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# Forecasting broad money velocity

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ABSTRACT

This paper applies traditional approaches and mixed-data sampling (MIDAS) to explain and forecast velocity of broad money in the euro area and the United States. Our results show that despite financial innovations, over the last two decades broad money velocity followed a declining trend with one break around the start of the financial crisis in both economies. A new result is that applying mixed-frequency techniques, we find improvements in velocity forecasts for the euro area at all horizons considered (one to eight quarters ahead), whereas for the US possible gains only refer to shorter-term forecasts.



## 1. Introduction

Monetary developments can help to guide monetary policy decisions of central banks. The literature provides two principal motivations for monitoring the velocity of broad money. One is that the velocity of circulation of money is a key concept in monetary theory and an important element of monetary analysis (Brunner & Meltzer, 1963; Fisher, 1911; Laidler, 1990). It can provide policymakers with additional insights about inflationary and deflationary risks. If velocity is not constant, as assumed in the quantity theory of money, this can have a bearing on the relationship between money and prices. Moreover, the velocity of money provides a complementary perspective on money demand, thereby allowing policy-makers to cross-check the information gained from money demand models. However, unexpected shifts in the velocity of money may cause the long-run correlation between inflation and money growth to deteriorate (Lucas, 1988; Reynard, 2006) and thereby distort the leading indicator properties of monetary aggregates.

A second motivation is that understanding short-run fluctuations of velocity is important for understanding the role of money in business cycles. According to the monetarist perspective, changes in the money stock are important sources of output fluctuations. Central to this view is the assumption that velocity is a stable function of a few macro variables, such as interest rates. A large variability of velocity at the business cycle frequency presents a challenge to this assumption, espe-

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cially when most of it cannot be explained by variations in the macro variables. Hence, it is important for a central bank to understand changes in velocity.

In empirical research broad money has received considerable attention, because the Federal Reserve announced monitoring ranges for M2 and the ECB has monitored a reference value for broad money M3. The aim of this paper is to explain and forecast velocity for broad money in the United States and in the euro area. When examining the relationship between money and prices, a central debate refers to whether velocity is constant or not and whether there are structural changes owing to factors such as financial innovation. The present empirical analysis considers that money velocity can be time-varying. Though, we do not treat shocks to potential output and equilibrium velocity as latent variables as in El-Shagi, Giesen, and Logan (2015).

When explaining and forecasting money velocity an issue is that velocity and its explanatory variables are not sampled at the same frequency. For example, velocity data have a quarterly frequency, whereas opportunity costs have a monthly (or even daily) frequency. The neglect of higher frequency information in standard approaches can have a bearing on both regressions and forecast performance, because latest information at the higher frequency is not incorporated in traditional approaches. Against this background, the contribution of the paper to the literature is threefold. First, it provides new results on the stability of broad money velocity covering the financial crisis period. Second, it estimates velocity for broad money for two major economies applying an approach that uses mixed frequency techniques (MIDAS), as proposed by Gyhsels, Santa-Clara, and Valkanov (2004) and Ghysels, Sinko, and Valkanov (2007). Third, by comparing the results obtained by MIDAS with traditional approaches, it informs the debate on whether mixed frequency regressions outperform conventional approaches.

The paper is organised as follows. Section 2 explains the data used for the study. Section 3 describes velocity trends of broad money and introduces traditional approaches and the MIDAS approach to modelling money velocity. Section 4 discusses the results of the velocity estimates and compares velocity forecasts from the two approaches. Section 5 concludes.

## 2. Data and descriptive analysis

In this section, we describe the data used in the study. For the euro area, which was created in 1999, the time series are relatively short, but previous studies have demonstrated that velocity can be explained by a trend and some standard macro variables (Brand, Gerdesmeier, & Roffia, 2002; Dreger & Wolters, 2009; Faruqee, 2005). In the case of the US, the history is longer and while previous papers explain velocity by a trend and macro variables, these studies also identify sizeable structural breaks, which cannot be explained by these factors (Anderson, Bordo, & Duca, 2016; Judson, Schlusche, & Wong, 2014; Orphanides & Porter, 2000). In this respect, Orphanides and Porter (2001) argue that a lesson from the policy failure during the Great Depression of the 1930s and the Great Inflation of the 1970s was the importance of monitoring monetary developments.

Stock and Watson (2007) argue that inflation has become harder to forecast owing to instabilities in the Phillips curve and despite the fact that inflation has become less volatile over recent decades. At the same time, it has been shown in the literature that a combination of monetary and economic indicators (Dreger & Wolters, 2014; Falagiarda & Sousa, 2017; Fischer, Lenza, Pill, & Reichlin, 2009; Hofmann, 2009) can improve the forecast performance using monetary data. Unexpected shifts in the velocity of money, which distort the leading indicator properties of monetary aggregates, could be an explanation why the performance of money as a leading indicator of inflation on times deteriorated.

The velocity of money is the frequency at which one unit of currency is used to purchase domestically-produced goods and services within a given time period. Money velocity (V) is defined using the quantity identity:

$$V_t = \frac{P_t \cdot YR_t}{M_t} \tag{1}$$

with P is the price level, YR is real income and M the money stock. Velocity is thus the ratio of the current value of total nominal transactions to the stock of money. It can be used to determine the velocity of a given component of the money supply, providing some insight into whether consumers and firms are saving or spending their money. Rewriting (1) in terms of growth rates yields:

$$\Delta v = \Delta yr + \Delta p - \Delta m \tag{2}$$

For the euro area, the empirical exercise of this paper covers the period since the start of monetary union (i.e., 1999–2016). For monetary aggregates in the euro area and inflation monthly series are available, whereas for (nominal and real) GDP only quarterly series can be used.[2] Measures of end-of-month outstanding amounts denominated in euro (source: ECB) are used for the broad monetary aggregates M3 for the euro area. The data is working day and seasonally adjusted. Nominal GDP for the euro area denominated in euro is the series reported by Eurostat which is compliant with ESA95 National Accounts and has been seasonally adjusted. For real housing wealth (WR), we use a series on households' non-financial assets (fixed assets and land underlying dwellings) from the flow-of-funds statistics (source: ECB), which is quarterly and has been deflated by the HICP and has been seasonally adjusted. We construct the opportunity cost of M3 as the difference between the yield on

[2] While using monthly data of industrial production would be a way out, it is known from the literature that these data are quite volatile.