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The Implications of M4X for Quantitative Easing

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Money Still Matters – The Implications of M4X for Quantitative Easing[1]

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It has been argued that quantitative easing (QE) is designed to prevent a collapse of broad money. However, the official M4 broad-money measure was growing rapidly when QE was introduced. This figure was, though, exaggerated by artificial transactions within banking groups and some have suggested that broad money supply measures should exclude these transactions (M4X). This article tests whether the authorities are right to focus on M4X. It is concluded that M4X is more closely related to the wider economy than M4 but that the official M4X statistics need substantial improvement. The conclusions regarding QE generally are more nuanced and it is noted that the UK's fiscal profligacy is exacerbating the downturn in the private-sector, despite politicians' claims to the contrary.

Keywords: broad money, quantitative easing, monetarism

Introduction

The recent financial crash caused many central banks to reduce their official interest rates to unprecedented lows and hold them there subsequently. Monetary authorities then revived the historic technique of expansionary open market operations – i.e. buying government and other debt held by the private sector. One motivation for this 'quantitative easing' (QE) was the fear that the banking system would melt down in its absence, leading to a 1930s US-style collapse in money, output and employment (see Benford et al. (2009)). Unfortunately for the Bank of England, the renewed emphasis on broad money occurred when its established M4 definition had become distorted by artificial transactions designed to push bank liabilities off balance sheet.

The issue of how to measure money has bothered economists since the 1920s (see Robertson, 1928). Some three decades ago, there was an extensive literature examining which monetary definition was most closely related to the economy and whether the divergences between different monies could be explained (see Smith, 1978). However, British officials had erroneously come to the view that monetarism had been tried and failed by the mid 1980s. The appearance of rational expectations theory meant that many academic economists lost interest in money around the same time. One consequence has been that broad money and funding effects have been absent from most central bank forecasting models for many years. The renewed official emphasis on broad money has therefore occurred when there is no recent statistical analysis looking at the links between money and the economy, and funding policy and money. This article attempts to rectify these lacunae. However, a necessary preliminary is to explain how UK broad money is measured.

[1] The author would like to thank Tim Congdon, Gordon Pepper, and Andrew Lilico for their helpful suggestions on an earlier draft. The usual disclaimers apply. The statistical analysis was carried out in November and December 2009, using the latest data available at the time. The charts and text were updated in February 2010.

The problems of measuring broad money

The Bank of England defines M4 as consisting of notes and coin plus the deposit liabilities of over two hundred banks and building societies held by the domestic private sector. All deposits with a maturity under five years are incorporated and M4 includes wholesale money market instruments, commercial paper, bonds, and floating rate notes, which would once have been considered non-monetary liquid assets. The non-bank private sector is officially divided into: households; industrial and commercial companies; and the other financial corporation (OFC) sector, which includes securities houses, insurance companies and pension funds. The difference between M4 and M4X is that the latter excludes that part of OFC deposits held by the 'other intermediate other financial corporation' (OIOFC) sector (see Janssen, 2009). The Bank of England removed 64% of OFC deposits from M4X in 2009 Q4 with the consequence that M4X was 75% of M4.

There are some drawbacks to the figures for M4X given in Table A2.2.3 of the Bank's *Monetary and Financial Statistics*. One is that OIOFC deposits are subtracted from an M4 series that is not adjusted for changes in coverage (Bank code AUYN) rather than the 'break-adjusted' series (LPMVUBR), which is more consistent over time.[2] This difficulty has been dealt with here by subtracting OIOFC deposits from LPMVUBR. This gave a 2009 Q4 level for M4X identical to the Bank's number, but a yearly growth rate of 2.6% rather than the 1.1% reported by the Bank.[3] Another issue is that OIOFC deposits did not commence at zero when the figures start in 1997 Q4 but at £14.1bn or 2% of M4. The unofficial M4X series employed here has correspondingly been set at 98% of break-adjusted M4 before 1997 Q3.

Comparison of M4 and M4X

Chart 1 reveals that there was little difference between the annual growth of M4 and the author's measure of M4X until 2004. The two series then diverged until the yearly increase in M4 exceeded that in M4X by 15.7 percentage points in the first quarter of 2009, before narrowing to a 3.7 percentage point gap in the final quarter of 2009. The theoretical concept of 'money' is inevitably imperfectly represented by any given definition and divergent measures may still prove useful if the differences can be accounted for. However, the speed and degree with which M4 and M4X diverged makes it unlikely that the two can be reconciled. There is rather less evidence of monetary excess during the mid 2000s if M4X is employed instead of M4 but the symptoms of excessive money creation remain apparent (see Smith, 2009). The peak growth in M4X was the 11.5% recorded in 2006 Q3. This still looks too high when compared with the 3% to 7% band that some monetarist commentators have suggested is compatible with achieving the 2% inflation target in the long run.

[2] The Bank publishes break-adjusted growth rates for M4X. However, these do not provide the consistent series in levels required for statistical estimation.

[3] The equivalent figures for the annual growth in total M4 in 2009 Q4 are 6.4% (AUYN) and 5.2% (LPMVUBR), respectively.

Chart 1: Annual % changes in UK M4 broad money including and excluding OIOFC deposits, 1999 Q1 to 2009 Q4

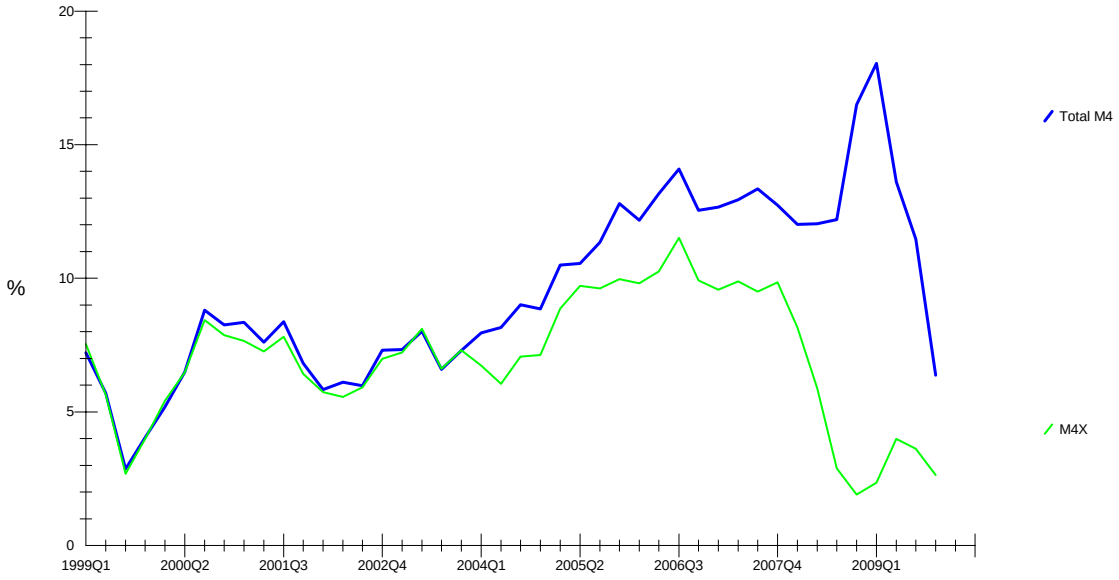
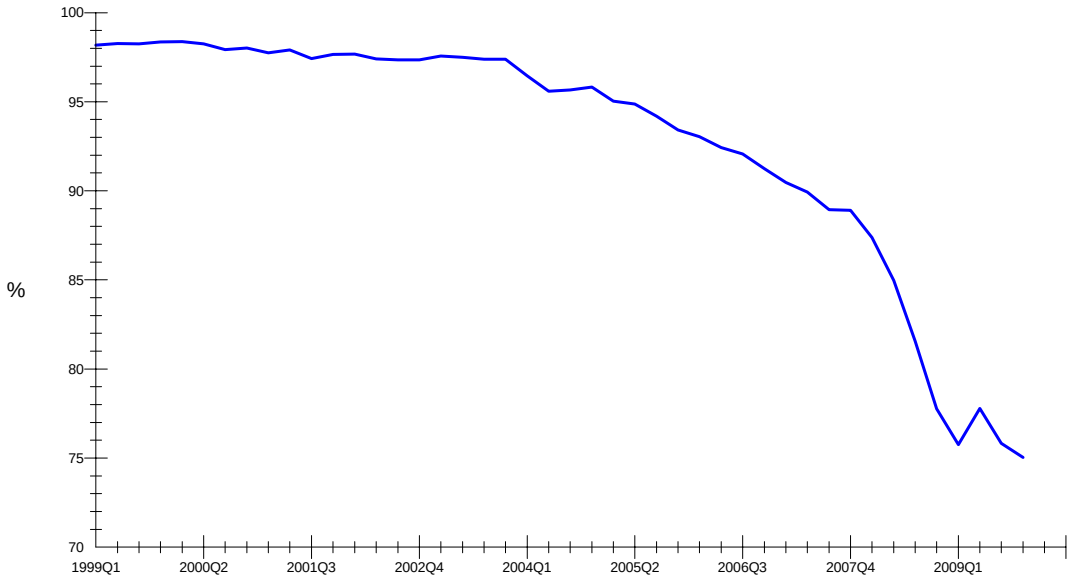


Chart 2 shows the ratio of M4X to total M4 broad money and brings out the cumulative divergence between the two series. It is clearly worrying that two plausible definitions of UK broad money now differ by approximately one quarter. However, the real world is both multivariate and stochastic and it requires a more formal approach to tease out the influences involved. These issues will now be addressed.

Chart 2: Ratio of UK M4 broad money excluding OIOFC deposits to total M4, 1999 Q1 to 2009 Q4



Statistical approaches to assessing monetary aggregates

There are at least five established ways in which statistical analysis can be brought to bear on the issues of whether M4X is superior to M4 as a measure of the money supply for the purposes of monitoring monetary policy, and whether either is stably related to the wider economy. The five approaches involve:

- Estimating a 'demand-for-money' equation and seeing which fits and forecasts better.
- Including the ratio of M4 to M4X amongst the independent variables in a demand-for-M4 relationship.
- Checking whether the departures from the estimated M4 relationship are correlated with OIOFC deposits.
- Estimating a 'money-multiplier' equation in which real private expenditure is 'explained' by a set of relevant variables including real broad money balances.
- Comparing the tracking performance of a macroeconomic model that includes different monetary definitions.

All five methods have been employed below but the emphasis will be on the demand-for-money, money-multiplier and whole-model approaches. Statistical methods only provide suggestive evidence, not proof. However, this is less of a concern if one is primarily interested in the relative performance of competing monetary aggregates. This is because any weakness in the underlying approach will probably affect different measures equally.

The demand for broad money

The classic demand-for-money approach goes back to the 1950s and relates the price-deflated money stock to: a measure of real income; an opportunity cost variable, such as the government bond yield; the own rate of interest paid on deposits; and inflation, which acts as an implicit 'tax' on money holdings (see Laidler, 1969). Income has been defined here as the volume of UK household consumption, which can be regarded as a proxy for anticipated lifetime wealth, or 'permanent', income. The price level has been represented by the implicit price of household consumption and the bond yield by the twenty-year gilt yield. The marginal 'own' rate paid on bank deposits has been represented by the three-month inter-bank rate; this is the best measure from 1972 onwards, when the banks started practising liability management, but it is inappropriate before 1971, when deposit rates were suppressed by a cartel: the statistical analysis was correspondingly confined to the post-1972 period. Chart 3 shows the ratios of M4 and M4X to gross domestic product (GDP) back to 1965 Q1. It reveals that the M4X ratio has been more stable than its M4 equivalent, despite an apparent upward trend in both measures.

Unfortunately, the role of the short-term interest rate is ambiguous in the demand-for-money context. This is because the short rate represents an opportunity cost variable for cash and non-interest bearing deposits but also represents the return paid on many interest-bearing deposits. As a result, two interest-rate terms were employed for estimation. The first was the three-month inter-bank rate on its own. The second was the difference between the twenty-year gilt yield and inter-bank rate. Chart 4 displays this difference because it has a crucial impact on the statistical results.

Chart 3: Ratio of UK M4 broad money including and excluding OIOFC deposits to non-oil money GDP expressed as an annual rate, 1965 Q1 to 2009 Q4

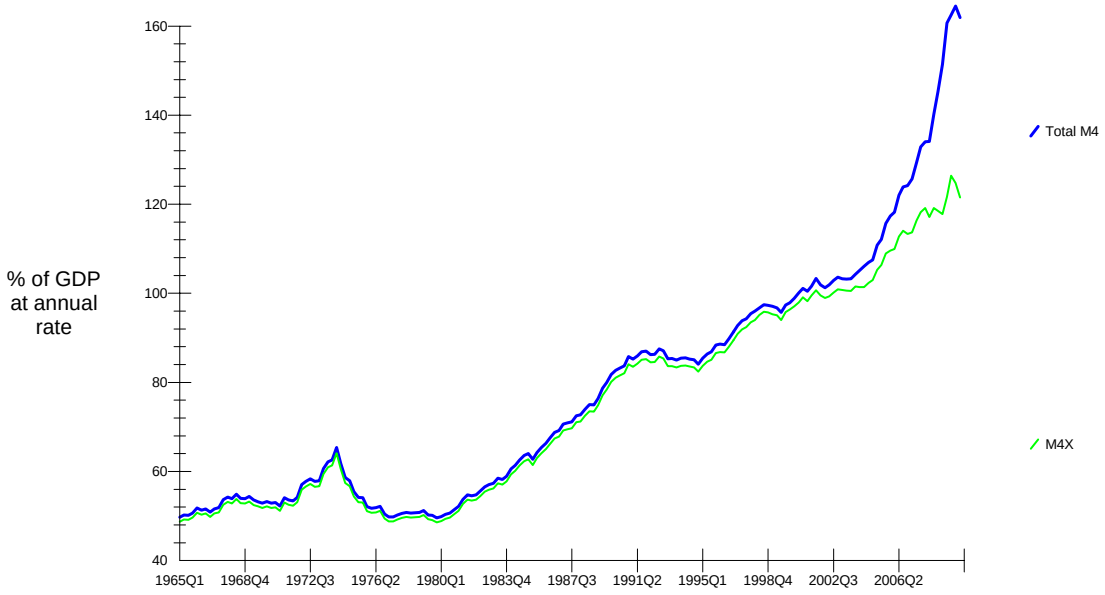
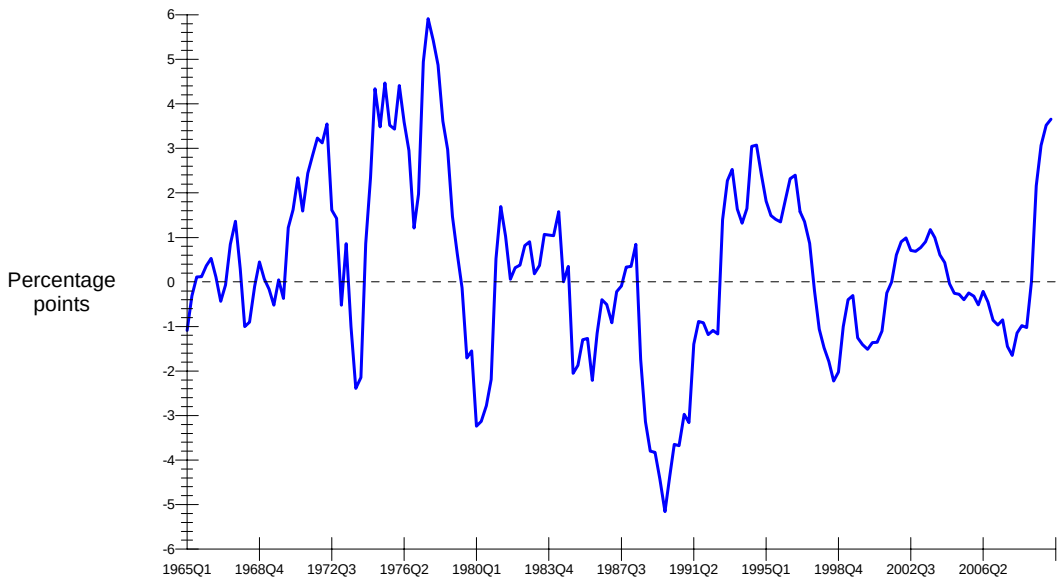


Chart 4: Excess of UK twenty-year gilt yield over three-month inter-bank rate, 1965 Q1 to 2009 Q4



Estimating the demand for broad money

For the statistical estimation, a conventional 'general-to-specific' methodology was adopted. This 'explained' the change in the logarithm of the real broad money supply using a set of variables that corresponded to both a long-run equilibrium solution and a set of short-term dynamic effects.[4] The short-term dynamic effects, which include those from changes in the logarithmic price level, are a crucial part of the theoretical and the statistical relationship and account for most of its explanatory power. However, the exposition becomes simpler if they are largely ignored from now on. The equilibrium solution of the M4X equation estimated over 1972 Q1 to 2009 Q3 had the properties that:

$$\log M4X/P = 2.2153 + \log HC - 0.0695*RIB - 0.0725*(RL20YR-RIB) \quad (1)$$

Where: P = the price level, HC = real household consumption, RIB = inter-bank rate, RL20YR = the gilt yield.

The economic interpretation is that the long-run income elasticity of demand for real M4X is unity - which was lower than might have been expected from the upward trend in the money/expenditure ratio - and that a 100 basis points increase in the excess of the twenty-year gilt yield over inter-bank rate eventually cuts the demand for M4X by 7.25 percentage points. On its own, a 100 basis points hike in inter-bank rate cuts M4X by 6.95 percentage points in equilibrium. However, combining the two inter-bank-rate terms implies that a 100 basis points increase in the inter-bank rate raises the demand for price-deflated M4X by 0.30 percentage points. This means that the demand for M4X reacts slightly 'perversely' to the short-term rate of interest in the long run, but is highly sensitive to gilt yields with the expected negative sign. The present 395 basis points excess of gilt-yields over inter-bank rate would correspondingly depress real M4X by 24½ percentage points, if sustained indefinitely.[5]

The equation explained 80.3% of the quarterly changes in the logarithm of real M4X, with a standard error (SE) of 0.69%. During estimation, dummy variables were included for each quarter from 2008 Q1 to 2009 Q3 to see whether the financial shocks of that period had disturbed the relationship. There were indications of negative shocks in the first and third quarters of 2008 but the one highly significant disturbance was that real M4X was almost 2% below expectations in 2009 Q2 and the same amount above in 2009 Q3. Such disturbances often reflect reporting errors in the provisional data, however. A forecast stability test carried out over the twenty quarters 2004 Q2 to 2009 Q3 had a root mean square error (RMSE) of 0.98% but

[4] The estimation process started with an 'unrestricted form' in the levels of the variables that contained up to four lags on the dependent and independent variables. Insignificant variables were progressively eliminated, and appropriate transformations such as first differences performed where the data justified it. The 'Error-Correction Models' that resulted were equivalent to dynamic difference equations, which contained both a static long-run equilibrium solution and a set of short-term dynamic effects. One advantage of this methodology is that it is possible to test whether the income elasticity of demand is exactly one, for example. Full details are available from the author on request.

[5] There is an implicit assumption that both interest rates are set independently of broad money. The whole model simulations reported later do allow for feedbacks.

this fell to 0.81% if the forecast test was stopped in 2009 Q1.[6] The conclusion is that there was no sign of significant instability in the underlying relationship between M4X and the wider economy between 2004 Q2 and 2009 Q1, but that there was a noticeable 'wobble' between 2009 Q2 and Q3.

Comparison of statistical results for M4 and M4X

The equivalent relationship for total M4 had similar long-run properties, although the combined coefficient on the three-month interest rate was slightly negative at minus 0.24 percentage points (see Equation 2 below). It is not improbable that the 'true' long-run effect is insignificantly different from zero in practice. The similarity between the M4 and M4X equations is not surprising, given that the figures for M4X up to 1997 Q3 were a scaled version of those for M4 and that much monetary volatility occurred in this period (see chart 6).

log M4/P= 1.9862 + log*HC -0.0778*RIB -0.0754*(RL20YR-RIB) (2)

(See Equation 1 for definition of terms.)

The statistical fit for the M4 equation up to 2009 Q3 was better than that for M4X (explanatory power 82%, SE 0.68%). However, this was only achieved after including dummy variables for each of the second to fourth quarters of 2008 and also for 2009 Q2. The fit was noticeably worse than for M4X if all dummies were excluded in both cases. The number and power of the shocks represented by these dummy variables indicate that the M4 equation had broken down badly in recent quarters. This was confirmed by forecast stability tests which had errors roughly twice the size of the M4X equivalents.

The next issue is whether the instability in the M4 equation can be accounted for by OIOFC deposits. As a mathematical identity, the logarithm of M4 *equals* the logarithm of M4X *plus* the logarithm of the ratio of M4 to M4X. This identity allows one to test whether OIOFC deposits should be excluded in their entirety, in which case the ratio of M4 to M4X would have a coefficient of unity, or only in part when the coefficient would lie between zero and one. In practice, the current change in the logarithm of the ratio of M4 to M4X appeared as highly significant ('t' value 7.5) with a coefficient of 0.69. However, it was not possible to find a significant long-run effect. Including the change in the M4/M4X ratio rendered all the 2008 and 2009 dummy variables insignificant, confirming that the growth of OIOFC deposits has indeed been a major distorting factor where M4 is concerned.

It is less clear that all OIOFC deposits should be removed from broad money, however. An experiment that involved putting the M4/M4X ratio into the M4X equation produced a significant negative long-run coefficient. Because OIOFC deposits are excluded from M4X, one would expect there to be no effect. This result suggests that there may be substitution between OIOFC deposits and some constituents of M4X. If M4X is being distorted downwards by OIOFC deposits, the

[6] The SE and RMSE are broadly equivalent to the familiar Standard Deviation. Forecast stability tests apply statistical criteria to see whether the RMSE is significantly larger than the SE, in which case the relationship is considered to have broken down.

Bank of England could over-stimulate the economy if it relied unduly on M4X. Finally, a forecast stability test for M4 from 2007 Q2 onwards gave a noticeably better result when the change in the logarithm of the M4/M4X ratio was included amongst the independent variables, while a regression of the deviations of M4 about its long-run steady state also found a significant effect from the M4/M4X ratio. This provides further evidence that the expansion of OIOFC deposits has distorted M4.

Money multiplier relationships

Keynesian opponents of monetarism in the 1960s and 1970s had two inconsistent counterarguments. One was that the relationship between money and nominal expenditure was unstable; the other was that any relationship between the two occurred because the supply of money was passively determined by the demand for it. In practice, most British monetarists have regarded narrow money as being demand determined[7] but have considered that broad money is subject to frequent supply shocks. This might result from regulatory changes, the balance sheet manipulations of commercial banks, the injections and withdrawals of liquidity caused by government funding policy (including QE) and international capital flows. The appropriate response to supply shocks is to estimate 'money-multiplier' relationships in which real expenditure is related to the increase in real broad money balances, the interest paid on money (with its sign reversed), and such other demand and supply variables as might be expected to influence activity. Government expenditure, which now accounts for over one half of UK GDP, is unaffected by money because the authorities can create it at will; while imports and welfare benefits act as offsetting 'swing factors' to private activity. This means that real private domestic expenditure (PDE) is a better measure than GDP for money-multiplier studies. During the first three quarters of 2009, Britain's GDP fell by 5.4% but real PDE plummeted by 11.7% (see Chart 5).

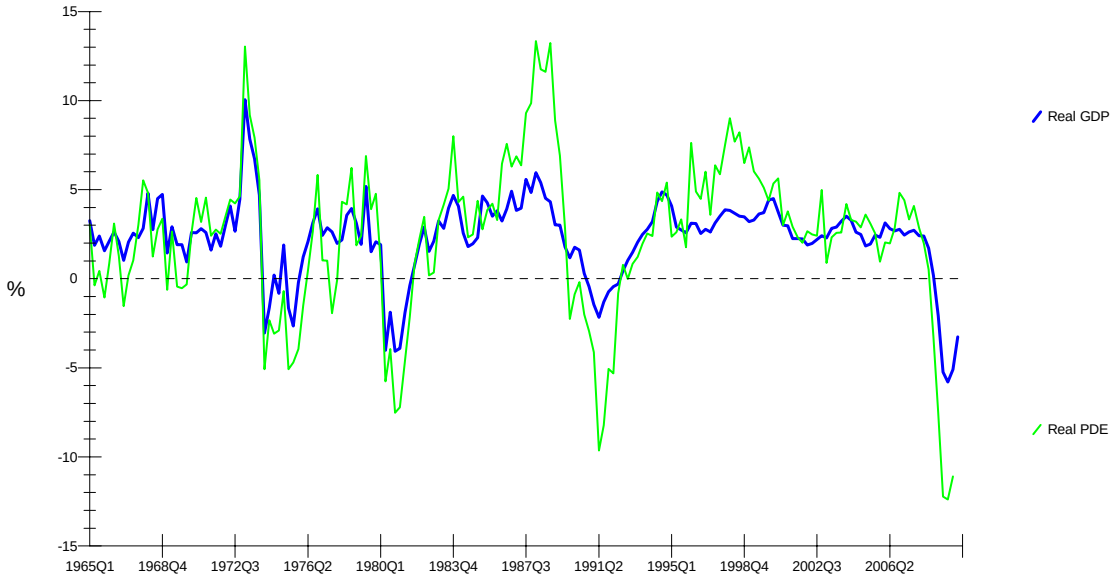
For the statistical analysis, equations were estimated that related the change in the logarithm of real PDE to: its own past levels; the change in the logarithm of real M4 or M4X; the real three-month inter-bank rate; the non-oil tax burden and General Government Net Borrowing, both expressed as smoothed ratios to non-oil GDP; a time trend; and a set of quarterly dummy variables from 2008 Q1 onwards. A standard 'nesting-down' procedure was employed until a final model in mixed changes and levels was achieved. In the case of M4X, the long-run steady state in levels over the period 1964 Q3 to 2009 Q2 was:

$$\log RPDE = 11.4766 - 0.0155*RRIB - TAXRAT - BRGRAT + 2.96\% \text{ per annum} \qquad (3)$$

Where: RPDE = Real Private Domestic Expenditure, RRIB = real three-month inter-bank rate, TAXRAT = ratio of non-oil taxes to non-oil GDP, and BRGRAT= ratio of General Government Net Borrowing to non-oil GDP

[7] A statistical equation for notes and coin is incorporated in the BEF model. However, it does not feedback elsewhere, apart from as funding for the budget deficit. There appears to be no stable relationship between broad money and the M0 monetary base, which adds bankers' balances at the Bank of England to notes and coin, despite the frequent textbook claims to the contrary. Since 2006 Q2, when the present M0 series commences, the M4X/M0 multiplier has ranged between 7.65 (2009 Q4) and 21.29 (2007 Q1). See Jansen and Andrews (2005) for further details on M0.

Chart 5: Annual % changes in UK real GDP and real private domestic expenditure, 1965 Q1 to 2009 Q3/Q4



In theory, broad money acts as a veil which should not affect the level of real PDE in the long-run, when real supply-side factors should dominate. This is why real broad money only appears as a short-term growth effect on the quarterly change in real PDE. The economic interpretation of the full Error Correction Model is that real PDE normally grows by 2.96% per annum. However, private activity falls by 1% for each 1 percentage point rise in the burdens of taxation and government borrowing,[8] while a 100 basis points rise in the real rate of interest cuts activity by 1.55%. In the short term, rises in the real rate of interest and the increase in the tax and spending burdens also have noticeable negative effects on the growth of real PDE, while an increase of 1% in real M4X boosts PDE growth by 0.65% after two quarters have elapsed. These results indicate that government spending crowds out private activity, irrespective of how it is financed. The rise in the government spending share between 1997-98 and 2009-10 will correspondingly have reduced the level of real PDE by 9.1% last year (i.e. by 0.73% per annum) or £81.6bn in cash terms and helps explain the collapse in the nation's taxable capacity. The other implication is that monetary policy operates through both the growth of real broad money balances and the real rate of interest, and not either one in isolation. This should discomfort both naive monetarists, who believe that only money matters, and neo-Keynesians who believe that only the interest rate affects the economy.

However, the statistical relationship for real PDE explained only 24.9% of the quarterly changes in real PDE between 1964 Q3 and 2009 Q2 and had a standard error of 1.64%[9]. In addition, three significant negative dummy variables were found

[8] The government's budget constraint states that public spending *equals* taxes *plus* borrowing. Since the long-run coefficients on taxes and borrowing were identical and the short-term effects similar, government spending can be used interchangeably with taxes and borrowing.

[9] The poor fit probably results from the volatility of stock building and the fact that welfare benefits, taxes, and government borrowing are not seasonally-adjusted. A similar equation for real household consumption

corresponding to 2008 Q4, 2009 Q1 and 2009 Q2, with coefficients in the range of 4.3% to 4.9%. This meant that a forecast stability test carried out from 2004 Q1 to 2009 Q2 yielded an unsatisfactory RMSE of 2.1%. Nevertheless, all the test results were still far better for M4X than for M4 and many other equations over-predicted following the Lehman's collapse in September 2008.[10] The money-multiplier findings were therefore consistent with the previous results in finding that M4X is a better measure than M4, while leaving more open the closeness of the links between M4X and the macro-economy.

Whole model simulations

One problem with money-multiplier studies is that several theories may be consistent with the estimated relationship. A better approach is to employ M4 and M4X in a larger structural model and compare their tracking and forecasting performance. This is only possible with a model that incorporates money, which rules out most central bank models. The macroeconomic-model test is seldom performed because of the effort involved. Fortuitously, the author's Beacon Economic Forecasting (BEF) model not only incorporates numerous feedbacks from broad money to the wider economy but also had to be largely re-built in the autumn of 2009 (Smith, 2010). This was caused by the rebasing of the UK GDP figures from a 2003 to a 2005 chain-linked basis in late June 2009 and a slightly earlier re-basing of the international data.

The previous 2003 chain-linked version of the BEF model, which revolved around M4, had badly over-predicted activity in 2008 and early 2009 because the rapid growth of real M4 had a pervasive expansionary effect throughout the UK sector of the model. When M4X figures became available in May 2009, the experiment was performed of replacing M4 with M4X in the input stream of the BEF model. The results of this substitution were spectacular. In particular, the replacement of M4 with M4X transformed the predicted outlook for economic growth with some 1½ percentage points coming off the previous forecast for 2009 and 2010. The tracking performance of other areas of the model also improved and it was possible to run the model with far fewer residual adjustments. This meant that the decision was taken to re-estimate the BEF model with M4X instead of M4 when the model was re-built in 2005 prices in the autumn of 2009. The re-estimated model tracked the economy far better than its predecessor and was capable of generating forecasts a decade ahead with little need for arbitrary residual adjustments. This confirmed that M4X is superior to M4 and suggests that a sophisticated version of monetarism remains a valid paradigm if cast in an appropriate modelling framework.

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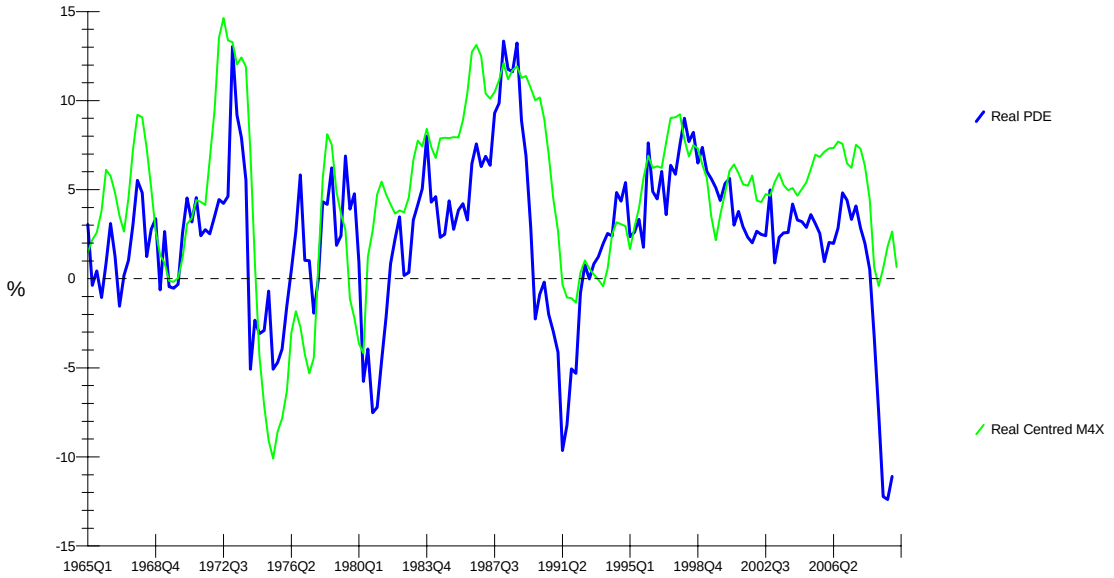
estimated over 1963 Q3 to 2009 Q1 explained 58.8% of its quarterly changes and had a standard error of 0.74%. The BEF model contains 69 endogenous statistical relationships, and there are separate equations for household consumption, private investment, and stock-building. The PDE results are not employed in the model.

[10] The author discussed the breakdown issue in the September 2009 Shadow Monetary Policy Committee report. This can be downloaded from the IEA website.

Chart 6: Annual % changes in UK real private domestic expenditure and real centred M4X broad money supply, 1965 Q1 to 2009 Q3/Q4



Some QE arithmetic

The demand-for-money is not the only framework for examining how QE affects broad money but it is convenient in the present context.[11] Equation 1 indicated that a 100 basis points reduction in the gilt yield caused a 7.25% increase in M4X. Sustained net purchases of British government securities from the non-bank private sector equivalent to 1% of non-oil GDP also seem to reduce the twenty-year gilt yield by 21.5 basis points.[12] Historically, some 53% of the Public Sector Net Cash Requirement (PSNCR) has been funded through gilt sales, although this was when budget deficits were generally smaller. In the absence of QE, the arithmetic becomes as follows. The BEF model forecasts that the PSNCR will average some 14% of non-oil GDP over the next few years and this would normally lead to net gilt sales equivalent to 7.7% of non-oil national output. This funding pressure would then add some 1.65 percentage points to the twenty-year yield and induce an 11.7% reduction in real M4X.

Viewed in this light, QE has mainly served to prevent the bond-market 'crowding out' of M4X that would otherwise have occurred. It also explains why the £200bn of QE has not had a more powerful effect, despite the fact that it represents a substantial direct monetary injection of 13% of M4X.[13] If the budget was balanced and QE ran at

[11] See Borio and Disyatat (2009) for an analysis of 'unconventional' monetary policies.

[12] This is based on a regression equation using data from 1964 Q1 to 2009 Q3. The other determinants of the gilt yield were real inter-bank rate, the real overseas bond yield and inflation.

[13] However, Table A3.2 of the January 2010 *Monetary and Financial Statistics* reveals that the authorities only purchased £33.7bn of gilts from the domestic non-bank private sector between 2009 Q2 and Q4, or 3.6% of non-oil GDP. This is roughly half the absolute size of effect discussed in the main text, even if persisted with indefinitely. The Bank has bought some commercial paper, but the main sellers of gilts were presumably the Debt Management Office, overseas residents and banks and building societies.

£200bn per annum indefinitely, it would cut the gilt-yield by 3.5 percentage points and boost real M4X by 25%. However, a one-off injection has a weaker effect – because the immediate effect is less than the final one. The stimulatory effects on M4X also start to fade once QE stops. This allows the Bank of England to sit on its QE acquired bonds until maturity and it need not take a capital loss on its holdings, as some City commentators have claimed. However, conventional 'expansionary' policies will lead to higher gilt yields, less monetary growth and weaker private activity, if bond investors believe that QE will be inflationary and/or the fiscal stance is unsustainable. This is why fiscal consolidation stimulates activity and employment, despite the Keynesian argument to the contrary.

Conclusions

The main conclusions are as follows:

1. The statistical research confirms that M4X is superior to M4 and that the growth of OIOFC deposits has distorted the relationship between M4 and the wider economy. However, an intermediate monetary definition between M4X and M4 might be preferable if it could be constructed.

2. The limitations of the M4X data make it hard to draw stronger conclusions. The Bank's statisticians were obliged to employ an industrial breakdown of bank deposits, intended for other purposes, to estimate OIOFC deposits. This is one reason why the figures are not more reliable. Another is the use of non-break-adjusted M4 to calculate M4X.

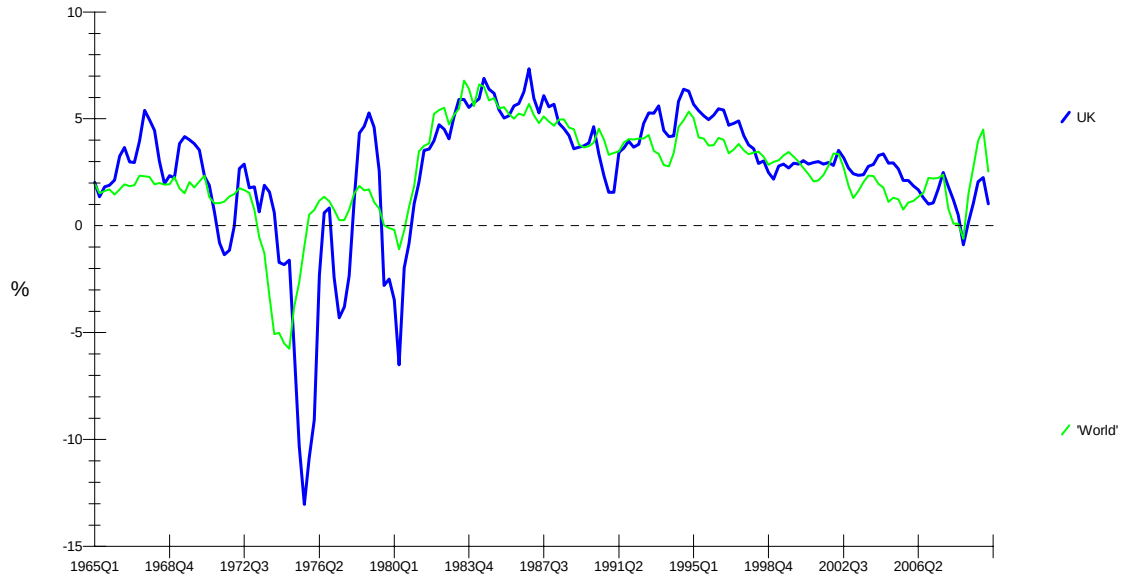
3. Some Bank officials have claimed that QE is mainly intended to boost the price of financial assets in the hope that the resulting wealth effect will stimulate activity. Another view is that the main function of QE is to shore up M4X. However, it is unclear whether this is meant to be achieved through the credit-counterparts arithmetic set out in Table A3.2 of *Monetary and Financial Statistics* or through reducing the opportunity cost of holding bank deposits. The demand for M4X rises significantly when gilt yields fall. However, official debt purchases have a limited impact on gilt yields, partly because real yields are largely determined internationally (Chart 7).

4. QE can have perverse effects if it leads to higher inflation expectations. It may be most effective when: the budget is broadly balanced; the central bank is buying up pre-existing debt, such as that left behind by a major war; and overseas investors know there is no foreign-exchange risk because the currency is credibly pegged by a device such as the gold standard. These conditions were met in the heyday of open market operations in the 1920s but are clearly not being met in Britain (or the US) today.

5. The money-multiplier analysis confirmed that M4X was preferable to M4, while leaving more open the closeness of the relationship between M4X and the wider economy. The results also suggested that the present fiscal profligacy is exacerbating the private-sector recession. Both the real short-

term rate of interest and the growth of real M4X affect private activity. Misguided regulatory interventions, which cause the banks to restrict the money supply, risk producing a second leg to the recession.

Chart 7: Real British and 'world' government bond yields, 1965 Q1 to 2009 Q4



6. This paper has concentrated on a comparison of aggregate M4 and M4X. An alternative is to disaggregate money into the holdings of: households; industrial and commercial companies; and other financial institutions, and examine each sector independently (see Congdon, 2005). This represents a potentially fruitful future line of enquiry but would require a second paper to do it justice.[14]

7. The implicit assumption so far has been that Britain behaves as a large closed economy in which domestic policies are the predominant influences. In practice, Britain has a small, open economy and overseas developments have a larger and quicker impact than the fiscal and monetary policy levers controlled by the UK authorities. British growth has been more closely associated with the growth of OECD real broad money than it has been with UK broad money since the 1960s and there has been a closer relationship between UK inflation and 'excess' OECD monetary growth than there has been with the increase in 'excess' domestic broad money (see Smith, 2007). One of the main ways in which domestic monetary policy impacts on the UK is through the exchange rate. However, this determines Britain's relative performance rather than its absolute one.

[14] The author carried out unpublished research in late 2007 which examined the demand for household money and the residual element of M4, using data from 1972 Q1 to 2007 Q2. The real household money equation explained 76.4% of the quarterly changes in household money over the period (SE 0.58%). The equation for the non-household element of M4 had a lower explanatory power of 50.2% and a SE of 2.64%. In both cases, the income elasticity was unity, but the interest-rate terms were significantly smaller with household money than the M4X figures reported here while those for non-household M4 were approximately twice as large. There is clearly a case for updating this research. The Bank's break-adjusted M2 series - which excludes wholesale deposits and extends back to July 1982 - also warrants statistical investigation.

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