred in the past and will have a bearing on future prices, might be systematically neglected.[13]

Given the stock of money at the end of period *t*, m_t, the constant, or reference, growth rate *r* (which is a rate compatible with price stability) would suggest a reference stock of money at the end of period *t*+1 of:

(20) $m_t + r = m_{t+1}^{reference}$,

where we assume, for simplicity, that the economy is in equilibrium at the end of period *t*, so that $m_t = p_t^* + y_t^* - v_t^*$; $m^{reference}$ represents the reference stock of money. Assuming an actual growth rate of money, a_1,[14] the actual stock of money at the end of period *t*+1 is:

(21) $m_t + a_1 = m_{t+1}^A$.

The difference between m_{t+1}^A and $m_{t+1}^{reference}$ is:

(22a) $m_{t+1}^A - m_{t+1}^{reference} = (p_{t+1} + y_{t+1} - v_{t+1}) - (p_{t+1}^* + y_{t+1}^* - v_{t+1}^*)$ or

(22b) $= a_1 - r$.

In period *t*+1, a simple comparison between the actual and reference growth rate would provide correct signals as far as price pressure is concerned. If $a_1 > r$ ($a_1 < r$), the price gap would indicate upward (downward) pressure on the price level; in the case of $a_1 = r$, the price gap would be zero.

If *r* is applied to the actual stock of money at the end of *t*+1 rather than to the equilibrium stock of money – which is implied under a constant reference growth rate concept –, the reference stock of money at the end of period *t*+2 would be:

(23) $m_{t+1}^A + r = m_{t+2}^{reference}$,

whereas the actual stock of money at the end of period *t*+2 is determined by the actual growth rate in that period, a_2:

(24) $m_{t+1}^A + a_2 = m_{t+2}^A$.

The difference between m_{t+2}^A and $m_{t+2}^{reference}$ is:

[13] See *Görgens, Ruckriegel, Seitz* (2004), Europäische Geldpolitik, p. 141.

[14] Here $a = \ln(1+A)$ and $r = \ln(1+R)$, where *A* and *R* represent the growth rates in percentage points divided by 100.

(25) $(m_{t+1}^{A} + a_2) - (m_{t+1}^{reference} + r)$ or

(26) $(a_1 - r) + (a_2 - r)$.

In period t+2, a simple comparison between the actual and envisaged growth rate of the stock of money does not necessarily provide a proper yardstick as far as detecting inflation pressure is concerned. The finding of, say $a_2 = r$, might not imply that excess liquidity and thus price pressure are absent. For instance, if actual money growth in t+1 was $a_1 > r$, the price gap would be positive and upward pressure on the (future) price level has to be expected. That said, only under the condition that the price gap is zero can a comparison between the actual and a constant money growth rate provide adequate insights into future inflation pressure.

4.3 The nominal money gap

The nominal money gap is defined as the difference between the actual stock of money, m_t, from the level implied by the "normative money stock", that is the stock of money that would have built up had money expanded in line with an envisaged growth path. Using a (somewhat arbitrary) base period (t = 0), the money gap is:

(27) $m_t - m_t^{normative} = m_t - (m_0 + t(p^* + b_y \Delta y_t^{potential}))$,

whereas $m_t^{normative} = m_0 + t \cdot \Delta m_t^{normative}$ with $m_0 = y_0 + p_0 - v_0$. The equation can thus be re-written as:

(28) $m_t - m_t^{normative} = y_t + p_t - v_t - (y_0 + p_0 - v_t^* + t(p^* + b_y \Delta y_t^{potential}))$ or equivalently

(29) $m_t - m_t^{normative} = (p_t + \hat{p}_t) + (p_t^* - p_t)$,

where $\hat{p}_t = p_0 + \sum_{t=1}^{n} p_t^*$. The nominal money gap is thus made up of the "price target gap" $(p_t + \hat{p}_t)$ and the price gap $(p_t^* - p_t)$. That said, the nominal money gap contains price rises which have already been realised in the past. The money gap thus reflects the cumulative deviations of actual inflation and output in the past from their envisaged (trend/equilibrium) values.

4.4 The monetary overhang

The "monetary overhang" (or, if negative, the "monetary shortfall") is defined as the difference between the actual nominal stock of money and the equilibrium stock of money calculated on the basis of actual values of y and i. Using the parameters of the long-run money demand equation, the monetary overhang is:

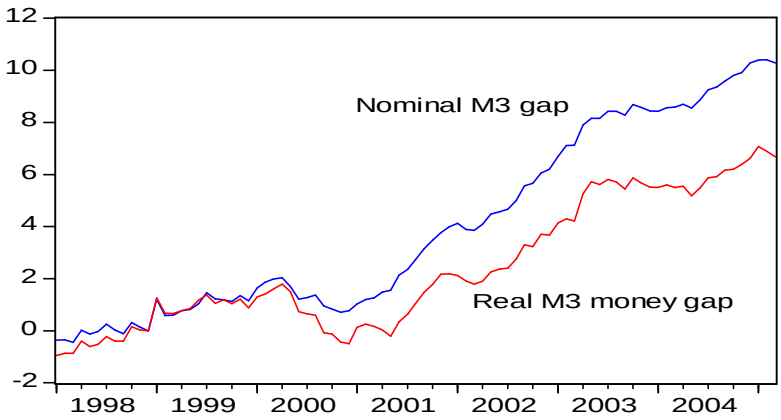
(30) $$m_t - m_t^{equilibrium} = m_t - (b_0 + p_t + b_y y_t + gi_t + e_t).$$

Under certain assumptions, the monetary overhang is de facto an indicator of disequilibria in the money market rather than an inflation indicator:[15] If the money demand function implies a stable cointegration relationship, the monetary overhang is a stationary variable (i.e. an error correction term) which should contain information on the future development of the money stock. Dynamic processes of adjustment would ensure that, following a "shock", the money holdings adjust to the path defined by the long-run money demand.

5 Comparisons of the measures of excess liquidity

Figure 1 provides an overview on the latest developments of the nominal and real money gap in the euro area for the period December 1998 to October 2004. As a result of persistent money expansion rates above the ECB's 4½% reference value the actual stock of M3 has become much higher compared to the stock of M3 envisaged to be in line with price stability. As a result, the nominal and real money gap have increased to around 10% and 6%, respectively. In what follows, we will take a closer look at the different signals provided by the excess liquidity measures.

Figure 1: Nominal and real money gap in the euro area



Note: The measure of the nominal money gap is defined as the difference between the actual level of M3 and the level of M3 that would have resulted from constant M3 growth at its reference value of 4½% since December 1998 (taken as the base period) in percent of the stock of M3. The measure of the real money gap is defined as the difference between the actual level of M3 deflated by the HICP and the deflated level of M3 that would have resulted from constant nominal M3 growth at its reference value of 4½% and HICP inflation in line with the ECB's definition of price stability, taking December 1998 as the base period, in percent of the stock of M3.

Source: ECB Monthly Bulletin, October 2004 and other issues.

5.1 The difference between the nominal money gap and the monetary overhang

In line with the considerations outlined above, the difference between the money gap and the monetary overhang (or monetary shortfall) can be modelled as follows:[16]

$$(31) \quad (m_t - m_t^{normative}) - (m_t - m_t^{equilibrium}) = m_t^{equilibrium} - m_t^{normative}$$

$$= (k' + p_t + b_y y_t + g i_t) - (m_0 + t(p^* + b_y \Delta y_t^{potential})) \qquad \text{or equivalently}$$

$$= (k' - m_0) + (p_t - (p_0 + tp^*)) + b_y (y_t - (y_0 + t\Delta y_t^{potential})) + g(i_t - i_0)$$

Following this expression, the difference between the money gap $(m_t - m_t^{target})$ and the monetary overhang is related to four determinants: (i) the extent to which the money stock in the chosen base period differs from a level consistent with long-run money demand at the macroeconomic variables obtained in the base period $(k' - m_0)$; (ii) the difference between the actual price level and its equivalent extrapolated from the base period on the basis of the inflation objective $(p_t - (p_0 + tp^*))$; (iii) a term related to the difference in the output gap since the base period $b_y(y_t - (y_0 + t\Delta y_t^{potential}))$; and (iv) a term related to the difference in the level of nominal interest rates prevailing in the current and the base period $g(i_t - i_0)$.

If the base period is chosen appropriately, the first component of this difference will be zero. If nominal interest rates are broadly speaking unchanged (as one might expect over a period of several years in an environment of price stability), then the last component will also equal zero. Therefore, there are two main substantive differences between the money gap and the monetary overhang as defined above:

First, the nominal money gap implicitly includes the cumulated impact on the money stock of deviations of the actual price level from a price level path which is determined ex ante (e.g. a price level objective determined by the base period and the desired inflation rate). In contrast, the monetary overhang automatically accepts "base drift" in the price level. In other words, at a conceptual level the money gap is an indicator more consistent with price level objectives, whereas the monetary overhang as defined above is more consistent with an inflation objective (and allows the price level to behave as a random walk, accepting one-off shifts in the price level on the principle that "bygones are bygones").

[15] This result, however, crucially hinges on the question whether the long-run relationship is found to be weakly exogenous with respect to real income and interest rates.

[16] For the following, see *Masuch, Pill, Willeke* (2001).

Second, the money gap increases relative to the monetary overhang in proportion to the output gap. In other words, the money gap incorporates the impact on the money stock of cumulated deviations of actual output from potential. Thus, if real growth since the base period is higher than potential growth, the money gap is larger than the overhang. In this sense, the money gap is a form of summary statistic, whereas the overhang merely reflects the additional information in money which is not included in its determinants (e.g. GDP and interest rates). A similar comparison can be made between the money gap and the real money gap (i.e. the P-star-based excess liquidity indicator).

5.2 The difference between the nominal money gap and the real money gap

Following again the basic considerations outlined in the last sections, the difference between the money gap and the real money gap as outlined above is:

$$(32) \quad (m_t - m_t^{normative}) - (m_t - m_t^{*})$$

$$= (k' + p_t + b_y y_t^{potential} + gi_t) - (m_0 + t(p^{*} + b_y \Delta y_t^{potential}))$$

$$= (k' - m_0) + (p_t - (p_0 + tp^{*})) + g(i_t - i_0)$$

The real money gap (as can be derived out of the P-star approach) represents an intermediate approach, where the impact of the output gap – that is the cumulated deviations of actual output growth from potential – on the money stock is included in the measure of excess liquidity (in this respect the real money gap is similar to the nominal money gap). At the same time, however, the impact of cumulated deviations of the actual price level from an implicit price level objective on the money stock is excluded (in this respect the real money gap is similar to the overhang concept). In assessing which of the measures of excess liquidity is most useful for monetary policy purposes, a number of considerations have to be borne in mind.

First, at a conceptual level, the importance of price level objectives, as opposed to inflation objectives, needs to be considered. If price level objectives are deemed important, a money gap measure may be more appropriate since this measure incorporates the impact on the money stock of deviations of such an objective. Second, consideration should be given to whether money should be used, at least in part, as a summary statistic of developments in the determinants of money or whether the focus of attention should be on the information in monetary developments which is not provided by alternative indicators which are included in the money demand framework.

In the former case, focusing on estimates of the money gap or real money gap (the P-star approach) may be more useful, since, for example, these measures encompass developments in the output gap. Alternatively, if analysing the additional information in monetary developments is deemed more useful, a focus on the monetary overhang/shortfall may be more appropriate since this does not incorporate the effects of the output gap or deviations of the price

level from a desired level on the stock of money and measure of excess liquidity. Obviously, the weight assigned to the gap measure relative to the overhang measure may thus also depend on the uncertainty regarding the estimates of the output gap in real time.

A final question relates to the use of the excess liquidity measures outlined above for the conduct of monetary policy in the euro area. As regards this issue, the ECB has on various occasions indicated the usefulness of these measures also for practical monetary policy in real time. The table below illustrates a scenario analysis carried out by the ECB in which inflation forecasts based on different variants of M3 and different assumptions for the adjustment coefficient describing the adjustment to a monetary disequilibrium are presented. In this case, the disequilibrium measure used is the monetary overhang.

Forecast HICP inflation based on P-star model using M3, M3 with slow adjustment and M3 corrected for the estimated impact of portfolio shifts

(annual percentage changes; contributions in percentage points)

	Inflation in 2005 Q4 [1)]	Contribution of the monetary overhang to inflation [2)]	Inflation in 2006 Q4 [1)]	Contribution of the monetary overhang to inflation [2)]
Scenario 1: official M3 growth with relatively rapid correction of excess liquidity [3)]	1¾ - 3	2 ½	1¼ -2¾	2
Scenario 2: official M3 growth with slow adjustment of excess liquidity [4)]	1¾ - 3	2¾	1¾ - 3¼	2 ½
Scenario 3: M3 growth corrected for the estimated impact of portfolio shifts	1 - 2¼	2	1-2 ½	1¾

Note: The forecasts were derived on the basis of monetary data up to the second quarter of 2004.

1) The forecast ranges are based on the 95% confidence interval around the point estimate of annual inflation.

2) The contribution of the money overhang to inflation shows the inflation rate that would prevail on the basis of the P-star model if the impact of oil prices and the cyclical state of the economy were removed from the forecast, to give a "pure" money-based forecast. The forecast for oil prices were taken from the assumptions of the September ECB Staff Macroeconomic Projection exercise. The indicator of the cyclical state of the economy (including forecasts) were derived as an average of estimates derived from using a standard Hodrick-Prescott filter, a production-function based approach as provided in T. Proietti, A. Musso and T. Westermann (2002), "Estimating potential output and the output gap for the euro area: a model-based production function approach," EUI working paper no. ECO 2002/9 and an estimate provided by the OECD. Forecasts for the first two indicators were derived using the results of the September ECB Staff Macroeconomic Projection exercise. The indicator of the cyclical state of the economy from the OECD is only forecast until the end of 2005. It was extended to the end of 2006 by using the quarter-on-quarter changes from the indicator of T. Proietti, A. Musso and T. Westermann (2002).

3) In line with parameter estimates for the money demand equation over the period 1980 to mid 2001.

4) The slower adjustment had been simulated by assuming that the future adjustment of the overhang occurs in line with an estimate of the above-mentioned money demand model between 1980 and 2004 Q2.

Source: ECB Monthly Bulletin, October 2004.

6 Summary

The overview of measures of excess liquidity as presented in this article rests on the notion that money affects output and prices with variable and uncertain time-lags and the assumption that the demand for money is a stable function of output and interest rates. That said, by taking into account excess liquidity measures monetary policy does not only take into account the current liquidity built up but also money expansion in the past when gauging risks to price stability in the future. As dynamic concepts, measures of excess liquidity should therefore provide policy makers with more adequate information as far as inflation pressure is concerned when compared with, for instance, constant money growth rates.

The analysis of excess liquidity measures on the basis of the transaction equation has revealed that inflation is actually – and in contrast to many interpretations which can be found in the literature – driven solely by money: neither the output nor the velocity gap – although both form an integral parts of the excess liquidity measures under review – can be held responsible from a theoretical point of view for exerting a persistent rise in the economy's price level. This is because a positive (negative) output gap is neutralised by a negative (positive) liquidity gap in the same magnitude. That said, the excess liquidity measures are in the spirit of Friedman's dictum that inflation is always and everywhere a monetary phenomenon.

Of course, empirical analysis has finally to provide the answer the question which measure of excess liquidity has the strongest impact on future inflation, therefore demanding attention from the point of view of policy makers. In the euro area, for instance, empirical evidence strongly supports the important role of the price gap in determining future inflation.[17] Nicoletti Altimari (2001) finds that money and credit aggregates contain information that is useful in forecasting medium-term and low-frequency trends in inflation. Trecroci and Vega (2002) as well as Gerlach and Svensson (2003) estimate inflation equations where the real money gap, the difference between actual and long-run equilibrium real balances, has predictive power for future inflation. Gerlach (2004) studying the expectational link concludes that money growth contains information about future inflation that is not embedded in the current rate of inflation or the output gap. Neumann and Greiber (2004) present empirical evidence for "core money" – defined as the excess of permanent nominal money growth over permanent real money demand growth[18] – that lends support to the ECB's view on the importance of M3 growth for inflation. Money exhibits a clear and stable relation with inflation, hence it can serve as an important indicator in assessing price developments in the euro area.

[17] See in this context also the analyses undertaken in the review of the ECB strategy.

[18] The "core money" approach differs from that of the P-star approach by excluding noisy short-run fluctuations of money growth generated by the accommodation of money demand shocks.

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