Multilateral Divisia monetary aggregates for the Euro Area

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Abstract

In light of the "two-pillar strategy" of the European Central Bank, good measures of aggregated money across countries in the Euro area are policy relevant. The objective of this paper is to focus on the multilateral Divisia monetary aggregates for the Euro area to produce a theoretically consistent measure of monetary services for the Euro area monetary union. Based on theory developed in Barnett (2007), the multilateral Divisia monetary aggregates for 17 Euro area countries are found to provide a better signal of recession, when compared to the corresponding simple sum monetary aggregates.

JEL Classification: C43, C82, E51, F33

Key Words: Divisia Index, European Union, European Monetary Union, Monetary aggregation.

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1. Introduction

The European Central Bank (ECB) attributes a special role to monetary aggregates under its two-pillar strategy. Economic analysis and monetary analysis are used to achieve and maintain price level stability. In light of the important role of the monetary aggregates in the Euro area, the need for an appropriate and theoretically consistent measure of monetary aggregates is highly relevant.

The Divisia monetary aggregates are based on microeconomic aggregation and index number theory. Barnett's (1980) initial results were derived for a single closed economy. Studies with single country data have repeatedly demonstrated that Divisia monetary aggregates are better measures than simple sum monetary aggregates in terms of policy criteria, such as causality and information content of the aggregate and stability of the money demand function. See, e.g., Barnett (1983), Barnett, Offenbacher and Spindt (1984,1991), Belongia and Ireland (2006, 2014, 2105a, 2016), Serletis and Rahman (2013), and Serletis and Gogas (2014)).

Simple sum monetary aggregates for the Euro area are widely used in economic research and are made available by the ECB. The simple sum approach is based on the assumption that the components are perfect substitutes. Barnett and Gaekwad (2018) found that monetary services in the Euro area are not perfect substitutes. Hence, simple sum aggregation over monetary services for the Euro area is not theoretically justified. Similar results have been found with U.S. data. See, e.g., Serletis and Robb (1986) and Serletis and Shahmoradi (2007).

In previous studies, Stracca (2004) and Darvas (2015) have constructed Divisia monetary aggregates for the Euro Area, but under the very restrictive assumption that the Euro area behaves as a single aggregated country. That assumption implies homogeneity across the Euro area, including price levels,

interest rates, and tastes. That assumption is not representative of the Euro area, which is an economic union of heterogeneous countries.

For an economic union like the Euro area, the relevant theory for construction of multilateral Divisia monetary aggregates was developed in Barnett (2003, 2007). The resulting multilateral Divisia monetary aggregates for the Euro area assume the existence of homogeneity within countries, but heterogeneity across countries within the economic union. The representative agents for each country can have different tastes and preferences, while conditioning upon different after-tax prices and interest rates. These generalizations are very relevant to the Euro area, which is a union of heterogeneous countries having characteristics that have not yet converged to each other. This paper constructs the Divisia monetary aggregates for the single countries and then constructs the multilateral Divisia monetary aggregates over the countries, taking into consideration diversity across the countries.

2. Aggregation within the Euro area

Let m_{kji} be nominal per capita holdings of asset $i \in$ {1,2,3,….,N}, located or purchased in country j, and owned by an economic agent in country k. Then let r_{kji} be the holding period after-tax yield on m_{kji}. The benchmark rate of return (on pure capital), R_k, is computed following Barnett et al (2013)[1].

The real user cost price of asset i, located or purchased in country *j*, and owned by residents of country *k* at time *t*, is given by $\pi^*_{kji}(t) = (R_t(t) - r_{kji}(t))/(1 + R_t(t))$, and the corresponding nominal user cost is $\pi_{kji} = p^*_k \pi^*_{kji}$. It measures the foregone interest or opportunity cost of holding monetary asset i, when the higher yielding benchmark asset could have been held.

Assuming m_{kji} is positive, so that $S_k = \{(i,j) : m_{kji} > 0 \text{ for all } i, j\}$, the Divisia growth rate of the nominal per-capita monetary services aggregate, M_k, for each country, k, is

[1] The details of computation of the benchmark rate of return, R_k, is explained in appendix B

$$d \log M_k = \sum_{(i,j) \in S_k} w_{kji} \, d \log m_{kji} \, . \tag{1}$$

Similarly, the Divisia growth rate of the monetary, nominal, user-cost price aggregate, Π_k, is

$$d \log \Pi_k = \sum_{(i,j) \in S_k} w_{kji} \, d \log \pi_{kji} \, , \tag{2}$$

where

$$w_{kji} = \frac{\pi^*_{kji} m^*_{kji}}{\sum_{(i,j) \in S_k} \pi^*_{kji} \, m^*_{kji}} = \frac{(R_k - r_{kji}) m_{kji}}{\sum_{(i,j) \in S_k} (R_k - r_{kji}) m_{kji}} \, , \quad \sum_{(i,j) \in S_k} w_{kji} = 1 \tag{3}$$

with $0 \leq w_{kji} \leq 1$ for all $k \in \{1, \ldots \ldots, K\}$, $j \in \{1, \ldots, K+Z\}$, $i \in \{1, \ldots \ldots, N\}$, and with $\sum_{(i,j) \in S_k} w_{kji} = 1$ for all k.

3. Aggregation over countries

The euro area's nominal per-capita monetary service flow, M, is given by

$$d \log M = \sum_{k=1}^{K} W_k \, d \log (s_k M_k) \, , \tag{4}$$

while the euro area's nominal monetary user-cost price, Π, is defined by

$$d \log \Pi = \sum_{k=1}^{K} W_k \, d \log \Pi_k \, , \tag{5}$$

where $s_k = \frac{H_k}{\sum_{k-1}^{K} H_k}$ is the population share of country, k, and

$$W_k = \frac{M^*_k \Pi_k s_k}{\sum_{k=1}^{K} M^*_k \Pi_k s_k} \, . \tag{6}$$

The corresponding discrete-time Divisia index for the Euro area is acquired by replacing the instantaneous differentials $d \log (z_t)$ by finite changes between periods, $\log (z_t) - \log (z_{t-1})$, and the instantaneous shares, W_{kt}, by $(W_{kt} + W_{k,t-1})/2$.

4. Data source and description

The data for monetary services and the corresponding interest rates are from the European Central Bank (ECB) and the central banks of the member countries of the Euro area. The Divisia monetary aggregates in this paper are monthly and start from January 2003.

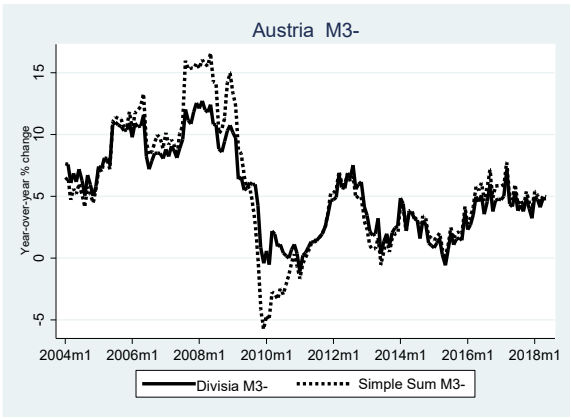
Our M1 and M2 monetary aggregate components follow the ECB definition. The ECB defines the M1 monetary aggregate to include currency in circulation and overnight deposits; M2 includes the components of the M1 aggregate, along with deposits with agreed maturity up to 2 years (DAM), and deposits redeemable at notice up to 3 months (DRN). In this analysis, Divisia M3- (M3 minus) contains the components of M2 along with debt securities with a maturity of up to two years.[2]

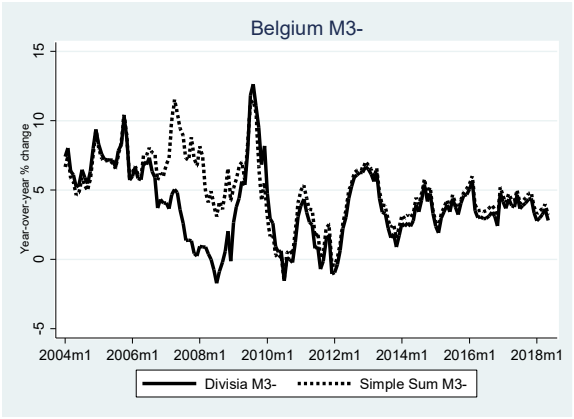
5. Divisia Monetary aggregates for the Euro area countries

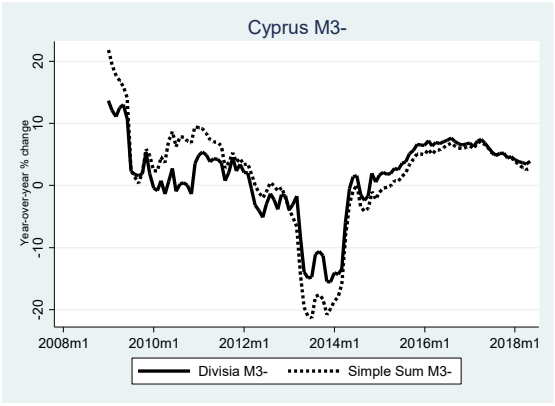
The construction of individual countries' Divisia monetary aggregates is prerequisite to the construction of multilateral Divisia monetary aggregates for the Euro Area. The single country Divisia monetary aggregates are constructed for the 19 Euro area countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Latvia, Lithuania, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain. Figure 1 shows the Divisia M3- aggregate for 17 of the countries, excluding Spain and Italy. The year over year percentage change in the Divisia M3- aggregate is compared with the corresponding simple sum aggregate for the 17 countries.

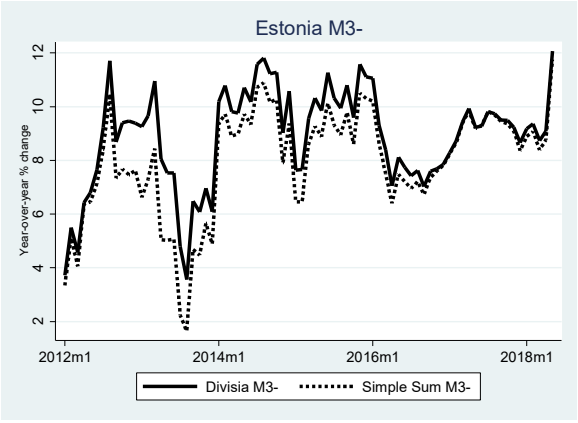
[2] The details of data sources are given in appendix B.

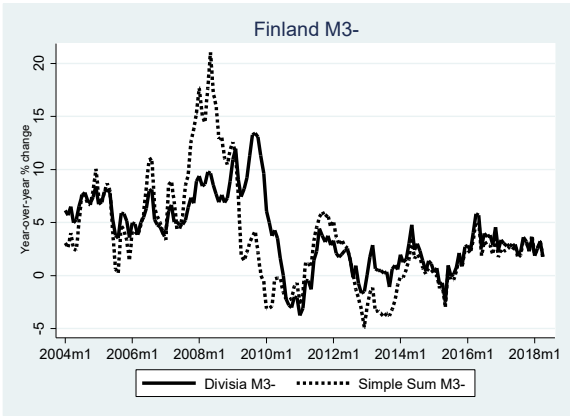
Figure 1: The year over year percentage change of the monetary aggregates for the 17 Euro area countries, excluding Spain and Italy.

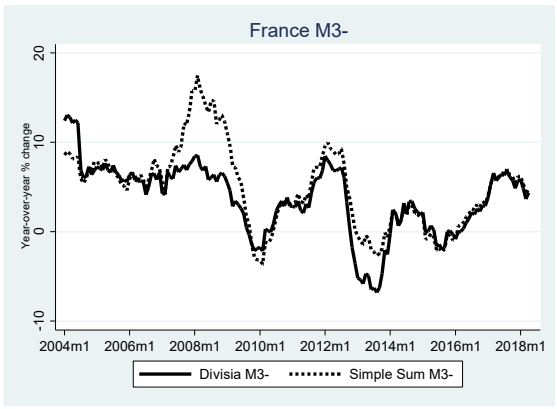


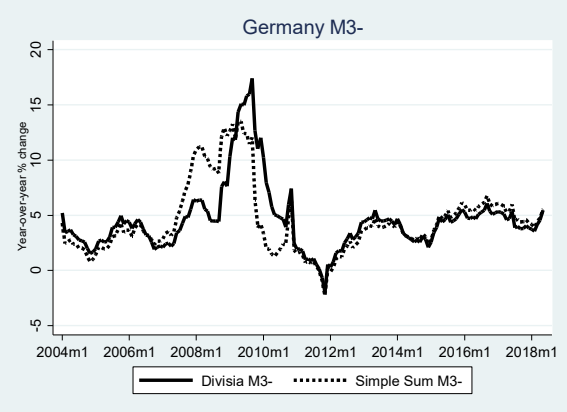


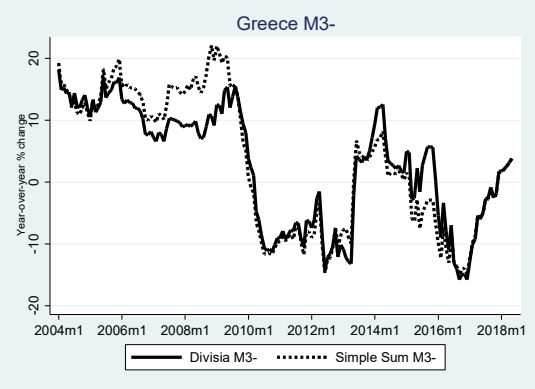


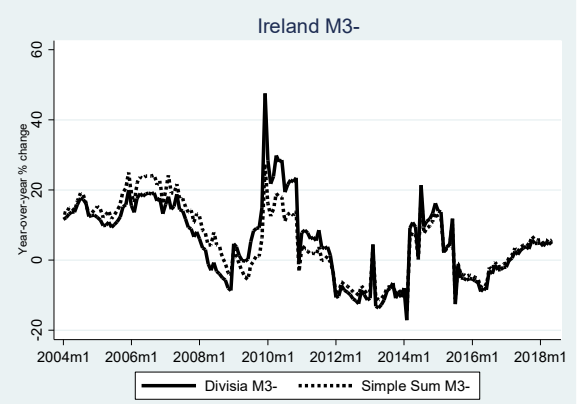


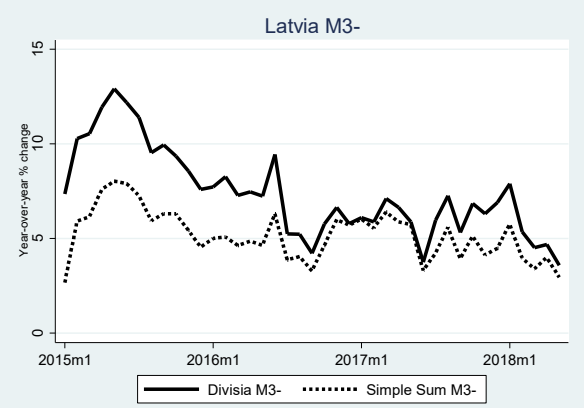


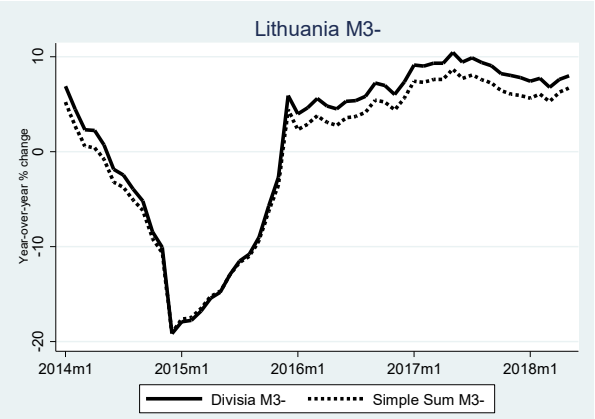


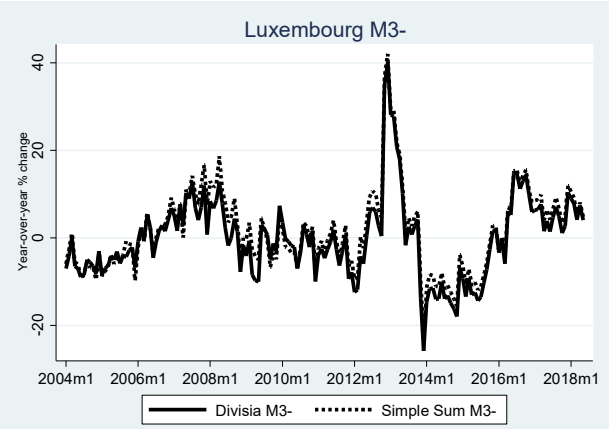

Germany M3-
Year-over-year % change
-5
0
5
10
15
20
2004m1
2006m1
2008m1
2010m1
2012m1
2014m1
2016m1
2018m1
Divisia M3-
Simple Sum M3-

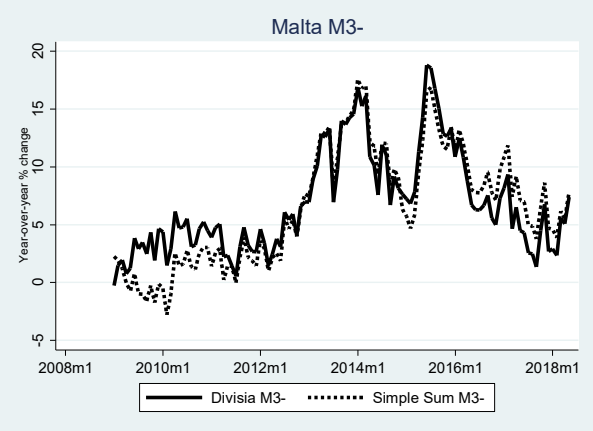

Greece M3-
Year-over-year % change
-20
-10
0
10
20
2004m1
2006m1
2008m1
2010m1
2012m1
2014m1
2016m1
2018m1
Divisia M3-
Simple Sum M3-

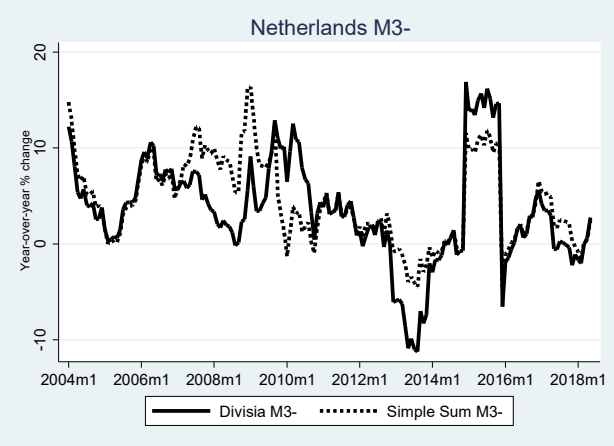

Ireland M3-
Year-over-year % change
-20
0
20
40
60
2004m1
2006m1
2008m1
2010m1
2012m1
2014m1
2016m1
2018m1
Divisia M3-
Simple Sum M3-

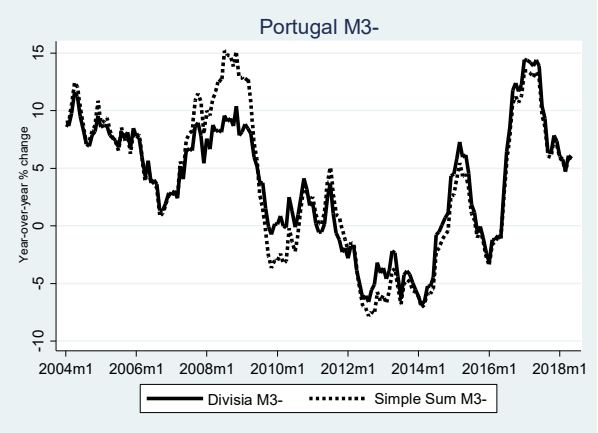

Latvia M3-
Year-over-year % change
0
5
10
15
2015m1
2016m1
2017m1
2018m1
Divisia M3-
Simple Sum M3-

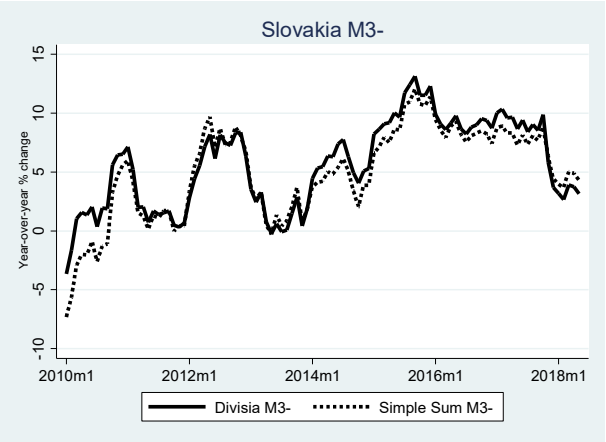

Lithuania M3-
Year-over-year % change
-20
-10
0
10
2014m1
2015m1
2016m1
2017m1
2018m1
Divisia M3-
Simple Sum M3-

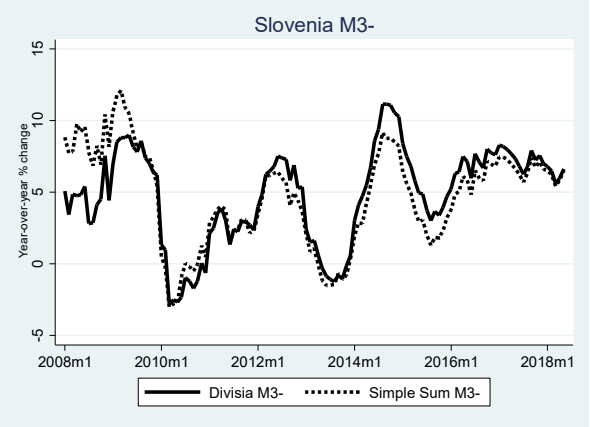

Luxembourg M3-
Year-over-year % change
-20
0
20
40
2004m1
2006m1
2008m1
2010m1
2012m1
2014m1
2016m1
2018m1
Divisia M3-
Simple Sum M3-











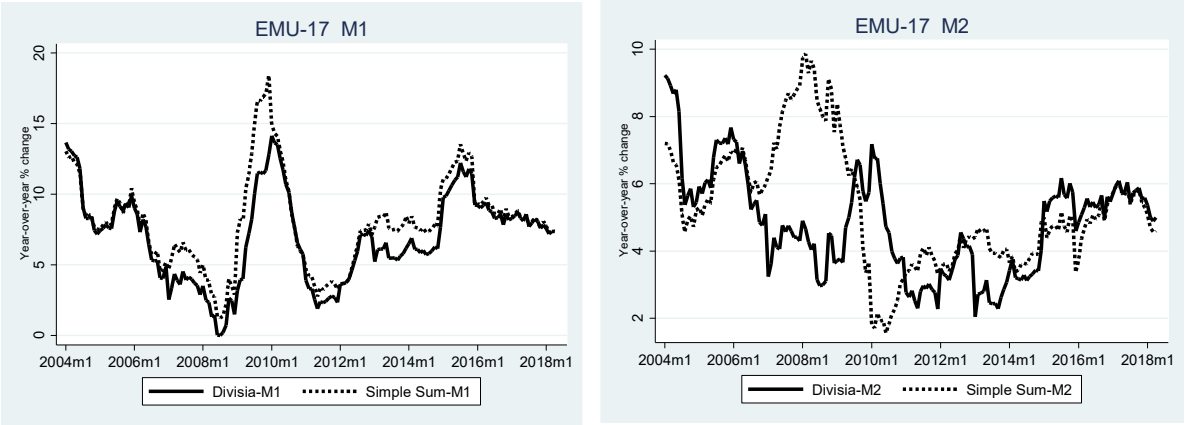
As displayed in the appendix, the European Central Bank data for monetary services for Italy and Spain

have shown a very steep change in the time frame of just one month.[3] In this paper, we have analyzed the monetary aggregates for the group of EMU 17 countries, excluding Spain and Italy, because of the very abnormal, steep changes in the data of the monetary services for those two countries, with results for the complete 19 country union available in the appendix.[4]

6. Multilateral Divisia monetary aggregates for the union EMU-17

The growth rates of the multilateral Divisia monetary aggregates are weighted averages of the growth rates of the countries' Divisia monetary aggregates. The weights used in the aggregation include the country's population share in the union, the countries' monetary aggregates, and the countries' user-cost aggregates.[5] Figure 2 shows the Divisia M3- aggregate for the EMU 17 union. The year over year percentage change in the Divisia M3- aggregate is compared with the corresponding simple sum aggregate.[6]

Figure 2: The year over year percentage change of the monetary aggregates for the EMU 17 union.

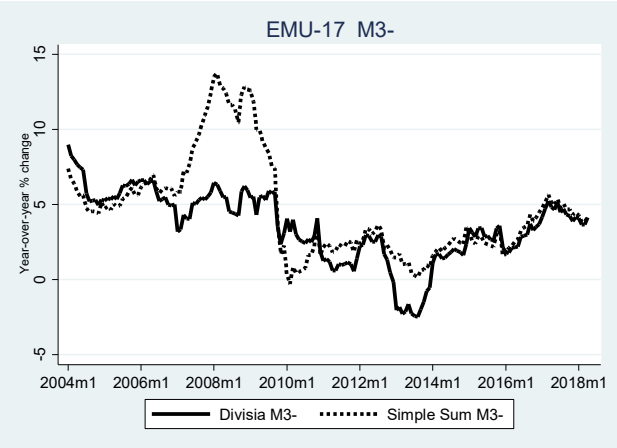


[3] Figure 1A shows Spain and Italy's monetary services. Figure 2A shows the Divisia M3- aggregate for Italy and Spain.

[4] In appendix A the corresponding results with the inclusion of Italy and Spain are presented, i.e. the union of the EMU-19 countries.

[5] Appendix B shows the weights for the countries, computed using equation 6.

[6] Appendix B shows the Divisia monetary user-cost price aggregates and the inside money aggregate for the EMU 17 countries.



7. Conclusion

With US monetary data, Barnett and Chauvet (2011) have observed that a divergence of the Divisia monetary aggregates from their simple sum monetary aggregates can provide a signal for impending financial instability. Rayton and Pavlyk (2010) have shown that the Divisia and the simple sum monetary aggregates did not correlate at the start of the recent economic crisis. Chan and Nautz (2015) found that the information content of the two indices diverged for the Great recession in Germany. Our individual country Divisia monetary aggregates and the multilateral Divisia monetary aggregates for the EMU 17 union show a divergence from the corresponding simple sum monetary aggregates and are lower than the corresponding simple sum monetary aggregates during the recent 2008-2009 economic crisis and the Euro area debt crisis.

In the single country case, the Divisia monetary aggregates have repeatedly been found to be better measures in terms of policy criteria than the simple sum (see, e.g., Barnett, Offenbacher and Spindt (1981, 1984) and Belongia and Ireland (2006, 2014, 2015a,b, 2016)). Given the prominent role assigned to money in the two-pillar strategy of the ECB, the country Divisia aggregates and the multilateral Divisia monetary aggregates for the Euro Area can be helpful tools in policy research.

This paper focuses on the multilateral Divisia monetary aggregates for the Euro area. The multilateral Divisia monetary aggregates are a theoretically consistent monetary services measure for an economic union, such as the Euro area (Barnett 2007). We find that multilateral Divisia monetary aggregates for the 17-countries Euro area can provide better signals of recessions than the corresponding simple sum monetary aggregates.

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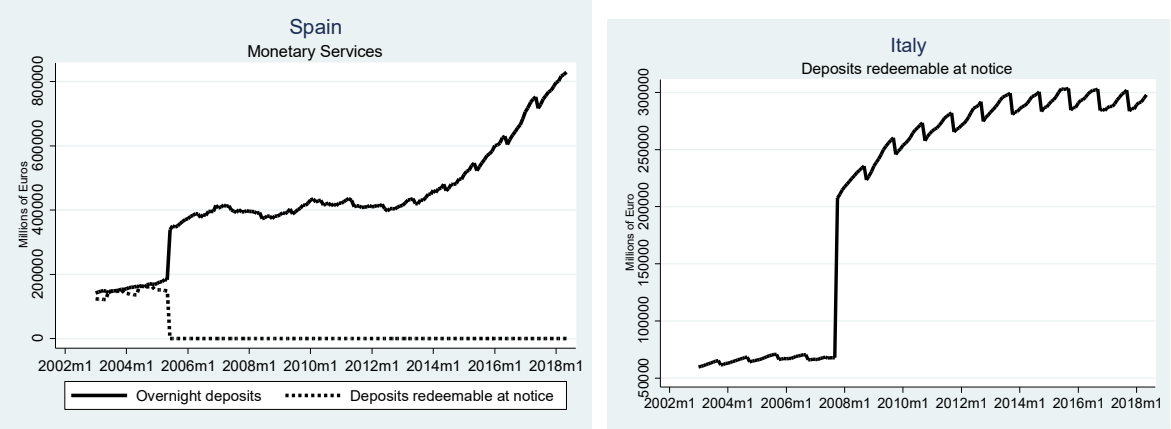
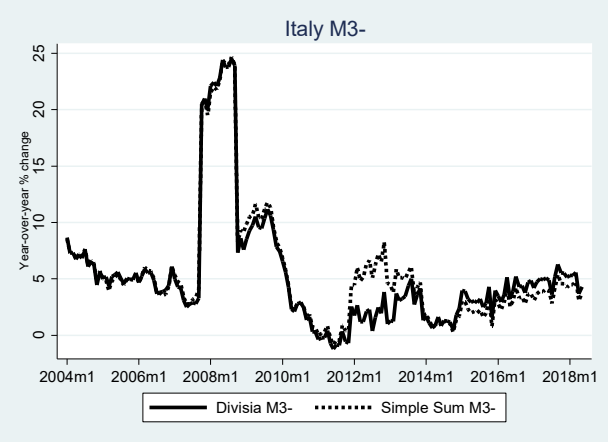
Appendix A: Italy and Spain

Figure 1-A: Monetary services of Spain and Italy.



In the case of Spain, the Overnight Deposits increased from 183,456.9 million euros to 339,240.7 million euros from May 2005 to June 2005. This is an 84.9% jump in just a one-month time period. The Deposits Redeemable at Notice in Spain decreased from 148,184.7 million euros in May 2005 to 2,150,608 euros in June 2005. This is an astonishingly sharp decrease in just one month. In the case of Italy, the Deposits Redeemable at Notice increased from 67845 million euros in September 2007 to 207685.2 million euros in October 2007. This is a steep jump of 206% in a one-month time period. Figure 2-A1 shows the Divisia M3- aggregates for Italy and Spain.

Figure 2-A: Monetary aggregates for Italy and Spain



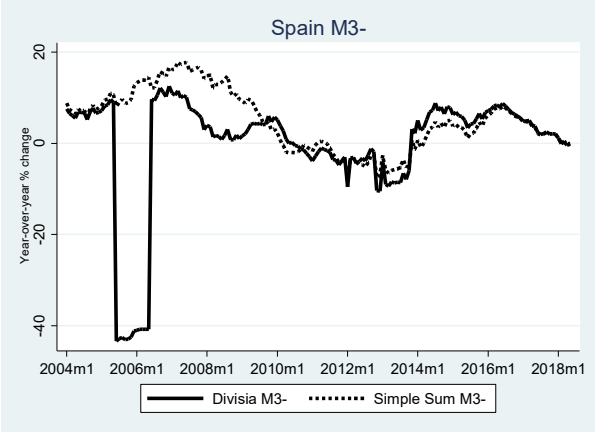
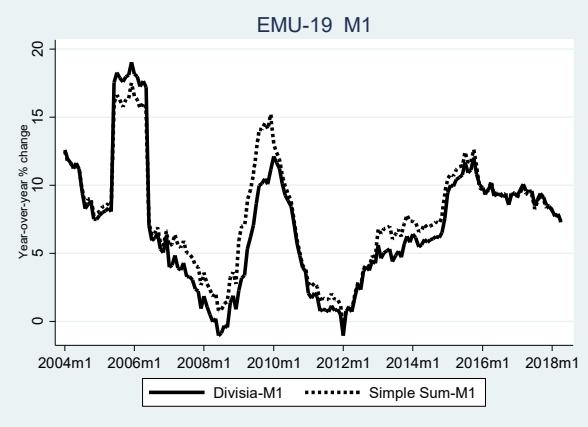
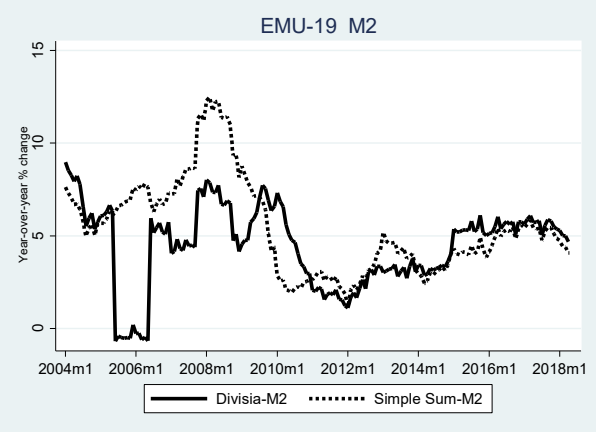
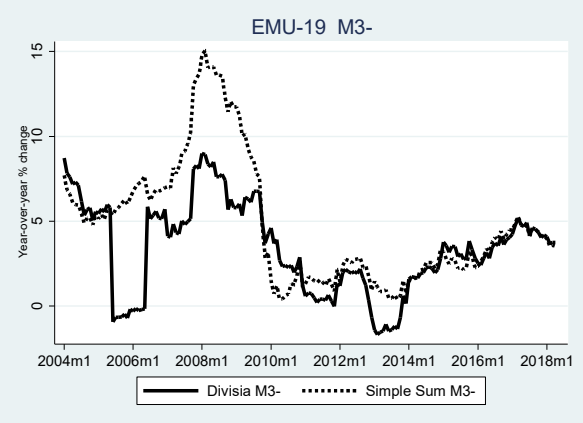


Figure 3-A: The year over year percentage change of the monetary aggregates for the EMU 19 union.







Appendix B: Data

B.1. Benchmark rate of return, R_k.

The benchmark rate of return, R_k, in country k is received on a pure investment, providing no services other than its yield, and hence is the rate of return on pure capital. The benchmark rate must be at least as high as the upper envelope over all the monetary aggregate's component yield-curve-adjusted rates of return. To determine the benchmark rate, we produce the upper envelope over the yield-curve-adjusted rates of return on all the monetary assets considered, along with the interest rate on loans of one year maturity, in accordance with Barnett et. al (2013).

B.2. Data sources and description

The data for monetary services and the corresponding interest rates are from the European Central Bank (ECB) and the central banks of the member countries of the Euro area. The data are available only from January 2003. Hence the starting period of the monetary aggregates in this paper is January 2003.

In this paper, the M1 and M2 monetary aggregates follow the ECB definition. The ECB defines the M1 monetary aggregate to include currency in circulation and overnight deposits; M2 includes the components of the M1 aggregate, Deposits with agreed maturity up to 2 years (DAM) and Deposits redeemable at notice up to 3 months (DRN).

The ECB has defined M3 to include the components of M2, repurchase agreements, money market fund shares/units and debt securities with a maturity of up to two years. The data for the amount and rate of return on repurchase agreements and on money market fund shares were not publicly available. Hence those two monetary services could not be used in the aggregation. In this analysis, the Divisia M3- (M3 minus) aggregate is defined to include the components of M2 and debt securities with a maturity of up to two years.

Table 1: Expenditure weights of 17 countries during the month of April 2018 in our aggregates for Divisia M1, M2, and M3-.

	M1	M2	M3-
Austria	0.043948	0.034849	0.034138
Belgium	0.045663	0.047192	0.047517
Cyprus	0.002462	0.002698	0.002623
Estonia	0.003934	0.003771	0.003724
Finland	0.018992	0.020277	0.018325
France	0.22973	0.303519	0.316033
Germany	0.485509	0.391032	0.371227
Greece	0.026107	0.034128	0.03742
Ireland	0.02145	0.01894	0.020437
Latvia	0.003819	0.004702	0.004532
Lithuania	0.00459	0.005386	0.005205
Luxembourg	0.002072	0.001154	0.001613
Malta	0.00232	0.0022	0.002188
Netherlands	0.052217	0.06963	0.071709
Portugal	0.035418	0.036286	0.039785
Slovakia	0.015411	0.017375	0.016647
Slovenia	0.006357	0.006861	0.006874

Figure 1-B: The inside money M3- aggregate for the EMU 17, with currency removed

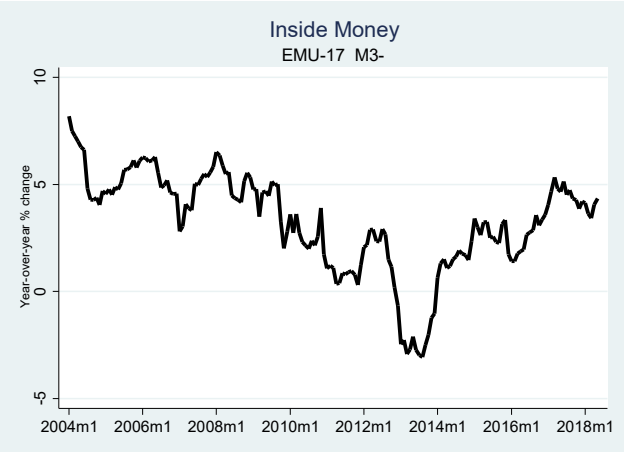


Figure 2-B: Divisia monetary user-cost price aggregate for EMU 17