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Does liquidity matter for money demand in euro area countries?

Alexander C. Jung
European Central Bank

Abstract

This paper estimates demand functions for the four main components of M3 for the euro area. Its aim is to examine whether the ECB's massive liquidity provision to euro area banks during the financial crisis is an important driver of money demand explaining regional differences across euro area countries. The approach of the paper is to apply panel analysis to the national contributions of the components of M3. Overall, the paper finds that central bank liquidity had a small, positive effect on the (long-run) demand for the components of M3 in the twelve euro area countries included. The liquidity effect is subject to considerable cross-country dispersion.

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Contact: Alexander C. Jung - alexander.jung@ecb.europa.eu.
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1. Introduction

In response to the financial crisis, main central banks in the world massively increased their liquidity supply to the banking sector. Overall, central banks' massive injections of liquidity stabilised the banking sector (see Heider, Hoereva and Holthausen 2009). The European Central Bank (ECB) increased the amount of liquidity it provides to banks with the aim to restore the normal functioning of the transmission mechanism. In this context, it introduced a wide range of non-standard measures by which it supplied euro area banks with ample liquidity, thereby strongly expanding its monetary base. On several occasions, the ECB reconfirmed its commitment to offer euro area banks the necessary liquidity "*as long as it is needed*" (for example see Draghi 2013).

The aim of this paper is to examine whether the ECB's massive liquidity provision to euro area banks during the financial crisis has been an important driver of money demand explaining regional differences across euro area countries. A previous study examining money demand relationships for headline M3 prior to the financial crisis (see Dreger and Wolters 2010) finds that liquidity is not an important factor when explaining the demand for M3 in the euro area. To the author's knowledge, so far no study has examined this subject using the components of M3 and covering the financial crisis period.

The paper is organised as follows. Section 2 explains the data used for this study. Section 3 presents the panel approach and the results from the empirical analysis. Section 4 concludes.

2. Data

This paper uses monthly data to estimate the demand functions for the main components of M3 for the euro area, for its national contributions and the corresponding interest rate spreads. It uses quarterly data for nominal GDP for the euro area and its member countries and converts these data into the monthly frequency. The empirical analysis covers twelve euro area countries for the sample 1999 to mid-2013.

Measures of end-of-month outstanding amounts denominated in euro (source: ECB) are used for the four main components of M3 for the euro area (changing composition) and their respective national contributions (source: Eurosystem): currency in circulation (CC); overnight deposits (OD); short-term deposits (SD); marketable instruments (MI). The data is working day and seasonally adjusted (see Chart 1). In addition, the analysis includes the euro area monetary base (MB) denominated in euro (changing composition) as proxy for liquidity (source: ECB). Nominal GDP denominated in euro for the euro area (changing composition) and for national countries are taken from Eurostat (which are compliant with ESA95 National Accounts). The quarterly GDP series are converted into monthly frequency using a cubic spline technique. Where necessary, the data has been seasonally adjusted using the Census X-12 procedure.

Several interest rate spreads for the euro area are computed to measure opportunity costs for the main components of M3 (see Chart 2). They are calculated as the difference between the rate of a "typical" alternative asset and the own rate of interest of the respective instrument.[1] The rate of return on overnight deposits (ROD) for the euro area (changing composition) is the series for new business applying to non-financial corporations (source: ECB MFI interest rate statistics). For the other short-term deposits the own rate (RSD) is computed as a composite rate which is a weighted average of the interest rate on deposits with agreed maturity of up to two years and deposits redeemable at notice of three months. The rates of return on these instruments for the euro area (changing composition) are the series for new business applying

[1] Opportunity costs for CC: return on short-term deposits (RSD); for OD: spread between RSD and ROD; for SD: spread between MT and RSD; for MI: spread between LT and ST. Note in this study we do not use national interest rates for the components of M3, since there appear to be some data gaps in the national series which would constrain the present sample. The country specific response is captured by the slope parameters. Moreover, the issue of fragmentation is addressed when estimating pooled regressions in Section 3.

to non-financial corporations (source: ECB). Both interest rates are computed applying the (relative) weights of each instrument in other short term deposits (M2-M1). For short-term (ST) market interest rates Euribor three month rates (source: Reuters) are used for the euro area (changing composition). It is assumed that this rate is a valid proxy for the own rate of return on MI. Moreover, for medium-term market interest rates (MT) the benchmark bond is used, i.e. yields on French government bonds with a maturity of 5 years (source: ECB). As proxy for the long-term market interest rate (LT) the benchmark bond is used, i.e. yields on German government bonds with a maturity of 10 years (source: Datasteam).

3. Panel analysis of the components of M3

In order to examine the impact of liquidity on euro area money demand, this section applies panel analysis to the national contributions of the main components of M3. This paper provides estimates for twelve euro area countries, i.e. the founding countries (including Greece).

3.1 Approach

The empirical approach is to estimate panel regressions so as to check whether liquidity is a long-run driver of money demand across countries and instruments. The demand functions for the components of M3 (CC, OD, SD, and MI) are estimated in nominal terms (sample 1999 to mid-2013) and are explained by fundamental factors such as national GDP and euro area interest rate spreads and euro area liquidity. While real money demand specifications impose price homogeneity, the nominal specification used in this paper is less restrictive, since it allows for the possibility that private agents could be subject to money illusion in the demand for certain components of M3 (see Calza et al. 2000).

In order to examine the long-run drivers of the demand for the components of M3 in the twelve euro area countries, the paper applies panel cointegration tests which allow examining the stability of the (long-run) relationship for each component in these countries. Then, it estimates pooled regressions both with fixed and random effects. A standard Hausman test is applied to check which of these two models better describes the data. In assessing cross-sectional dependence, the paper applies a battery of standard tests (see De Hoyos and Sarafidis 2006).

Money demand in the euro area has been subject to two significant structural breaks. One occurred at the start of the monetary union owing to the cash changeover: banknotes and coins were physically introduced at the end of a three year transitional phase in January 2002. A second one occurred, during the financial crisis, when the ECB lowered interest rates to levels close to zero and introduced non-standard monetary policy measures. In line with the results of separate breakpoint tests, the regressions therefore include dummies for the cash changeover during 1999 to end-2001 (D_{cash}), and for the impact of the financial crisis as of 2010.4 (D_{crisis}).

Pooled regressions with fixed effects capture the possibility that a structural factor that is not time-varying, but country specific (such as fragmentation) explains differences in the demand for the components. In the fixed effects regression slope parameters are identical for all national contributions:

$$m^i_{j,t} = \alpha_j + \beta\, y_{j,t} + \gamma\,(R^i_t - r^i_t) + \delta\, mb_t + \varepsilon_j D_{cash} + \varphi_j\, D_{crisis} + \vartheta_t \qquad (1)$$

with j denoting individual countries, $m^i_{j,t}$ is the log of component i at time t, $y_{j,t}$ is the log of nominal GDP at time t, R^i is the interest rate on the "typical" alternative investment, r^i is the own rate of return of component i, and mb_t is the log of the euro area monetary base at time t.

Like (1) the random effects model has identical slope parameters for all national contributions, but unlike it, the constant factor is assumed to be identical across countries with only random deviations (this model thus implies the absence of a factor such as fragmentation):

$$m^i_{j,t} = (\alpha + \tau_j) + \beta\, y_{j,t} + \gamma\,(R^i_t - r^i_t) + \delta\, mb_t + \varepsilon_j D_{cash} + \varphi_j D_{crisis} + \eta_t \qquad (2)$$

where α comprises the mean and τ is a random deviation by country, and the other notations as above.

In order to check for the presence of regional variation in the (long-run) coefficients, we specify a random coefficient model (3). This model allows distinguishing money demand functions individually. Different responses across countries to shocks in explanatory variables show up in different slope parameters:

$$m^i_{j,t} = (\alpha + \tau_j) + \beta_j\, y_{j,t} + \gamma_j\,(R^i_t - r^i_t) + \delta_j\, mb_t + \varepsilon_j D_{cash} + \varphi_j D_{crisis} + \omega_t \qquad (3)$$

with the notations as above.

3.2 Results

Table 1 shows results for panel cointegration tests of the demand functions and their fundamental drivers. These tests confirm the existence of a long-run relationship between each main component of M3, the (national) activity variable, the corresponding opportunity cost variable and liquidity (at the 1% significance level), thereby indicating the overall stability of the (long-run) relationship. The results for the long-run demand functions of the four main components of M3 (equation 1 and 2) also show that overall central bank liquidity had a small, positive effect on the (long-run) demand for the components of M3 in the twelve euro area countries included (see Table 2, column 4). In this context, both the fixed effects model and the random effects model suggest that the liquidity effect for marketable instruments was not significantly different from zero. According to the Hausman test the fixed-effects model is preferable to the random-effects model for all components of M3.

Standard tests generally fail to reject the null of cross-sectional independence at the 1% significance level.[2] Other standard diagnostic tests for panel regressions are applied using a test for autocorrelation suggested by Woolridge (2002), and a likelihood ratio test on the GLS specification on the regression to check for heteroscedasticity. These tests reject the presence of heteroscedasticity for all specifications. Likewise, they reject the presence of autocorrelation for the components CC and SD, but for OC, MI they fail to reject it at the 1% level. As a check for the robustness of the results, the paper applies the FGLS estimator, which corrects for first-order autocorrelation. The results obtained using this method (see Table 2) are more clearly in favour of a small, positive liquidity effect for all components of M3.

The results of equation (3) show that the liquidity effect is subject to considerable cross-country dispersion (see Table 3, column 4 and 8 respectively). In order to better assess whether the regional dispersion of the parameters is systematic, the fixed-effects model is re-estimated applying different country groupings according to criteria such as "inflation performance" (relative to the euro area average), "financial stability" (distinguishing between stressed and non-stressed countries), and "country size" (distinguishing between large and small countries). These additional tests (see Table 2) show that, with regard to country size, the liquidity effect was broadly similar for the liquid components of M3, whereas for the less liquid components there were significant differences. Moreover, for currency in circulation and other short-term

[2] For overnight deposits the results are somewhat mixed, since Pesaran's CD test rejects the null, whereas Friedman's test and Free's test fail to reject the null of cross-sectional independence.

deposits, the liquidity effect was stronger for the stressed euro area countries than for the non-stressed ones, but for overnight deposits and marketable instruments the results suggest a stronger impact of liquidity on the non-stressed countries. In addition, for cash and short-term deposits, the liquidity effect on money demand was stronger for countries with inflation above the euro area average than for those below the average, whereas for overnight deposits the reverse was observed.

4. Conclusions

This paper applies panel analysis to measure the impact of liquidity on the demand for the main components of M3 in the euro area. The results of this paper enhance the understanding of the transmission of monetary policy measures aiming at steering the liquidity in the euro area. This question is relevant, since the ECB has adopted several non-standard measures, which allot large amounts of liquidity to the euro area banking system (such as the very long-term refinancing operations and the more recent targeted longer-term refinancing operations). Panel cointegration tests confirm the existence of a stable, long-run relationship between liquidity, joint with traditional factors (such as activity and opportunity costs), and the demand for the main components of M3 for the twelve countries considered. Overall, the paper finds that liquidity had a small, positive effect on the (long-run) demand for the components of M3 in the twelve euro area countries included. Hence, the paper suggests that a large-scale allocation of central bank liquidity to euro area banks can be expected to increase money demand in the euro area. Although national contributions of headline M3 have been found to broadly co-move with the corresponding aggregate for the euro area (see Mehrotra 2007), this paper finds that the liquidity effect on the demand for money across euro area countries displays considerable cross-country dispersion. When analysing these differences along the dimensions "country size", "financial stability" and "inflation performance", it appears that the liquidity impulse is transmitted in a somewhat uneven manner to the components of M3.

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Table 1: Panel cointegration tests by component of M3

System	Rank r	Eigenvalue statistics	Probability	Result
Currency in circulation				
m^i, y, mb	= 0	68.00	0.00	One cointegration
	≤ 1	25.66	0.37	vector
m^i,y,r^i	= 0	77.70	0.00	One cointegration
	≤ 1	30.88	0.16	vector
m^i, y, r^i, mb	= 0	66.57	0.00	One cointegration
	≤ 1	19.83	0.71	vector
Overnight deposits				
m^i, y, mb	= 0	96.12	0.00	One cointegration
	≤ 1	23.11	0.51	vector
m^i,y,R^i-r^i (1)	= 0	155.70	0.00	One cointegration
	≤ 1	38.93	0.03	vector
m^i, y, R^i-r^i, mb	= 0	118.00	0.00	One cointegration
	≤ 1	31.47	0.14	vector
Short-term deposits				
m^i, y, mb	= 0	107.20	0.00	One cointegration
	≤ 1	17.43	0.83	vector
m^i,y,R^i-r^i	= 0	97.81	0.00	One cointegration
	≤ 1	31.41	0.14	vector
m^i, y, R^i-r^i, mb (1)	= 0	405.30	0.00	One cointegration
	≤ 1	29.92	0.19	vector
Marketable instruments				
m^i, y, mb	= 0	57.94	0.00	One cointegration
	≤ 1	18.92	0.76	vector
m^i,y,R^i-r^i	= 0	67.85	0.00	One cointegration
	≤ 1	25.20	0.40	vector
m^i, y, R^i-r^i, mb	= 0	67.59	0.00	One cointegration
	≤ 1	10.25	0.99	vector

Notes: Johansen Fisher panel cointegration test for rank r with one lag; sample 1999.1 to 2013.11 (trace statistics provide broadly similar indications). (1) contains a linear deterministic trend.

Table 2: Pooled demand functions for four main components of M3 (Equations 1 and 2)

	Coefficients Equation	α	β	$\gamma^{(1)}$	δ	ε	φ	Prob	Adj R^2	Pooled obs.
Currency in circulation										
	Fixed Effects	-9.93** (0.52)	0.77** (0.06)	-2.98** (0.75)	0.82** (0.02)	0.04* (0.02)	-0.07** (0.02)		0.95	1968
	Random Effects	-11.57** (0.37)	0.98** (0.04)	-3.78** (0.73)	0.76** (0.02)	0.07** (0.02)	-0.07** (0.02)	<0.01	0.97	1968
	FGLS	-12.52** (0.32)	1.11** (0.00)	-4.25** (0.99)	0.73** (0.02)	0.09** (0.02)	-0.07** (0.02)			1968
	Small countries	-11.07** (0.56)	0.80** (0.07)	-4.00** (0.93)	0.87** (0.03)	0.00 (0.02)	-0.09** (0.02)		0.91	1312
	Large countries	-4.27** (1.12)	0.38** (0.11)	0.14 (1.08)	0.80** (0.04)	0.09** (0.03)	-0.05* (0.02)		0.77	656
	Inflation > average	-10.83** (0.55)	0.78** (0.06)	-4.66** (0.95)	0.88** (0.03)	0.16** (0.02)	-0.05** (0.02)		0.95	1148
	Inflation ≤ average	-24.49** (1.60)	2.62** (0.18)	-6.93** (1.17)	0.29** (0.05)	0.06* (0.03)	-0.17** (0.02)		0.94	820
	Stressed countries	-5.50** (0.65)	0.22** (0.07)	-2.36** (0.94)	0.96** (0.03)	0.09** (0.02)	-0.04* (0.02)		0.56	820
	Non-stressed countries	-20.07** (0.79)	2.10** (0.09)	-6.92** (0.97)	0.45** (0.03)	0.08** (0.02)	-0.18** (0.02)		0.97	1148
Overnight deposits										
	Fixed Effects	-9.40** (0.42)	1.82** (0.05)	-17.09** (1.57)	0.05* (0.02)	0.05** (0.01)	0.04** (0.01)		0.75	1968
	Random Effects	-8.22** (0.42)	1.67** (0.04)	-16.03** (1.56)	0.09** (0.02)	0.02 (0.01)	0.03* (0.01)	<0.01	0.76	1968
	FGLS	-0.94 (0.65)	0.72** (0.01)	-9.51 (5.00)	0.35** (0.05)	-0.11** (0.04)	-0.01 (0.04)		-	1968
	Small countries	-7.50** (0.48)	1.75** (0.06)	-18.78** (2.11)	0.01 (0.03)	0.05** (0.02)	0.04* (0.02)		0.23	1312
	Large countries	-16.27** (0.72)	2.25** (0.07)	-15.15** (1.86)	0.05 (0.02)	0.06** (0.02)	0.03** (0.01)		0.64	656
	Inflation > average	-9.81** (0.56)	1.93** (0.06)	-16.52** (2.47)	0.02 (0.03)	0.06** (0.02)	0.04 (0.02)		0.65	1148
	Inflation ≤ average	-1.54* (0.70)	0.82** (0.08)	-12.01** (1.38)	0.29** (0.02)	-0.05** (0.01)	0.06* (0.01)		0.99	820
	Stressed countries	-18.15** (0.74)	2.79** (0.08)	-23.69** (2.79)	-0.12** (0.03)	0.15** (0.03)	0.08 (0.02)		0.99	820
	Non-stressed countries	0.57 (0.34)	0.59** (0.04)	-7.41** (1.11)	0.34** (0.02)	-0.05** (0.01)	0.09* (0.01)		0.75	1148

Short-term deposits										
	Fixed Effects	7.76** (0.56)	-0.44** (0.06)	0.81 (0.94)	0.69** (0.03)	-0.12** (0.02)	-0.17** (0.02)		0.42	1968
	Random Effects	6.36** (0.55)	-0.27** (0.06)	0.87 (0.95)	0.65** (0.02)	-0.10** (0.02)	-0.16** (0.02)	<0.01	0.29	1968
	FGLS	-0.90 (0.80)	0.64** (0.01)	1.12 (2.75)	0.42** (0.06)	0.00 (0.02)	-0.12** (0.05)		-	1968
	Small countries	8.10** (0.64)	0.70** (0.07)	1.83 (1.23)	0.81** (0.03)	-0.16** (0.02)	-0.26** (0.02)		0.10	1312
	Large countries	1.90 (1.02)	0.47** (0.10)	-1.16 (1.18)	0.38** (0.03)	-0.02 (0.02)	0.01 (0.02)		0.55	656
	Inflation > average	9.64** (0.72)	-0.84** (0.08)	2.70 (1.42)	0.86** (0.04)	-0.20** (0.03)	-0.26** (0.02)		0.413	1148
	Inflation ≤ average	-9.29** (0.89)	1.67** (0.10)	-0.11 (0.77)	0.13** (0.03)	0.05** (0.01)	-0.10** (0.01)		0.85	820
	Stressed countries	2.65** (0.98)	-0.14 (0.10)	3.63* (1.67)	0.79** (0.04)	-0.06* (0.03)	-0.16** (0.03)		0.59	820
	Non-stressed countries	9.88** (0.70)	-0.48** (0.08)	-1.25 (1.00)	0.58** (0.03)	-0.13** (0.02)	-0.15** (0.02)		0.51	1148
Marketable instruments										
	Fixed Effects	-23.168** (2.02)	3.03** (0.22)	7.76** (1.72)	-0.09 (0.08)	0.11* (0.06)	-0.50** (0.06)		030	1968
	Random Effects	-17.89** (1.83)	2.40** (0.19)	5.94** (1.70)	0.05 (0.08)	0.02 (0.06)	-0.52** (0.06)	<0.01	0.30	1968
	FGLS	-4.17** (1.87)	0.77** (0.03)	2.24 (3.45)	0.42** (0.14)	-0.17 (0.10)	-0.60** (0.12)		-	1968
	Small countries	-30.83** (2.54)	3.88** (0.29)	12.86** (2.48)	-0.11 (0.11)	0.31** (0.08)	-0.43** (0.08)		0.05	1312
	Large countries	-9.37** (1.66)	-0.01 (0.16)	-4.28** (1.04)	0.22** (0.05)	-0.39** (0.03)	-0.65** (0.03)		0.16	656
	Inflation > average	-20.17** (2.59)	3.13** (0.28)	8.09** (2.59)	-0.34** (0.12)	0.19* (0.09)	-0.39** (0.09)		0.15	1148
	Inflation ≤ average	-50.22** (4.49)	5.46** (0.49)	13.01 (2.05)	-0.31* (0.12)	0.23** (0.07)	-0.70** (0.06)		0.64	820
	Stressed countries	-28.81** (3.84)	3.94** (0.39)	8.16* (3.36)	-0.47** (0.15)	0.44** (0.12)	-0.49** (0.12)		0.69	820
	Non-stressed countries	-10.50** (2.23)	1.28** (0.26)	4.67** (1.67)	0.47** (0.09)	-0.20** (0.05)	-0.43** (0.05)		0.19	1148

Notes: Sample 2000.1 to 2013.8. A dummy for the euro cash changeover has been included for the period 1999.1 to 2001.12 and for the impact of the financial crisis for the period 2010.4 to the sample end 2013.8. * indicates significance at 5%; ** at 1%; standard errors in parenthesis. Prob.: Hausman specification test selects the random effects model, if the probability exceeds *5%*.

Country size: "small countries" are: Austria, Belgium, Finland, Greece, Ireland, Luxembourg, Netherlands, Portugal; "large countries" are: Germany, France, Italy, Spain. Among those 12 countries stressed countries are: Greece, Ireland, Italy, Spain, Portugal.

(1) Opportunity costs for CC: return on short-term deposits (RSD); for OD: spread between RSD and ROD; for SD: spread between MT and RSD; for MI: spread between LT and ST.

Table 3: Country characteristics of money demand functions by component of M3 (equation 3)

Country	α	β	$\gamma^{(1)}$	δ	α	β	γ	δ
	Currency in circulation				**Overnight deposits**			
Austria	-16.26	1.75	-3.92#	0.48	-9.53	1.73	-22.34	0.15
Belgium	-16.73	1.76	-3.16	0.50	-8.34	1.60	-9.73	0.13
Germany	-6.60	0.63	2.03#	0.75	-15.38	2.05	-27.79	0.15
Finland	-19.33	2.25	-10.91	0.36	0.32#	0.78	-17.48	0.18
France	-14.23	1.43	-2.28	0.54	-5.22	1.36	-2.86	0.04
Greece	-12.14	0.95	-4.67	0.84	-7.96	2.00	-14.32	-0.15
Ireland	-12.02	0.65	-9.60	1.04	-20.61	2.78	-55.77	0.21
Italy	-19.49	1.85	-4.34	0.54	-8.73	1.63	-16.09	0.10
Luxembourg	-18.39	1.52	-12.69	0.88	1.01	0.70	0.87	0.29
Spain	-5.68	0.50	-3.19	0.77	-21.34	2.66	-7.58	0.10#
Netherlands	-6.34	0.40	-0.40	0.88	-3.15	1.08	-4.89	0.19
Portugal	-10.65	0.84	-2.27	0.83	2.29	0.85	-4.97	-0.03
	Short-term deposits				**Marketable instruments**			
Austria	-6.70	1.41	0.17#	0.20	-95.67	10.85	11.60	-0.93
Belgium	-5.34	1.61	-0.03#	-0.03	-11.12#	0.81#	18.07	0.83
Germany	1.63	0.79	-2.86	0.11	-8.72#	1.58	1.64#	-0.04#
Finland	-6.86	0.95	0.20#	0.53	-24.74	3.02	3.60#	0.18#
France	-7.03	1.23	-0.78#	0.32	-15.39	2.18	-1.63	0.01#
Greece	-35.30	2.74	7.24	1.23	72.08	-3.22	-15.19	-2.06
Ireland	-0.59#	0.61	3.38#	0.41	-56.44	3.99	-5.08#	1.75
Italy	0.90#	0.31	-0.47	0.57	-28.35	3.54	4.52	-0.36
Luxembourg	8.30	0.95	-1.65#	-0.39	1.21#	1.01	-11.29	0.08#
Spain	7.15	-0.19#	0.72#	0.59	14.56	-0.39	-8.85	0.17
Netherlands	-11.45	1.93	2.92	0.11	-12.50	1.50	25.99	0.32
Portugal	2.62	0.48	1.38#	0.27	-56.77	3.57	33.32	1.92

Notes: Sample 2000.1 to 2013.8; 1968 pooled observations. A dummy for the euro cash changeover has been included for the period 1999.1 to 2001.12 and for the impact of the financial crisis for the period 2010.4 to the sample end 2013.8.

 # indicates that reported parameter estimates were not significant at the 10% level. (1) Opportunity costs for CC: return on short-term deposits (RSD); for OD: spread between RSD and ROD; for SD: spread between MT and RSD; for MI: spread between LT and ST.

Chart 1: Development of the monetary base and main components of M3 (EUR billions)

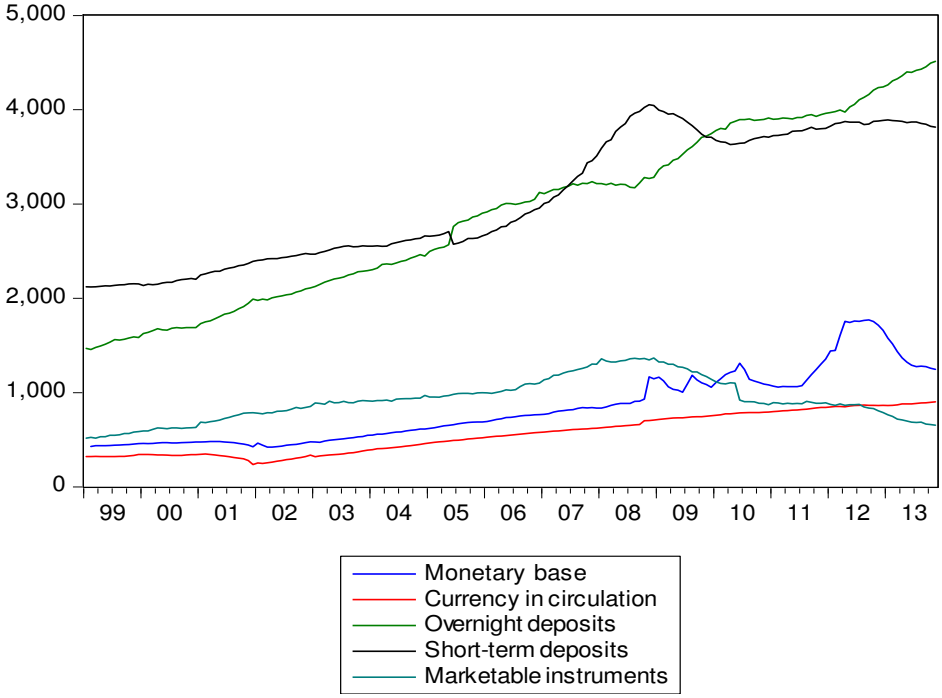

Chart 2: Development of the interest rate spreads (in percent)