Changes in the Indicator Properties of Narrow Monetary Aggregates

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- *Past research has shown that, compared with other monetary aggregates and expressed in real terms, net M1 and gross M1 have traditionally provided superior leading information for output growth.*
- *Financial innovations and the removal of reserve requirements have made it increasingly difficult to differentiate between demand and notice deposits. This suggests the need to re-examine the information content of narrow monetary aggregates (such as net M1 and gross M1) that depend on this distinction.*
- *Evidence examined in this article shows that, since 1993, real M1+* has become a better indicator of future output growth than real gross and net M1.*

While many countries have abandoned monetary targeting[1] over the past two decades, monetary aggregates are still useful indicators of future economic activity. This is true even though growth in these aggregates has at times been affected by shifts in the demand for money. As suggested in Longworth (2003), there are several reasons to believe money can provide leading information for output growth, including its role in the transmission of monetary policy. In Canada, the relationship with output growth is shown in the literature to be the strongest for narrow monetary aggregates (Hostland, Poloz, and Storer 1987; Muller 1992; Maclean 2001; Siklos and Burton 2001; Hassapis 2003). However, some authors have found that the link between real economic activity and monetary aggregates has weakened over the past two decades (Siklos and Burton 2001).

Past studies have found that narrow monetary aggregates, particularly real net M1 and gross M1, contain explanatory power for real output growth one to two quarters ahead.

At the Bank of Canada, narrow monetary aggregates expressed in real terms (i.e., deflated by a price index)

* M1+ consists of gross M1 plus chequable notice deposits plus adjustments.

1. The goal of monetary targeting is to keep the money supply growing at a specific rate.

BOX 1

Definitions of Narrow Monetary Aggregates

Gross M1 (hereafter GM1): currency outside banks *plus* demand deposits *plus* adjustments[1]

Float: funds in transition for settlement

Net M1 (hereafter M1): gross M1 *minus* float

M1+: gross M1 *plus* chequable notice deposits *plus* adjustments

M1++: M1+ *plus* all non-chequable notice deposits *plus* adjustments

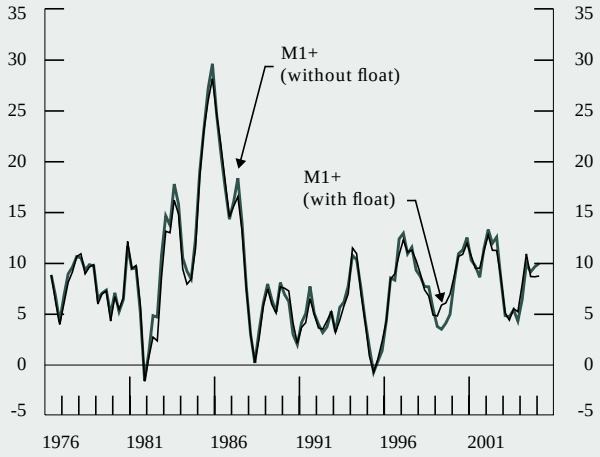
The Difference between Gross and Net Aggregates

Float consists of the amount of funds in transition between the time a cheque is deposited or a payment is sent and the time the payment is settled. For example, before a cheque is settled, the funds are subject to double counting.[2] Unlike gross monetary aggregates, net aggregates are adjusted for float to accommodate the issue of double counting. While the adjustment for float is what differentiates gross M1 from net M1, float is an insignificant portion of M1+ and M1++; as shown in Chart B1, the year-over-year growth of M1+ is little affected by whether an adjustment is made for float.[3] Given this consideration, the analysis of M1+ and M1++ in this article is restricted to measures on a gross basis.

Chart B1

M1+ (with and without float)

Year-over-year percentage change



1. "The Bank of Canada adjusts its monetary aggregates each time one of the following four events takes place: (i) the acquisition of a trust company by a bank (ii) the acquisition of an entity in a sector that was not previously included in the monetary aggregates (e.g., investment dealer) (iii) the formation of a bank from a trust company or companies (iv) the acquisition of a bank by a trust company." In addition, "the monetary aggregates were also adjusted in the past to (i) eliminate a number of discontinuities related to changes associated with the 1980 Bank Act revision, and (ii) introduce a new reporting system for the banks" (Kottaras 2003, 2).

2. For more details, see Cozier (1993).

3. The same conclusion applies to M1++.

continue to be monitored to assess their information content for real output. Past studies have found that narrow monetary aggregates, particularly real net M1 and gross M1, contain explanatory power for real output growth one to two quarters ahead. But no study compares how the leading-indicator properties of various narrow aggregates (net M1, gross M1, M1+, and M1++) for output growth have evolved over the recent period. (See Box 1 for definitions of narrow monetary aggregates.)

Financial innovations in banking products over the years have made it increasingly difficult to differentiate between demand and notice deposit accounts. For example, both types of account now offer similar interest rates and comparable accessibility to funds. The elimination, between 1992 and 1994, of reserve requirements on all bank accounts in Canada has removed the need for banks to discriminate between demand and notice deposit accounts (Aubry and Nott 2000).[2] As a result, the classification of accounts by financial institutions between demand or notice deposits has become increasingly arbitrary.

The blurred distinction between the two types of deposit raises questions about the value of those monetary

2. The reserve requirements were 10 per cent on demand deposits and 3 per cent on notice deposits. These requirements were imposed only on the chartered banks.

aggregates whose very definition is based on such a distinction. Specifically, M1 and GM1, which include currency and demand deposit accounts, are directly affected by this classification issue. The broader measures of narrow money, namely M1+ and M1++, capture both demand and notice deposits and, hence, should not be affected. Since this classification has become somewhat artificial, it is possible that the narrower aggregates (GM1 and M1) no longer contain superior information to that of M1+ and M1++. It is therefore interesting to compare the various narrow monetary aggregates with respect to their properties as leading indicators for output growth.

Creation of the Narrow Monetary Aggregates in Canada

There are many ways to aggregate various financial assets and money stocks to represent the supply of money. Economists generally aggregate money using two approaches (Laidler 1969). The first approach is to group those monetary assets that most closely represent some underlying definition of money, such as a medium of exchange or a store of value. The second approach is to define money as an aggregation of financial assets that have the most significant empirical relationship with certain macroeconomic variables, such as real output and inflation. However, no single method of monetary aggregation has been universally accepted, because there is no simple "one size fits all" approach to deal with the numerous economic concepts of money (Laidler 1999). As White (1976, 49) remarked, "the answer to . . . the related choice between alternative money definitions [is] based on the usefulness of the various aggregates for policy purposes."

The Bank of Canada began publishing monthly data for monetary components well before 1970. It was not until the 1970s, however, that the monetary aggregate M1 was reported. During the 1980s, the Bank also began reporting M1A, which is defined as the sum of M1 plus daily-interest chequing accounts and non-personal notice deposits. This aggregation comprised the most liquid monetary accounts and was intended to represent money for transactions purposes and purchasing power.

Financial Innovations and Money Distortions

In the past 20 years, financial innovations have played a significant role in the way economic agents have managed their money and financial assets. These innovations have caused important shifts among the monetary accounts, ultimately blurring the distinction between the various narrow monetary aggregates. The first wave of innovations in banking products, which took place from 1978 to 1986, significantly reduced the demand for M1 in both the corporate and household sectors in Canada (Aubry and Nott 2000). On the corporate side, a number of new cash-management packages allowed businesses to consolidate several accounts into one centralized account. As a result, firms were able to reduce their total working cash balances. For households, the introduction of daily-interest savings accounts (chequable and non-chequable) boosted incentives to deposit and transfer money into these accounts, which were not included in the measurement of M1 because they were unlikely to have been used for transactions purposes before the adoption of such financial innovations. Throughout this period, new financial products introduced by deposit-taking institutions continued to offer households and firms increasing flexibility in the type of account in which to hold deposits.

The second major wave of financial innovations began around 1993. Mutual fund products gained popularity relative to notice deposits as a saving vehicle, and free credit balances (cash or margin accounts intended for trading financial assets) grew rapidly. More importantly, as mentioned earlier, the removal of reserve requirements in the mid-1990s eliminated the need for banks to differentiate between demand (transactions) and notice (savings) deposits for reserve purposes. Indeed, many banks can no longer distinguish "demand" deposits from some types of notice deposit. As well, interest payments on some types of demand deposit became more common. In addition, the innovations in business accounts also made a significant contribution to the boost in the growth of GM1. A sizable share of GM1 was thus allotted to the sale and purchase of financial assets rather than to transactions for purchasing goods and services (Aubry and Nott 2000). Lastly, the development of Internet banking during the late 1990s enabled bank clients to easily transfer money between non-savings and savings accounts. This allows bank clients to deposit money in accounts that yield higher interest, while still being able to transfer money for transactions purposes without first having to give notice to the bank.

Towards M1+ and M1++

Thus, over the years, it has become increasingly difficult to differentiate between money held for transac-

tions purposes and money held as savings. This has ultimately led to concerns about whether M1 and GM1 are adequate measures of transactions balances. Financial institutions are also experiencing difficulties in classifying and reporting their deposit accounts as either demand or notice, raising concerns about the quality of M1 and GM1 data. In an effort to capture a broader notion of transactions money and to internalize the shifts occurring in some of the components, two alternative measures of narrow money, M1+ and M1++, have been published and monitored by the Bank since 1999. M1+ and M1++ are not affected by the distinction between demand and notice deposits because they incorporate both account categories. As such, they capture the components related to transactions purposes, as well as to savings purposes. For all of these reasons, the Bank of Canada has been motivated to explore new ways to define measures of transactions money (Gilbert and Pichette 2003).

Over the years, it has become increasingly difficult to differentiate between money held for transactions purposes and money held as savings.

Evolution of the Information Content of Narrow Monetary Aggregates

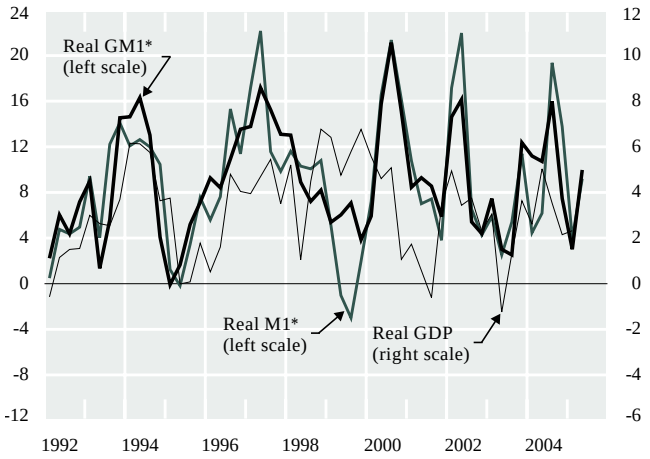
It has been generally determined that the growth of narrow money tends to precede growth in real output. Early research has verified the significance of this relationship over long historical samples (Hostland, Poloz, and Storer 1987; Muller 1992). Given the changes in the financial and regulatory environment over the 1990s, it is essential to examine how this relationship between narrow money and output has evolved over time.

Charts 1 and 2, which are similar to a chart published in the Bank of Canada's semi-annual *Monetary Policy Report*,[3] plot the quarterly growth of real gross domestic product (GDP) and the two-quarter moving average[4] of the growth of various real narrow monetary aggregates (lagged one quarter). The charts suggest that movements in the real monetary aggregates have usually preceded movements in real output growth, indicating that the movements in money growth have some leading information for future output growth. In

Chart 1

Growth of Real GDP, Real GM1, and Real M1

Quarter-over-quarter percentage change at annual rates

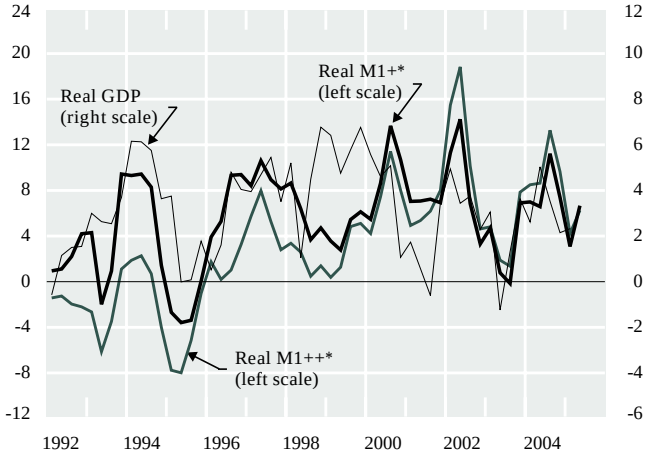


* Two-quarter moving average of growth in GM1 and M1 (deflated by core CPI), one quarter earlier. Core CPI is the consumer price index excluding the eight most volatile components and the effect of changes in indirect taxes on the remaining components.

Chart 2

Growth of Real GDP, Real M1+, and Real M1++

Quarter-over-quarter percentage change at annual rates



* Two-quarter moving average of growth in M1+ and M1++ (deflated by core CPI), one quarter earlier. Core CPI is the consumer price index excluding the eight most volatile components and the effect of changes in indirect taxes on the remaining components.

3. Many studies have shown that the first and second lag of money growth are the only significant lags in explaining real output growth. For example, see Hostland, Poloz, and Storer (1987) and Longworth (2003).

4. A two-quarter moving average is the average of a variable in this period and in the preceding one (i.e., $mx_t = (x_t + x_{t-1}) / 2$).

the literature, this lag effect is traditionally shown to be the strongest between output growth and the growth of GM1 and M1.

To quantitatively assess how this lead-lag relationship has evolved over time, a simple empirical exercise is performed to calculate the rolling correlations between the lagged two-quarter moving average of real narrow money growth and real output growth. The total sample is derived from the period 1975Q1 to 2005Q1. A 10-year correlation for the period 1975Q4 to 1985Q3[5] is calculated for each of the combinations considered (GM1, GDP), (M1+, GDP), and (M1++, GDP). The start and end dates are then rolled forward (1976Q1 to 1985Q4), and the 10-year correlations are calculated again. The start and end dates continue to be rolled forward, and the same exercise is performed until 2005Q1. For simplicity, the results using real M1 are not presented, since they are broadly consistent with those using real GM1.

During the period from 1975 to 1991, real GM1 had better leading information for output growth. But real M1+ has become the more relevant indicator since 1993.

Chart 3 shows the results of the rolling exercise for the 10-year correlations between output growth and the lagged two-quarter moving average of real money growth.[6] The following conclusions can be drawn from this chart:

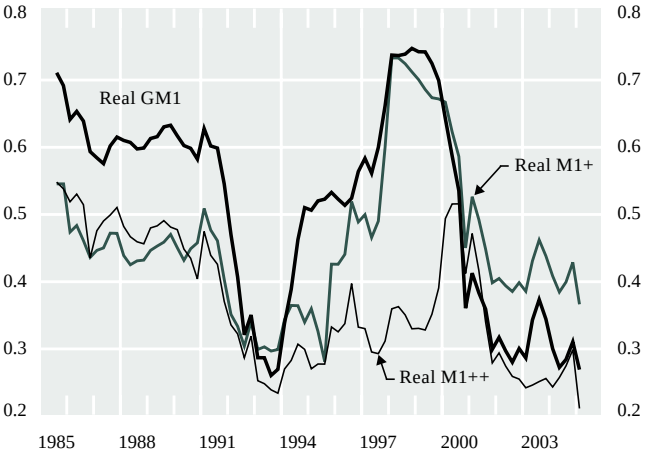
1) Over the period 1985 to 1996, the correlations using real GM1 were generally higher than those using real M1+ and real M1++. Over the period 2000 to 2005, however, there has been a clear deterioration in the correlations using real GM1. In the more recent period, the correlation using real GM1 has fallen to about 0.30, which is close to the lowest value over the entire sample.

2) Since 2000, the correlations using real M1+ outperformed the ones using real GM1.

Chart 3

10-Year Rolling-Window Correlations for the Growth of Real GDP and Real Lagged Monetary Aggregates (two-quarter moving average)

Quarter-over-quarter percentage change at annual rates



* Each observation shows the correlation for a 10-year period ending at the corresponding date.

3) The correlations pertaining to real M1+ have been fairly stable over the whole sample and have generally been around 0.45, on average.

These results suggest that a shift has likely occurred in the information content of real narrow monetary aggregates for output growth. While GM1 had higher correlations over the first part of our sample period, M1+ had stronger correlations in more recent years. Thus, the information content of real GM1 has deteriorated over time, while the information coming from real M1+ has been stable.

On a more formal basis, the results described in Box 2 support this view and determine that 1992 was the year when a shift occurred.[7] During the period from 1975 to 1991, real GM1 had better leading information for output growth. But real M1+ has become the more relevant indicator since 1993. This new regime is likely to persist, since the developments that made it difficult to distinguish between demand and notice deposits are permanent. This finding is consistent with the existence of a shift in the estimated parameters of the

5. This correlation corresponds to the 1985Q3 observation.

6. Correlations using the lagged two-quarter moving average are higher than those using only the first lag.

7. The correlations in Chart 3 cannot be used to isolate the date of the change in regime because they will include observations from both regimes for a period of 10 years following the change. Thus, we use the methodology in Box 2 to identify the period of regime change.

Box 2

Regime Shift in the Information Content of Narrow Monetary Aggregates

The correlations analysis provides evidence of changes in the relationship between output growth and the various narrow monetary aggregates. The exercise does not indicate, however, when these changes might have occurred, nor does it identify which narrow monetary aggregate has been the most informative over a certain period of time. In order to address these issues, a two-state regime-switching model for real GDP growth was estimated, using quarterly data from 1975Q1 to 2005Q1. For consistency with other parts of this article, the results are reported using the two-quarter moving average growth rate of money variables.[1, 2]

In regime 1, the monetary variable related to real GDP growth is real GM1, while in regime 2, the monetary aggregate of interest is real M1+. In addition to providing estimates of the parameters in these relationships, the model provides estimates of the probability of being in regime 1 (p_{1t}) or regime 2 (p_{2t}), with $p_{1t} + p_{2t} = 1$ in each quarter. If real GM1 were better at explaining output growth than real M1+ at observation t, p_{1t} would be higher than p_{2t}.

The estimated model is as follows:[3]

Regime 1

$$\Delta(GDP)_t = \underset{(4.67)}{2.86} + \underset{(1.52)}{0.18}*\Delta(GDP)_{t-1} + \underset{(4.33)}{0.27}*\Delta(GM1)_{t-1}$$

Regime 2

$$\Delta(GDP)_t = \underset{(1.47)}{0.52} + \underset{(4.36)}{0.48}*\Delta(GDP)_{t-1} + \underset{(2.97)}{0.20}*\Delta(M1+)_{t-1}$$

where Δ is the growth rate and t denotes time. In both regimes, the coefficients on money growth are positive and significantly different from zero. This suggests that monetary aggregates are useful for predicting output growth over the two regimes. Results in Chart B2 show that, over the period 1975 to 1991, the probability that output is best explained by regime 1 is near 1.0, on average. In comparison, over the period 1993 to 2005, the probability that output is best explained by regime 2 is near 1.0, on average. These results imply that real GM1 is better at explaining output growth up to 1991, while real M1+ has become the better indicator since 1993. They suggest that a shift to a new regime occurred around 1992.

We have also conducted the same exercise using other combinations of real narrow monetary aggregates (GM1 vs. M1++, M1 vs. M1+, and M1 vs. M1++); all results lead to the same general conclusion. That is, narrow monetary aggregates not affected by the distinction between demand and notice deposits (M1+ and M1++) have become more informative in predicting future output growth since 1993. The year 1992 represents a transition period when the model using GM1 became less informative than the one using M1+. This transition period corresponds to the time when the reserve requirements were being phased out.

1975Q4–1991Q4[4]

$$\Delta(GDP)_t = \underset{(4.61)}{2.25} + \underset{(2.46)}{0.26}*\Delta(GDP)_{t-1} + \underset{(4.28)}{0.27}*\Delta(GM1)_{t-1} \quad \bar{R}^2 = 0.38$$

$$\Delta(GDP)_t = \underset{(2.74)}{1.32} + \underset{(3.40)}{0.37}*\Delta(GDP)_{t-1} + \underset{(2.73)}{0.14}*\Delta(M1+)_{t-1} \quad \bar{R}^2 = 0.28$$

1993Q1–2005Q1

$$\Delta(GDP)_t = \underset{(1.60)}{0.89} + \underset{(3.77)}{0.46}*\Delta(GDP)_{t-1} + \underset{(2.05)}{0.10}*\Delta(GM1)_{t-1} \quad \bar{R}^2 = 0.32$$

$$\Delta(GDP)_t = \underset{(2.27)}{1.09} + \underset{(3.53)}{0.43}*\Delta(GDP)_{t-1} + \underset{(2.54)}{0.14}*\Delta(M1+)_{t-1} \quad \bar{R}^2 = 0.35$$

We also regress simple linear equations for the two subperiods, 1975Q4 to 1991Q4 and 1993Q1 to 2005Q1. As shown in the equations above, in the first period (1975Q4–1991Q4), the explanatory power ($\bar{R}^2$) of the equation using GM1 is higher than that using M1+. In the second period, however, the equation using M1+ is shown to have a higher explanatory power.[5] In addition, the coefficient on real GM1 is much higher in the first period than in the second. These results confirm our findings using regime-switching models.

1. For more details, see the forthcoming Bank of Canada Working Paper by Chan, Djoudad, and Loi, "Changes in the Indicator Properties of Narrow Monetary Aggregates."

2. Using one-quarter lagged money growth (instead of the two-quarter moving average) would not change the qualitative results presented here.

3. Bracketed terms are *t*-statistics.

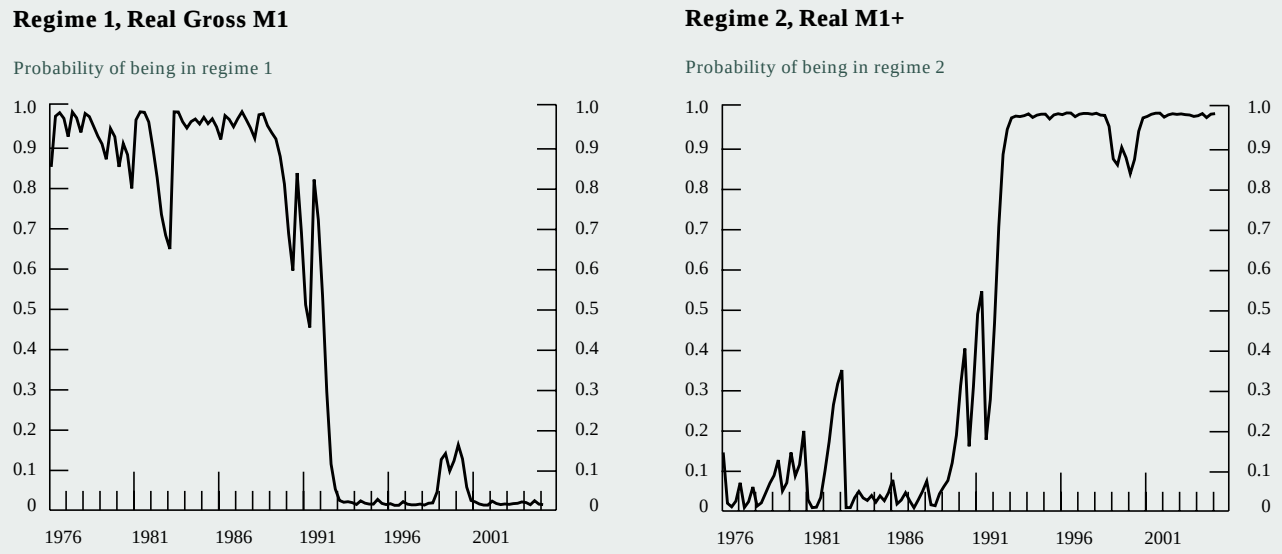
4. Bracketed terms are *t*-statistics.

5. The higher explanatory power of M1+ compared with GM1 is even more noticeable if we consider alternative specifications. For more details, see Chan, Djoudad, and Loi (forthcoming).

Box 2 (cont'd)

Chart B2

Real Gross M1 vs. Real M1+ as an Indicator of Real Output Growth



money demand equation that occurred over that period (Hendry 1995; Maclean 2001).

Conclusion

Financial innovations and the removal of reserve requirements have made the distinction between demand and notice deposits artificial. As a result, financial institutions are finding it increasingly difficult to allocate new accounts between these two categories. Thus, there are growing concerns that this change may have eroded the leading information of M1 and GM1 for future GDP growth. Consequently, M1 and GM1 may no longer provide more information than M1+ and M1++.

Our findings suggest that the leading-indicator properties of M1, GM1, M1+, and M1++ for GDP growth have shifted over time. Previous empirical results had suggested that real M1 and real GM1 were traditionally better indicators for future output growth. More recently, however, real M1+ has become more informative. Thus, we find evidence in favour of the existence of a regime shift in the indicator properties of narrow money for output growth. This regime change occurred in 1992 and is likely to persist.

When constructing the narrow monetary aggregates, the primary goal was to capture the supply of transactions money. Given institutional changes and financial innovations, the concept of transactions money is no longer likely to be adequately captured by GM1 or M1. We argue that the broader measure M1+ now better defines transactions money. Indeed, today there is less need for agents to carefully consider their holding of cash, since many non-term assets are easily converted into cash. This renders the distinction between demand and notice deposits less relevant for money demand.

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