Economics Bulletin

Volume 34, Issue 1

Liquidity in the liquidity crisis: evidence from Divisia monetary aggregates in Germany and the European crisis countries

Makram El-shagi
California State University - Long Beach & Halle Institute for Economic Research

Logan J Kelly
University of Wisconsin

Abstract

While there has been much discussion of the role of liquidity in the recent financial crises, there has been little discussion of the use of macroeconomic aggregation techniques to measure total liquidity available to the market. In this paper, we provide an approximation of the liquidity development in six Euro area countries from 2003 to 2013. We show that properly measured monetary aggregates contain significant information about liquidity risk.

Citation: Makram El-shagi and Logan J Kelly, (2014) "Liquidity in the liquidity crisis: evidence from Divisia monetary aggregates in Germany and the European crisis countries", *Economics Bulletin*, Vol. 34 No. 1 pp. 63-72.
Contact: Makram El-shagi - Makram.El-Shagi@iwh-halle.de, Logan J Kelly - logan.kelly@uwrf.edu.
Submitted: January 27, 2013. **Published:** January 20, 2014.

1 Introduction

The global financial crisis of 2007 and 2008 triggered a critical fiscal debt situation in a number of Euro area countries, namely Greece, Ireland, Italy, Portugal and Spain (G.I.I.P.S.). This debt crisis hampered liquidity provision by the European banking sector, since the sovereign debt of G.I.I.P.S. played an important role in the portfolios of most of the major banks in Europe. Thus, at least in countries whose banking sector was exposed to the debt of G.I.I.P.S., the sovereign debt crisis should coincide with a rapid reduction of available liquidity, and if so, an appropriate measure of liquidity could provide an early warning of impending financial crisis.

While there has been much discussion of the role of liquidity in the recent financial crises, there has been little discussion of the use of macroeconomic aggregation techniques to measure total liquidity available to the market. Since interest bearing assets usually provide substantially less liquidity than cash, the simple sum measures of aggregate liquidity widely used by central banks are, at best, an inferior approximation of liquidity (see, e.g., Barnett, 1980, Kelly et al., 2011, Barnett and Chauvet, 2011 and Barnett, 2012). Simple sum aggregates are especially problematic in times of financial crisis, when interest rates and the composition of money are highly heterogeneous.

In this paper, we provide an approximation of the liquidity development in six Euro area countries from 2003 to 2013 using Divisia aggregation, as proposed in the monetary aggregation literature. Our sample consists of Germany, which is one of the most stable countries in Europe, and the aforementioned crisis countries. We are able to show that simple sum money understates the growth of liquidity in Germany and overstates the growth of liquidity in most of the crisis countries. Moreover, we find that Divisia aggregates are excellent predictors of debt crisis. Thus, the story told by Divisia liquidity aggregates gives considerably more substance to the argument that rapid liquidity loss has played a significant role in the propagation of the European debt crisis.

2 Construction of Divisia Aggregates

2.1 Data

For our analysis, we break M3 down to the seven components defined by the ECB: currency in circulation, overnight deposits, deposits with an agreed maturity of up to two years, deposits redeemable at notice up to three months, repurchase agreements, money market funds, and bank debt securities of a maturity up to two years. We use monthly stock outstanding from January 2003 to March 2013. The quantity data used, with the exception of cash, is available through EuroStat. Currency in circulation can only be proxied on the country level, since currency flows freely within the Euro area. For our analysis, we use currency put into circulation by each country's central bank on behalf of the ECB as reported by the IMF (IMF currency hereafter).

The measure closest to currency in circulation within a country published by the ECB is currency issued (ECB currency hereafter). ECB currency is simply the total Euro System currency multiplied by the share in the ECB's capital belonging to that NCB, which does not necessarily mirror the actual currency in circulation within a nation because it cannot account for the free flow of currency within the Euro area. Nevertheless, data exists on cash withdrawals (both over the counter and through ATM's) and the cash recycled by the NCB, which admits a proxy of currency, i.e. IMF currency. This data is available through the IMF's international financial statistics database. Since cash is mostly disseminated to satisfy local demand, this indicator should reflect the dynamics of cash usage much more closely than ECB currency.[1]

All quantity data is seasonally adjusted stock outstanding. In the case of Spain, deposits redeemable on notice where abolished in mid 2005. Since the data prior to this date does not allow robust seasonal adjustment, we work with unadjusted data for this asset in Spain. For all asset quantity data, missing observations are replaced by a linear interpolation.

It is also necessary to measure the rate of return yielded by each asset class. To capture that given assets can change their degree of liquidity, we consider new business interest rates for the entire stock when computing opportunity costs of liquidity if they are available. Interest rate data is available for most countries and asset classes, but there are time-country-asset observations that were unavailable. As far as there are merely short gaps in the data we generally apply a linear interpolation for the missing observation. If the gaps are too large or a time series is missing entirely, we proxy the missing data using the interest rate of a similar asset in the same country. In very few cases, data for the first few months of 2013 was missing. Since the interest rate movements over the entire term structure were very small in Europe in these months, we assume fixed interest rates in those cases. All interest rates are ECB Retail MFI rates. Table I summarizes how interest rate data was collected and how, when necessary, it was proxied.

[1]IMF currency does not account for currency carried into or out of a nation by the public. If there are persistent net flows of currency in a single direction, this may cause currency to be mismeasured. While the distortions are small for most countries, in the case of Portugal, inflows of currency are large enough that the Banco de Portugal has destroyed more cash than it has disseminated. This has lead to negative values for currency to be reported for Portugal. Since our analysis heavily relies on exploiting the dynamics of liquidity, we do, nevertheless, use the IMF currency, treating negative values as zero. Our results are robust to choice of proxy for currency. While the information content of our Divisia liquidity measures deteriorate slightly when we replace IMF currency with ECB currency, they remain the same in order of magnitude.

Table I: Explanation of Rate of Return on Asset Classes

Asset	Interest Rate	Notes
IMF Curency	Currency is assumed to yield no interest	
Overnight deposits Deposits with maturity less than two years	Interest rate differs for private households and non financial firms. Where possible, we use the quantity share weighted average of the two interest rates.	Separate quantity data is not available for Italy and Portugal. In these cases, we use an unweighted average.
Deposits redeemable at notice	Because interest rates on deposits redeemable at notice are only available for the complete sample in Italy and Germany, we use the interest rate on overnight deposits as a proxy.	For all countries other than Italy and Germany, the relative importance of deposits redeemable at notice is very small and diminishes to near insignificance at the end of our sample.
Repurchase agreements	The repurchase agreements rate is available for all countries except Ireland and Portugal where repurchase agreements have a small quantity share.	In Ireland and Portugal we use the money market fund rate as a proxy.
Money market funds	Money market rates are only available for Europe as a whole rather than by country, thus we use the Euro interbank overnight rate (EURIBOR).	
Bank debt (maturity less than two years)	Interest rate data on bank debt securities by each country is not available, but data on bank debt in the Euro area is available by rating.	To proxy country level bank debt rates, we use bank debt rate associated with the credit rating of the country (Based on the sovereign rating history of Fitch IBCA).

2.2 Divisia aggregation

The first step in building a Divisia liquidity aggregate is to find the own rate of the so called benchmark asset, i.e. a totally illiquid investment asset. Human capital is a common example of such a pure investment asset in theoretical treatments. Unfortunately, the own rate of return on such a benchmark asset is not available in practice. Thus, we must choose a proxy for this benchmark rate (R). We examine two possible proxies.

The first benchmark rate (R_1) is calculated as the maximum of a portfolio of interest rates, which is referred to in the literature as the "upper envelope curve," plus a 100 basis point liquidity premium. The portfolio of interest rates for R_1 includes the interest yielded by the monetary assets included in the aggregate. This method, which is the current standard in the literature, is referred to by Anderson and Jones (2011) as their preferred benchmark rate and is similar to the method used by Stracca (2004). The second benchmark rate (R_2) is calculated by adding a variable liquidity premium to the same upper envelope curve of returns on monetary assets. We set the variable liquidity premium to be the spread between the ten-year and one-year government bond rates.[2] This method is an experimental approach that we are proposing in order to deal with the volatility present during the financial crisis. Figure 1 plots each benchmark rate.

The benchmark rate, along with each component asset's own rate, is used to calculate each asset's user cost as follows

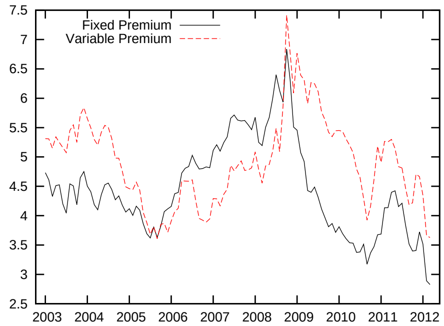
$$\psi_{n,t} = \frac{R_{i,t} - r_{n,t}}{1 + R_{i,t}}, \tag{1}$$

where $R_{i,t}$ is either the first or second benchmark rate in period t, and $r_{n,t}$ is the own rate of return on asset n in period t. Note that the addition of a positive liquidity premium to the benchmark rate precludes the possibility of a negative user cost (see Barnett, 1980, for more on the user cost formula).

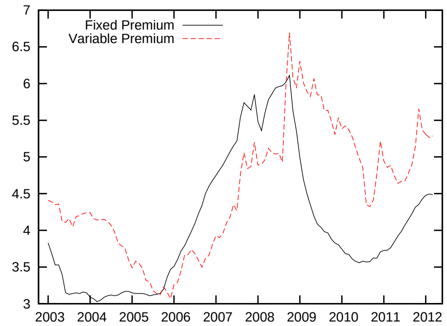
3 Cross Country Comparisons

For all countries that are considered in our sample, the story told by the simple sum and both Divisia specification is essentially identical until the end of 2007. Money is increasing steadily. Even in Portugal, the only country where money growth is somewhat volatile before the crisis, the dynamics captured by simple sum and Divisia are almost the same. However, from 2007 on (mid 2006 on in Ireland) Divisia and simple sum money start to diverge strongly. In the crisis countries, both Divisia aggregates indicate a much stronger decline in liquidity than simple sum does. Contrarily, in Germany, our only stable country, simple sum understates liquidity growth.

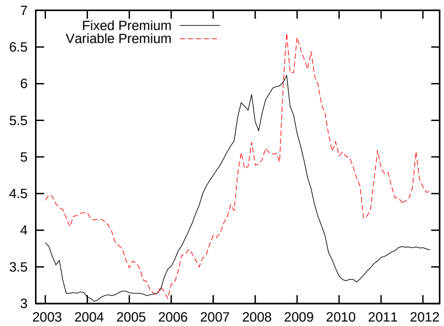
[2]Though this does not happen in our sample, we would set the liquidity premium to zero if the one-year bod rate ever exceeded the ten-year bond rate.



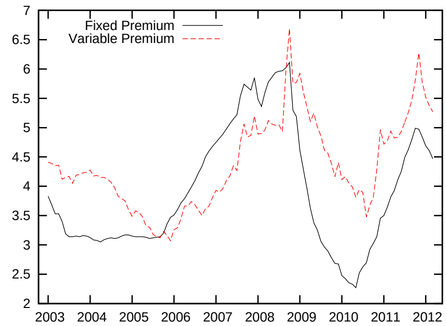
(a) Germany



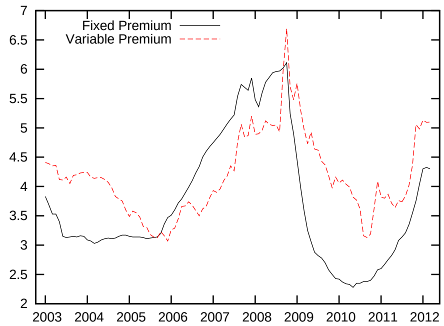
(b) Ireland



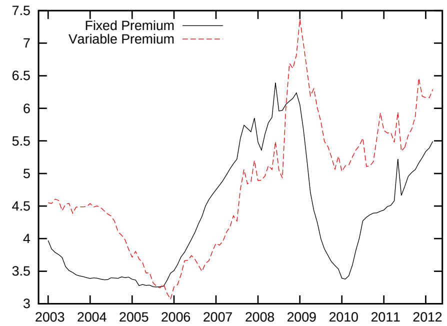
(c) Spain



(d) Portugal

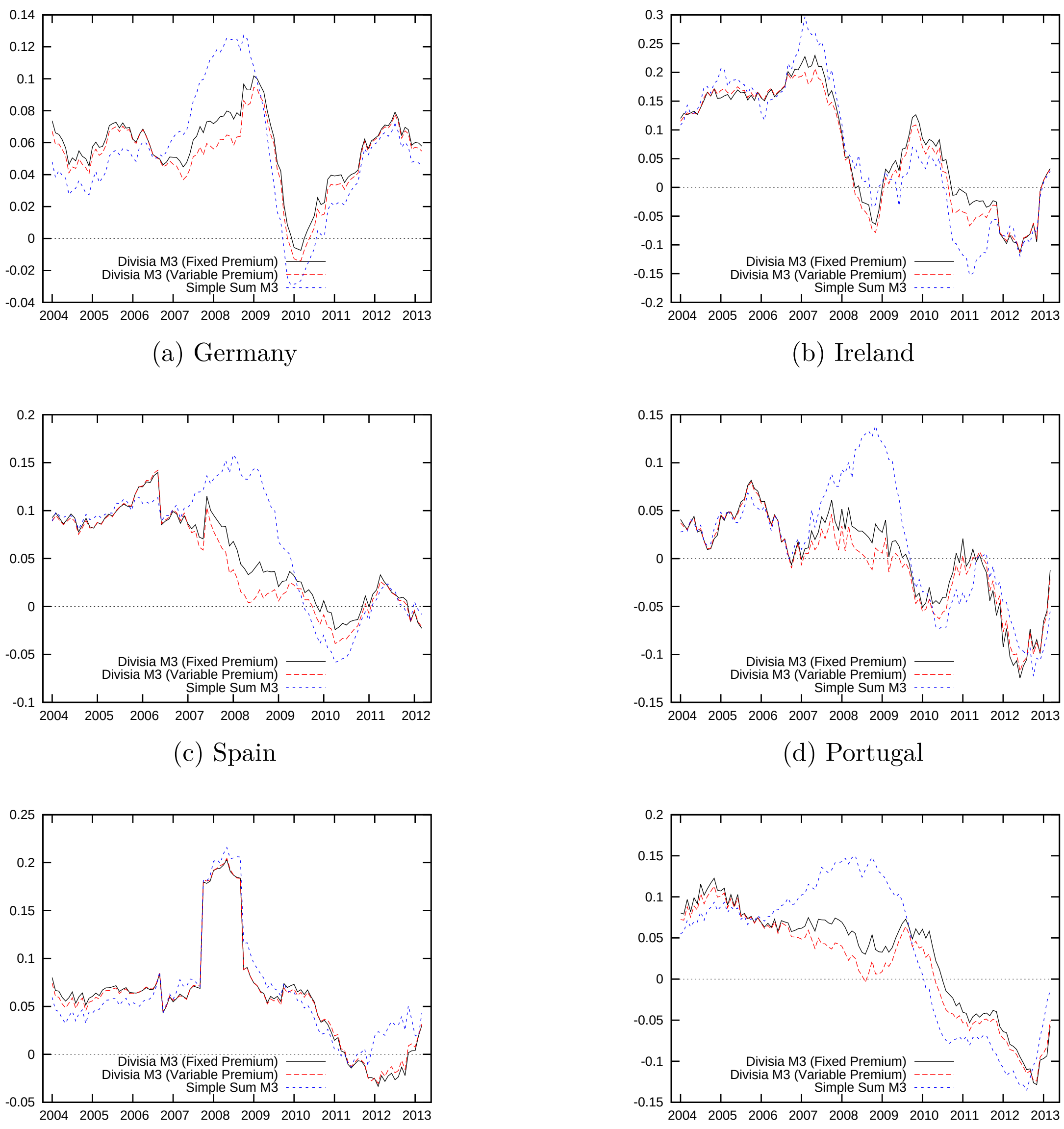


(e) Italy



(f) Greece

Figure 1: Benchmark rates for each country in the sample calculated using both a variable and fixed liquidity premium. (2003M01 -2013M03)



(a) Germany (b) Ireland (c) Spain (d) Portugal (e) Italy (f) Greece

Figure 2: Year over year liquidity growth rate as measured by the Divisia and simple sum liquidity aggregates for each country in our sample (2004M01-2013M03)

4 Financial Crisis Signaling

Qualitatively, the Divisia monetary aggregates, regardless of benchmark rate chosen, behave quite differently from the official simple sum measure of M3. However in order to determine if this difference represents valuable information, we embed our Divisia aggregates in a prediction framework proposed by Knedlik and von Schweinitz (2012) who study early warning signals in the context of the European sovereign debt crisis. Knedlik and von Schweinitz use a signals approach, which is a nonparametric threshold technique for binary choice models introduced byKaminsky and Reinhart (1999).[3] An indicator issues a signal whenever it exceeds a threshold that is calibrated to optimize an objective function accounting for the trade off between erroneously predicted events (Type-I error) and missing signals (Type-II error). Following Alessi and Detken (2011), we choose the objective function[4]

$$U = min(\theta, 1-\theta) - \theta\frac{C}{A+C} - (1-\theta)\frac{B}{B+D}, \qquad (2)$$

where A is the number of correct signals, B is the number of missing signals, C the number of wrong signals, D is the number of periods where a signal is neither issued nor required, and θ is a weighting parameter.

We take the dating of the crises in the periphery countries from the original paper by Knedlik and von Schweinitz (2012) and use their parameters in the signals approach, i.e. we employ a utility function with $\theta = 0.5$ and use a signal window of 24 months prior to the crisis, i.e. signals should be sent in each of the 24 months prior to the crisis. To allow comparability to our Divisia aggregates we shorten the sample for all available indicators to start in 2004. Note that 2004 is the earliest year of year growth rate admitted by the Euro data. Table II reports utility scores of Divisia (R_1), Divisia (R_2) and the simple sum monetary aggregates we calculate, as well as the scores of the best performing indicator variables examined by Knedlik and von Schweinitz. Utility scores, U, range from -0.5 to 0.5 where larger values indicate better performance.

5 Conclusion

Compared to a range of indicators used to predict the debt crises proposed by Knedlik and von Schweinitz (2012), all of our liquidity aggregates (in year-over-year growth rates) perform very well. In particular, our newly developed Divisia aggregate is only outperformed by government deficit and unemployment in predicting the debt crises. Moreover, Divisia aggregates detect turning point in the development of liquidity quicker than do simple sum aggregates, i.e. for the crises countries (with the exception of Italy), Divisia begins to decline several months before simple sum. As a result,

[3] For a detailed survey of Early-Warning Systems literature, see Abiad (2003).

[4] For a more detailed technical description of the methodology see e.g. El-Shagi et al. (2012).

Table II: Utility score from signaling model using various indicators

Indicator[a]	**Utility Score**[b]
Government Deficit*	0.36
Unemployment rate	0.30
Divisia (R_2)†	**0.27**
Labor Force Participation†	0.25
Household Debt*	0.25
Divisia (R_1)†	**0.24**
Simple Sum M3†	**0.23**
Non-MFI Debt*	0.22
Private Debt*	0.21
Government Debt*	0.16

* and † indicates that the signal variable was a ratio to GDP and year over year growth rate, respectfully.

[a] Results of the best indicators found by Knedlik and von Schweinitz (2012) are given for comparison.

[b] Utility scores range from -0.5 to 0.5 where larger values indicate better performance.

even after the Divisia aggregates began declining, the simple sum aggregate continued to indicate that the ECB's policy was effectively expanding liquidity. While we do not believe this constitutes an argument that simply injecting more liquidity into the market could have prevented the European sovereign debt crisis, it does suggest that a Divisia aggregate could have revealed sooner that ECB's policy was not averting the crisis.

References

Abiad, A. (2003) "Early warning systems: A survey and a regime-switching approach" *IMF Working Papers*.

Alessi, L. and C. Detken (2011) "Quasi real time early warning indicators for costly asset price boom/bust cycles: A role for global liquidity" *European Journal of Political Economy 27*(3), 520–533.

Anderson, R. and B. Jones (2011) "A comprehensive revision of the US monetary services (Divisia) indexes" *Federal Reserve Bank of St. Louis Review 93*(5), 325–59.

Barnett, W. A. (1980) "Economic monetary aggregates: An application of index number and aggregation theory" *Journal of Econometrics 14*(1), 11–48.

Barnett, W. A. and M. Chauvet (2011) "How better monetary statistics could have signaled the financial crisis" *Journal of Econometrics 161*(1), 6 – 23.

Barnett, W. A. (2012) *Getting it wrong: How faulty monetary statistics undermine the FED, the financial system, and the economy* The MIT Press.

El-Shagi, M., T. Knedlik, and G. von Schweinitz (2012) "Predicting financial crises: The (statistical) significance of the signals approach" Technical report, IWH-Diskussionspapiere.

Kaminsky, G. and C. Reinhart (1999) "The twin crises: The causes of banking and balance-of-payments problems" *American Economic Review*, 473–500.

Kelly, L. J., W. A. Barnett, and J. W. Keating (2011) "Rethinking the liquidity puzzle: Application of a new measure of the economic money stock" *Journal of Banking and Finance 35*(4), 768–774.

Knedlik, T. and G. von Schweinitz (2012) "Macroeconomic imbalances as indicators for debt crises in Europe" *Journal of Common Market Studies 50*(5), 726–745.

Stracca, L. (2004) "Does liquidity matter? Properties of a Divisia monetary aggregate in the Euro area" *Oxford Bulletin of Economics and Statistics 66*(3), 309–331.