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Money demand models for Russia: A sectoral approach

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Abstract

We estimate money demand models for certain monetary aggregates across different institutional sectors (a novelty for the Russian case). Our results comprise a collection of money demand equations that include different combinations of explanatory variables. Comparing the validity of these models on the basis of statistical criteria is virtually implausible. Therefore we suggest the simultaneous employment of a whole set of such models and illustrate the approach by presenting the distribution of monetary overhangs calculated on the basis of the estimated models.

Keywords: monetary aggregates, money demand, households, non-financial corporations
JEL classification: E41, C22, D14, D22.

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1 Introduction

The analysis of the monetary developments is of obvious interest for central banks. As discussed in Papademos and Stark (2010), monetary aggregates are apparently useful in assessing inflation risks (particular for the long run) as well in identifying financial imbalances. For Russia the necessity of relying on monetary indicators seems especially evident since the money stock may arguably be regarded as the most comprehensive monetary-stance indicator for the Russian economy. This is to a large degree due to the fact that monetary and fiscal policy measures (such as the Bank of Russia's forex purchases or sovereign funds management) may have direct effects on the money supply without being reflected in the levels of policy interest rates[1] (see Ponomarenko et al. (2012) for a review).

An important aspect of empirical properties of monetary aggregates is the existence of a stable money demand function, which is often regarded as the most basic structural backdrop of monetary analysis. The money demand function is a fundamental relationship that captures the interactions between money and other important economic variables such as income and wealth. Thus a robust relationship between monetary aggregates and other macroeconomic variables can help to explain and interpret monetary developments. From a normative perspective, money demand models are a starting point for developing benchmarks for the level or growth of money.

Admittedly, estimating a robust money demand function is a most nontrivial task. An environment of rapid financial deepening, currency substitution and dramatic macroeconomic fluctuations renders it necessary to enhance the model's specification and look for additional explanatory variables. Working with relatively short time series means that it may be impossible to select the most appropriate model based on empirical properties at the time when the models are being estimated (realisation of their instability may come only at a later stage). In fact, like most econometric models, short time series may lead to a function's parameterisation being extremely sensitive to taking into account new observations, even where the relationship does not eventually break up. Thus, the revision of money demand models is a common occurrence. This means that for practical reasons it may be undesirable to rely on a single model that may over time prove to be unstable. In-

[1] In fact considering the relative insignificance of interbank money markets (particularly domestic) in Russia and the high volatility of short-term interest rates, it is doubtful that any money market interest rate or any of Bank of Russia's interest rates *per se* could be legitimately regarded as a policy rate over the last decade.

stead, in this paper we will present a collection of money demand models that may be used simultaneously to increase the robustness of the results.

Another novelty of our approach is estimating money demand separately for different institutional sectors. Empirical money demand analysis based on aggregate data may obscure possible behavioral differences between the financial, non-financial corporate, and household sectors. The individual sectors may be subject to different constraints on their money holding behavior or may have different alternative non-monetary investment opportunities and thus different opportunity costs of investing in money. Looking at individual sectors may therefore enable richer explanations of the forces driving monetary developments.

The paper is structured as follows. Section 2 discusses the general set-up of the model. Section 3 presents the dataset and Section 4 reports the empirical results. Section 5 concludes.

2 Money demand model specification

The main motives for holding money are its use as a medium of exchange and as a store of value. As noted in Papademos and Stark (2010) the selection of variables representing these needs is not necessarily straightforward. For example in the Russian case, while Oomes and Ohnsorge (2005), Korhonen and Mehrotra (2010) and Sosunov (2013) estimate canonical money demand functions composed of scale and opportunity cost variables, Mehrotra and Ponomarenko (2010) and Ponomarenko et al. (2012) augment the model with wealth and uncertainty variables. Our general specification of the long-run real money demand in log linear form is

$$(m\text{-}p) = \beta_0 + \beta_1 y + \beta_2 (w\text{-}p) + \beta_3 OC + \beta_4\, unc, \quad (1)$$

where m is the monetary aggregate deflated by the price level; OC is the vector of opportunity costs; y, p, w and unc are the scale, price level, wealth and uncertainty variables respectively. In our generalized approach we attempt to estimate a model that contains one variable from each of these categories. Failing that, we proceed by excluding the variables from supplementary categories (wealth and uncertainty) and searching for more parsimonious specifications.

We estimate money demand for a set of monetary aggregates that differ along two dimensions. First is the range of broader and narrower definitions of money (M1, M2, M2X, M2Y; see Section 3 for details). This is a common issue faced by researchers when modeling money demand in Russia since this choice may strongly affect the behavior of the monetary variables (in terms of e.g. sensitivity to (de)dollarization processes and the relative importance of transactions/saving motives behind its dynamics). For example Oomes and Ohnsorge (2005) and Ponomarenko et al. (2012) report money demand estimates for several monetary aggregates while Sosunov (2013) constructs a new ad-hoc measure for this purpose.

Secondly, we estimate sectoral versions of the model, which is a novelty for money demand analysis in Russia, albeit far from unprecedented elsewhere (see e.g. von Landesberger (2007), Seitz and von Landesberger (2010), Martinez-Carrascal and von Landesberger (2010) for examples involving the euro area; Thomas (1997a,b), Brigden and Misen (1999), Chrystal and Misen (2001a,b), Bridges and Thomas (2012) for the UK; Calza and Zaghini (2010) for the US). As noted in the literature, the relative importance of money holding motives may vary across sectors, leading to different developments in the sectoral components of money over the course of the business cycle. In general, differences in money demand behavior across sectors could be the result of two factors. First, the constraints surrounding the money-holding decision process can vary widely across sectors, which could lead to different elasticities of money demand with respect to the same determinants. Similarly, the need to execute transactions will vary between economic sectors, leading to differing income elasticities of money demand. Second, the sectors may have different sets of alternative, non-monetary investment opportunities and thus different opportunity costs of holding money, in particular when tax, regulatory framework and corporate governance considerations are accounted for. Furthermore, although all the sectors hold money for transactions purposes, the level of transactions depends on different economic scale variables (e.g. for households, consumption spending; for corporations, working capital and/or production). Looking at individual sectors may therefore allow for richer explanations of the forces driving monetary developments, leading to a better understanding of monetary developments across the business cycle.

3 Data

Monetary aggregates. Definitions of monetary aggregates range from narrow (more liquid) aggregates to broader aggregates which include less liquid components that serve more for store-of-value than for transactional purposes. M2 (national definition), which comprises cash in circulation and banks deposits denominated in national currency, is the main aggregate for analysis and policy formulation at the Bank of Russia. In our study we also estimate the demand for the M1 aggregate, which excludes time deposits and arguably represents the part of money that is used primarily for transaction purposes. Analyzing national currency monetary aggregates may not suffice since the presence of financial dollarization is an important feature of the Russian economy (see Ponomarenko et al. (2013) for a review). The measure of money stock used by the Bank of Russia that includes foreign currency denominated deposits is the broad money (M2X) aggregate. In this study we also construct the monetary aggregate M2Y, which includes foreign cash holdings in the non-financial sector. The M2Y aggregate is not published by the Bank of Russia and, as it includes cash denominated in foreign currency, its measurement is problematic. In this study we use the indirectly measured foreign cash holdings reported in the International Investment Position of the Russian Federation and Balance of Payments of the Russian Federation. In Table 1 we summarize the components of the different monetary aggregates used in this study.

Table 1 Components of monetary aggregates

Components	**M1**	**M2**	**M2X**	**M2Y**
Currency in circulation	x	x	x	x
Demand deposits in national currency	x	x	x	x
Time deposits in national currency		x	x	x
Deposits in foreign currency			x	x
Cash in foreign currency				x

In our study we also use M2X and M2Y, which we adjust for valuation effects of foreign currency-denominated components (M2Xadj and M2Yadj). This seems reasonable in the context of monetary analysis since fluctuations caused by exchange-rate changes are not linked to real transactions and so could be misleading. On the other hand the wealth effect caused by these re-evaluations could still have a macroeconomic impact. We therefore analyze both types of aggregates, estimated as follows:

First the growth rates were adjusted:

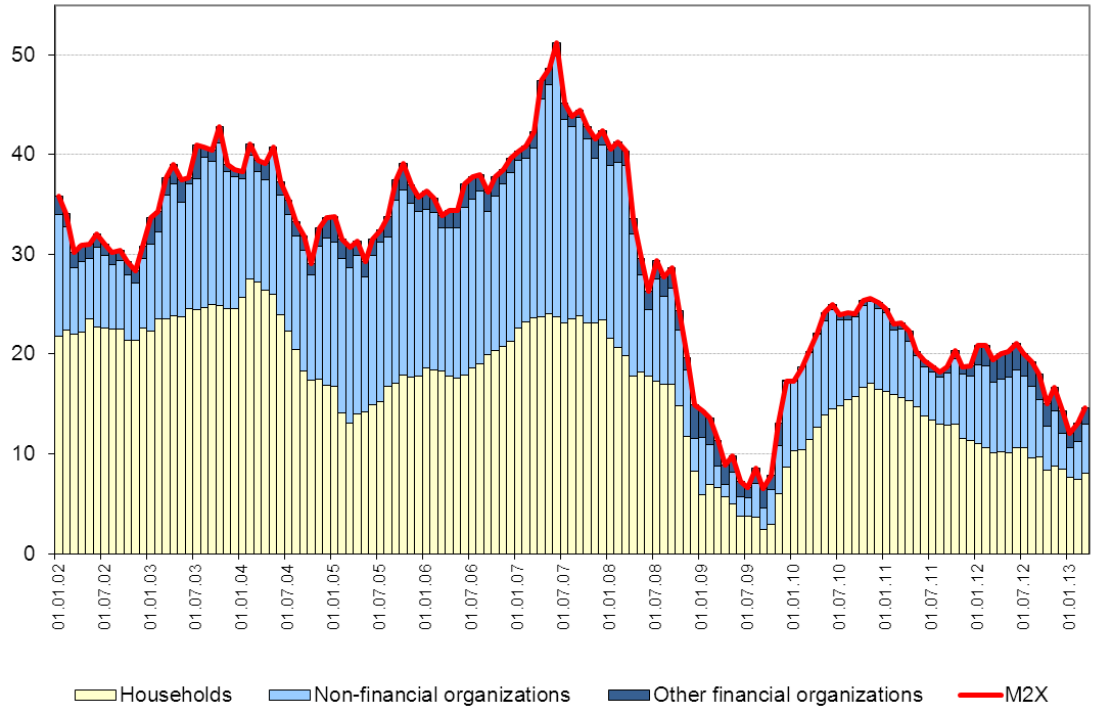
$$\Delta adj = s^{*}\Delta r + (1\text{-}s)^{*}\,\Delta f/e\,, \tag{2}$$

where s is the share of ruble-denominated components at the end of previous period, Δr the growth rate of ruble-denominated components, Δf the growth of foreign currency-denominated components and e the ruble's depreciation against the bi-currency basket. The base index is then constructed using the adjusted growth rates.

In our paper we also construct and analyze sectoral monetary indicators[2]. As presented in Figure 1, monetary developments in different sectors of the Russian economy are indeed evidently heterogeneous at certain times. It is also clear that the role of money holdings in the other financial institutions' sector is relatively insignificant (Figure 1). Because of this and also because the specification of money demand function for this sector could substantially differ from the general specification (1) adopted in this paper, we limit our analysis to the household (HH) and non-financial corporation (NFC) sectors.

[2] The data on sectoral deposits are published by the CBR. Estimates of national currency holdings by households are available from Rosstat. Distribution of national currency holdings between non-financial and other financial corporations is assumed to be proportional to the breakdown of deposits. Foreign cash is assumed to be held exclusively by households.

Figure 1 Contributions of sectors to broad money annual growth (%)



Scale variable / price level. We use GDP as scale and GDP deflator as price-level variables. In line with the literature on sectoral models, we also test households' final consumption (CONS) and fixed capital investment (INV) as scale variables and the corresponding deflators as price levels.

Wealth. We use housing prices[3] (HP), stock prices[4](SP) and aggregate asset (AP) price indices as a proxy for wealth. The aggregate index is the weighted[5] average of housing and equity prices indices. As suggested in Seitz and von Landesberger (2010) we test both actual and trend[6] values of the indices. We expect the growth of wealth to positively affect money demand as transactions in asset markets increase. The increase in wealth due to rising asset prices may also be associated with increased demand for other liquid assets (including money) that are part of the wealth portfolio.

[3] As reported by Rosstat.
[4] Represented by ruble RTS index.
[5] Similarly to Gerdesmeier et al. (2010) the weights are inversely proportional to the variables' volatility, i.e. $\Delta\,\textit{Asset prices} = \sigma_{sp}/(\sigma_{sp} + \sigma_{hp})\,\Delta\textit{Housing prices} + \sigma_{hp}/(\sigma_{sp} + \sigma_{hp})\,\Delta\textit{Equity prices}$, where σ is the standard deviation of the respective variable. The resulting weights equaled 0.87 for housing and 0.13 for equity prices.
[6] The trends are calculated using ex-post and recursive versions of HP-Filter (λ=1600).

Uncertainty. We tested several indicators of uncertainty: unemployment rate (UNEMP), consumer confidence index (CONF), annual GDP growth rate (DGDP) (all reported by Rosstat). We also measure uncertainty by stock index volatility[7] (VOL). We expect higher uncertainty to be associated with greater precautionary demand for money.

Opportunity costs. The choice of opportunity cost indicator is quite complicated in the case of Russia. The relative underdevelopment of the financial market precludes the use of money market interest rates for this purpose. On the other hand, exchange-rate fluctuations have been identified as important money demand determinants for Russia by all previous studies as well as in other emerging market economies (see e.g. Dreger et al. (2007)). Interestingly, national currency depreciation can be considered an opportunity cost only for holding ruble aggregates since interflows between ruble and foreign currency-denominated deposits would not affect broad money measures. In fact national currency depreciation would increase the implied ruble yield of foreign currency-denominated components of broad aggregates. Another opportunity cost indicator that may be considered is return on non-financial assets proxied by the consumer-price inflation rate[8] (as in e.g. Korhonen and Mehrotra (2010)). Including all these simultaneously in the estimated relationship is hardly plausible due to length-of-time-series limitations. Instead we adopt a more parsimonious approach and construct an aggregate opportunity costs variable as the spread between own-yield and alternative-yield, as presented in Table 2.

Table 2 Own and alternative yield indicators for different monetary aggregates

Monetary aggregate	Own yield	Alternative yield
M1	–	Aggregate yield on ruble and foreign currency deposits
M2	Yield on ruble deposits	Yield on foreign currency deposits
M2X, M2Y	Aggregate yield on ruble and foreign currency deposits	Consumer prices inflation rate

[7] The variance of RTS index returns over rolling periods of 180 days.
[8] We tested the growth rate of asset prices as an indicator of alternative yield but this did not produce satisfactory results.

The own yield of ruble components is measured by the interest rate on households' long-term ruble time deposits.

The own yield of foreign currency components is the weighted average of interest rates on euro and USD deposits (with time-varying weights equal to those in CBR's bi-currency basket) plus the ruble's depreciation against the bi-currency basket over the two last quarters, which presumably proxies the exchange-rate expectations. There is however some evidence that the magnitude of the currency-switching reaction to exchange rate fluctuations had deteriorated after the managed exchange rate regime was abandoned and the ruble's volatility had increased[9]. We therefore introduce a time varying parameter to scale down the impact of realized exchange-rate fluctuations on perceived yield of foreign currency assets in times of increased exchange rate volatility[10]:

$$FY = i + d\mu \quad (3)$$

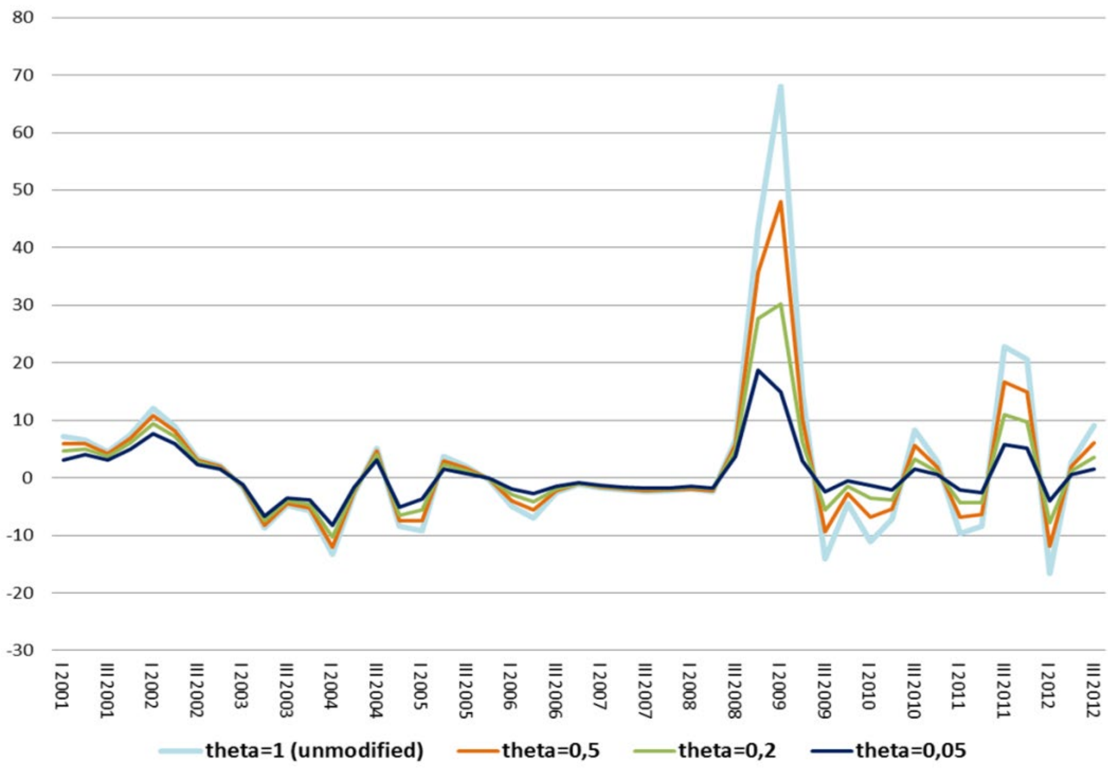
$$\mu = \theta V, \quad (4)$$

where FY is the yield on foreign currency deposits, i the weighted average of interest rates on USD and euro deposits, d the realized ruble depreciation against the bi-currency basket, V the variance of the ruble depreciation rate against the bi-currency basket over rolling periods of 180 days, and θ is a calibrated parameter that takes values from 0 to 1 ($\theta = 0$ implies discounting d completely, $\theta=1$ implies using unmodified d, see Figure 2).

[9] See e.g. Bank of Russia's Quarterly Inflation Review, 2Q 2012, p.25.

[10] See Kokenyne et al. (2010) for empirical evidence of exchange rate volatility affecting financial dollarization.

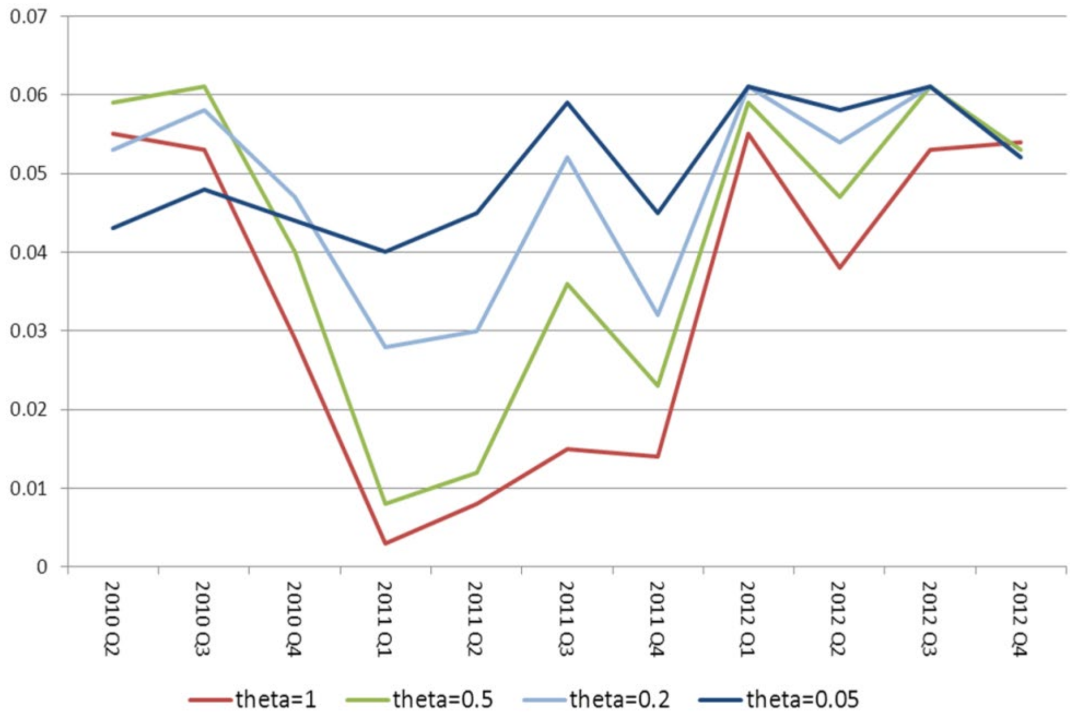
Figure 2 Implied expectations of bi-currency basket appreciation rate (*dμ*) given different values of *θ* (annualized 2-quarter average, %)



We estimated the models using different values of θ and found that in certain cases assuming θ =0.05 helps to obtain the most stable results[11] (Figure 3). We therefore assume this value in our estimation exercise.

[11] Although admittedly in many cases there were only negligible differences between estimates obtained scaled down and unmodified exchange rate fluctuations.

Figure 3 Recursive estimates of β3 coefficient (for M2X in households sector money demand function)



The aggregate yield is the weighted average (with weights proportional to shares of ruble and foreign-currency deposits in the total amount of deposits) of ruble and foreign currency component yields.

All components of opportunity cost measures are in quarterly terms. All variables except those in the opportunity cost and uncertainty categories are in logs. The time sample is 2000Q4─2012Q4, which gives us 49 quarterly observations. The variables are presented in Figures A1-A6 in the Annex.

4 Empirical results

4.1 Cointegration analysis

In our paper we concentrate solely on the long-run part of the money demand relationship. As discussed in Ponomarenko et al. (2012), given the exogenous nature of the sources of nominal money growth in Russia and the underdevelopment of alternative financial assets that could be used for savings purposes beyond those included in (broad) monetary aggregates, modeling short-run monetary developments based on money demand factors may be problematic. Moreover, estimating comprehensive models that include dynamic relationships of money and other macroeconomic variables (e.g. VECM) would hardly be plausible in our generalized approach that implies estimating not one but a collection of models. We therefore proceed by modeling money demand functions as cointegrating[12] relationships that conform to several criteria.

We test for cointegration using the test proposed by Johansen (1996). Our tests are conducted with unrestricted constant and seasonal dummy variables, and lag length of four. We consider the results satisfactory if the hypothesis of no cointegration is rejected (the results are presented in Table A1 in the Annex). Although there is some indication that several cointegrating relationships may be present in some cases, for the sake of economic interpretability and feasibility of our approach, we proceed by assuming a single cointegrating relationship in each model.

The cointegration vectors are estimated by the simple two-step estimator (S2S). As Brüggemann and Lütkepohl (2005) show, this estimator produces relatively robust estimates for small samples. The estimation is conducted with unrestricted constant and seasonal dummy variables. The lag length is four. We cross-check the results obtained with S2S by estimating the cointegration vectors using Fully Modified-OLS (Philips and Hansen (1990)) in a parsimonious single equation set-up. We use pre-whitening with lag length determined by Schwarz criteria and Barlett kernel with the cut-off determined by the automatic Andrews (1991) procedure. In both cases we accept the model only if the estimated parameters have the expected sign and are statistically significant at least at the 10% level.

We obtain 40 different models of money demand. The detailed results are presented in Tables A2─A7 in the Annex. The composition of the models is summarized along different dimensions (institutional sectors and type of monetary aggregates) in Tables 3 and 4.

[12] The results of conventional unit root tests (available on request) indicate that the variables (with possible exception of some variables from the *OC* and *unc* categories) are of I(1) order of integration and cointegration analysis is therefore relevant.

Table 3 Composition of money demand models (breakdown by sector)

Sector:	Explanatory variables (number of models containing the variable)		
	Y	***W***	***UNC***
HH (13 models)	GDP (11)	AP** (1)	CONF (3)
	CONS (2)	HP * (1)	UNEMP (1)
	–	–	DGDP (1)
NFC (9 models)	GDP (3)	SP** (4)	VOL (1)
	INV (6)	SP* (3)	UNEMP (3)
	–	SP (1)	–
		HP** (1)	
Aggregate (18 models)	GDP (18)	HP** (3)	CONF (6)
	–	HP* (2)	UNEMP (7)
		AP (1)	–
		AP** (1)	

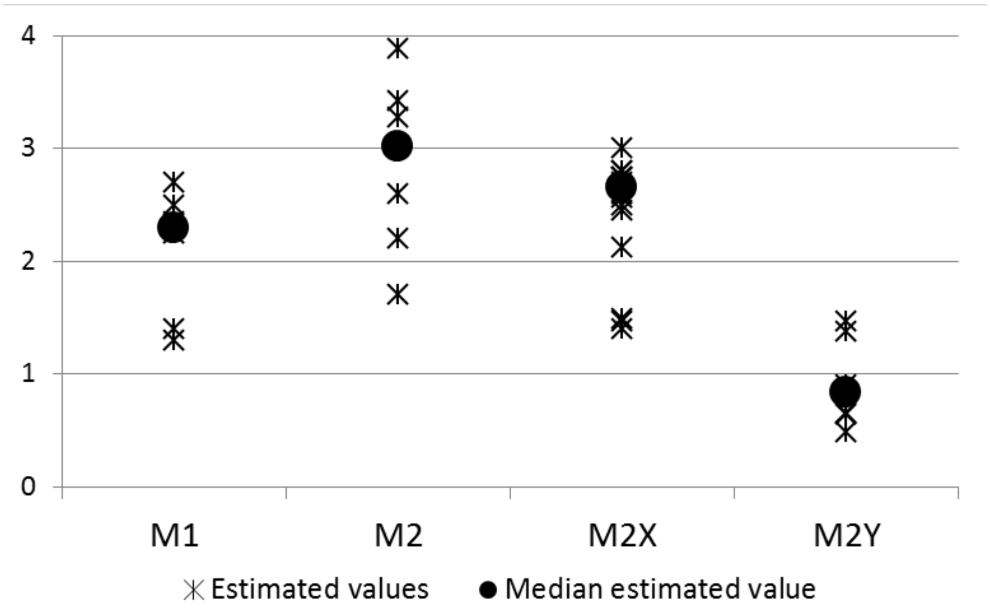
Table 4 Composition of money demand models (breakdown by monetary aggregate)

Monetary aggregate:	Explanatory variables (number of models containing the variable)		
	Y	***W***	***UNC***
M1 (6 models)	GDP (4)	AP** (1)	CONF (2)
	INV (2)	SP ** (1)	DGDP (1)
	–	SP* (1)	–
M2 (8 models)	GDP (6)	AP** (1)	CONF (3)
	CONS (1)	HP** (4)	VOL (2)
	INV (1)	SP** (3)	–
M2X (18 models)	GDP (15)	HP** (1)	CONF (3)
	INV (3)	HP* (3)	UNEMP (7)
	–	SP** (2)	VOL (1)
		SP* (2)	–
		SP (1)	
M2Y (8 models)	GDP (7)	–	CONF (2)
	CONS (1)		UNEMP (1)

** — trend value; * — recursively estimated trend value; *OC* variable (calculated as a spread between own and alternative yields presented in Table 2) is present in all but one of the models.

The resulting collection of money demand function comprise conceptually manifold (but conceptually similar) combinations of explanatory variables. Each of the auxiliary categories of variables (i.e. wealth and uncertainty) is present in approximately half of the models. Notably, the wealth variable (usually in the form of stock prices) is included in all models for the NFC sector. Using alternative scale variables also proves to be relevant, again mainly for the NFC sector. Among the monetary aggregates, only the demand for the M2Y seems to be better modeled with canonical models including only scale and opportunity cost variables.

Figure 4 Estimates of $\beta_1+\beta_2$ in money demand models for different monetary aggregates

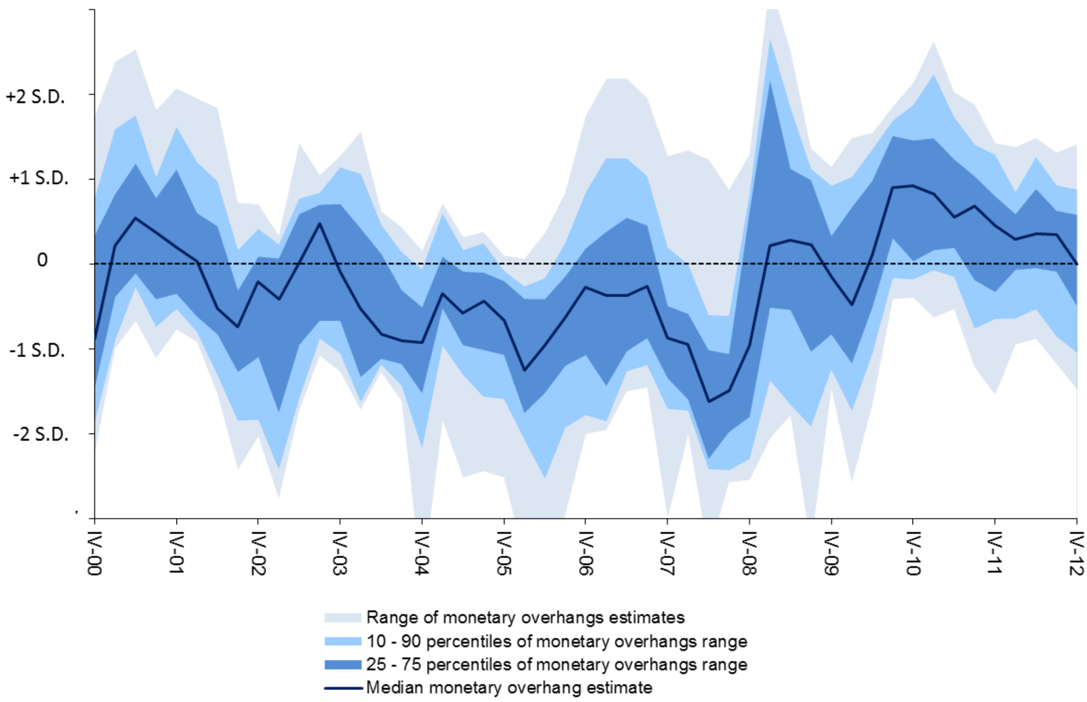


Interestingly, the procyclicality of demand for money can be measured by income elasticity β_1 or, if the wealth variable is present, by the sum of the income and wealth elasticities $\beta_1+\beta_2$ (as pointed out in e.g. Greiber and Setzer (2007)). This indicator seems to be very high for Russia (see Figure 4), which is usually associated with ongoing institutional changes such as financial deepening and the return of confidence in the national currency. This is especially true for M2 and M2X aggregates, while the demand for narrow M1 aggregate seems to be less procyclical. Notably the estimated income elasticities for M2Y are very close to the theoretically justified unity. This, together with the fact that a parsimonious specification of the model seems sufficient to establish the money demand relationship, may point to M2Y as a preferable indicator for the analysis of monetary developments in Russia. Unfortunately, high uncertainty associated with its measurement precludes its use as such.

4.2 Monetary overhangs

The estimated long-run equations may be used to construct monetary overhangs to measure excess liquidity. A monetary overhang is estimated as the deviation of actual money stock from the equilibrium level determined by the observed values of the explanatory variables. We derive these measures for the estimated models, which gives us a collection of aggregate[13] and sectoral monetary overhang estimates (presented in standardized form in Figures 5–7).

Figure 5 Aggregate monetary overhangs (standard deviations)



[13] In addition to aggregate monetary overhang measures derived from money demand models for aggregate monetary indicators, we calculate aggregate measures as weighted averages of monetary overhangs derived from sectoral money demand models estimated by the same econometric method.

Figure 6. Monetary overhangs in household sector (standard deviations)

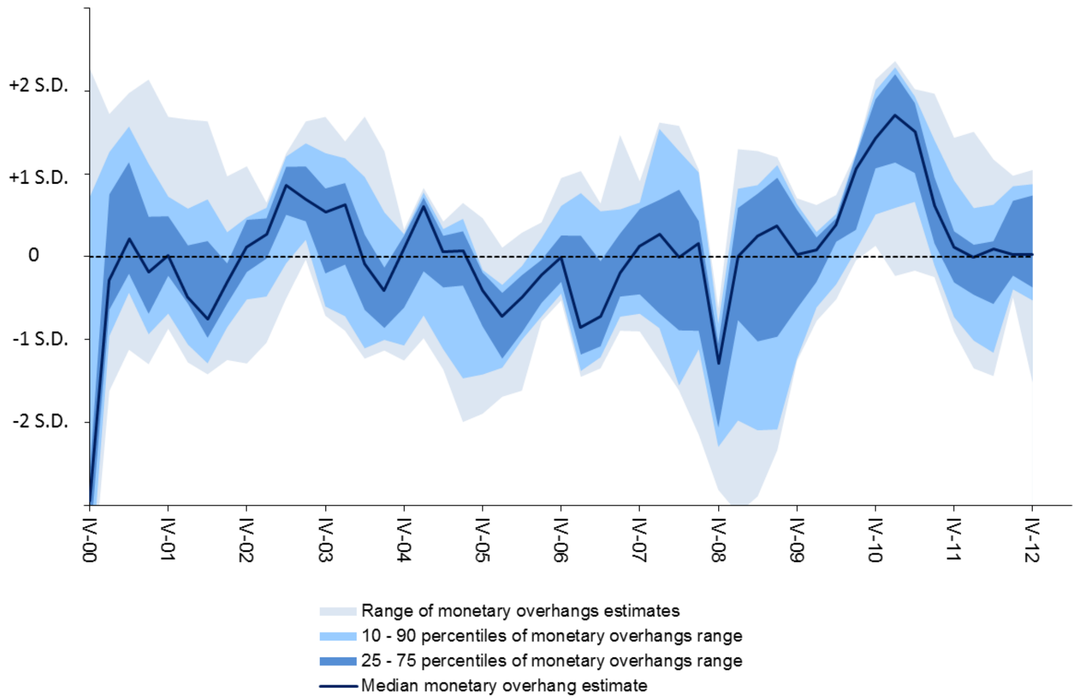
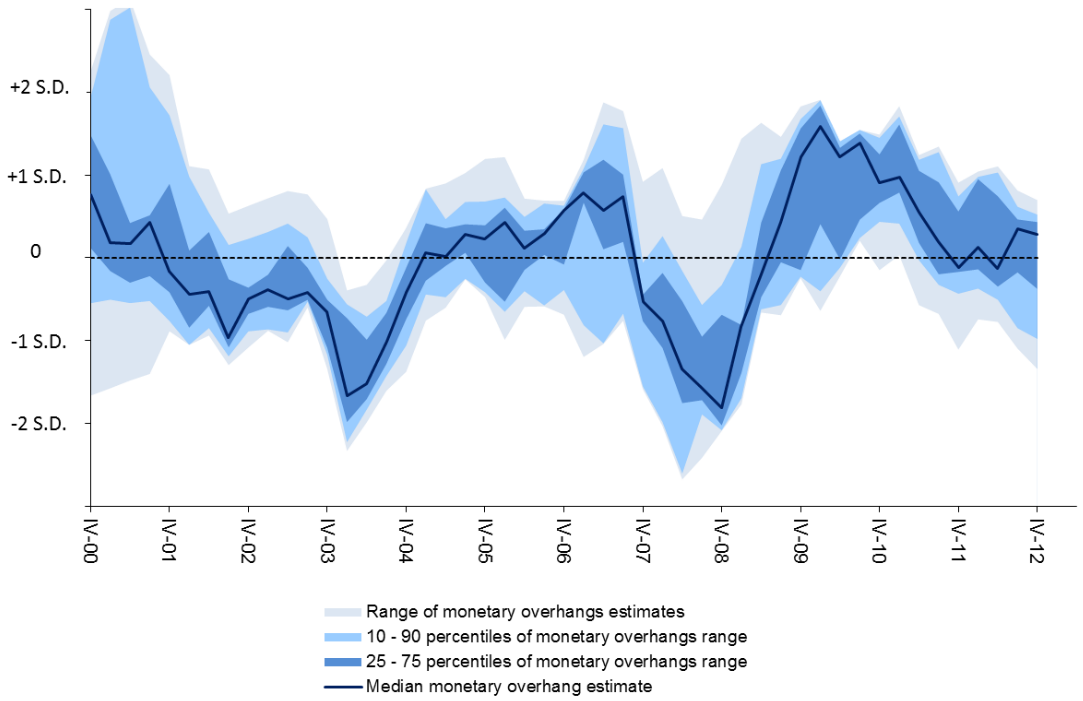
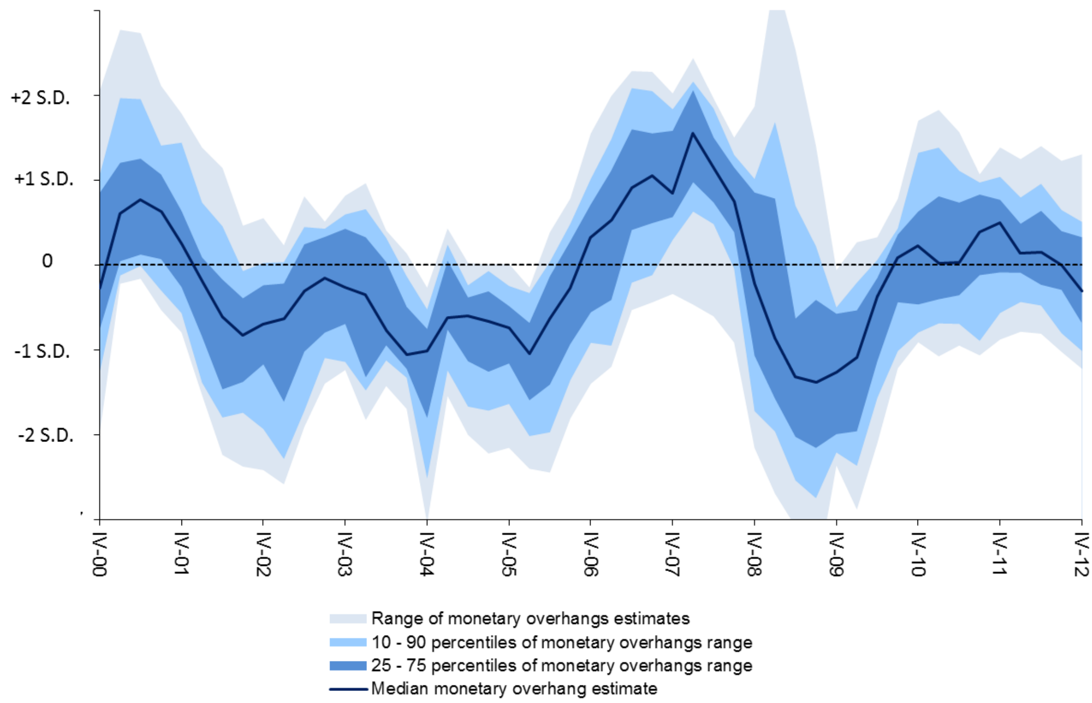


Figure 7 Monetary overhangs in NFC sector (standard deviations)



The measures indicate a shortage of liquidity during the financial crisis in Russia (late 2008 — early 2009). Then, as money growth picked up (mainly due to fiscal measures; see Ponomarenko et al. (2012) for a review) while money demand fundamentals' remained weak, the monetary overhangs climbed to high levels before recently returning to normal levels. As an alternative to estimating monetary overhangs basing on observed explanatory, one can use the trend[14] value of the scale variable to calculate equilibrium money stock (Figures 8—10). That would bring the resulting measure closer to the money gap notion (see e.g. Masuch et al. (2001)). In this case we get an indication of excess liquidity before the crisis becomes more evident while the post-crisis positive monetary overhang is being scaled down.

Figure 8 Aggregate monetary overhangs estimated for trend values of scale variables (standard deviations)



[14] The trend values were estimated via the HP-filter (λ=1600).

Figure 9 Monetary overhangs in household sector estimated for trend values of scale variables (standard deviations)

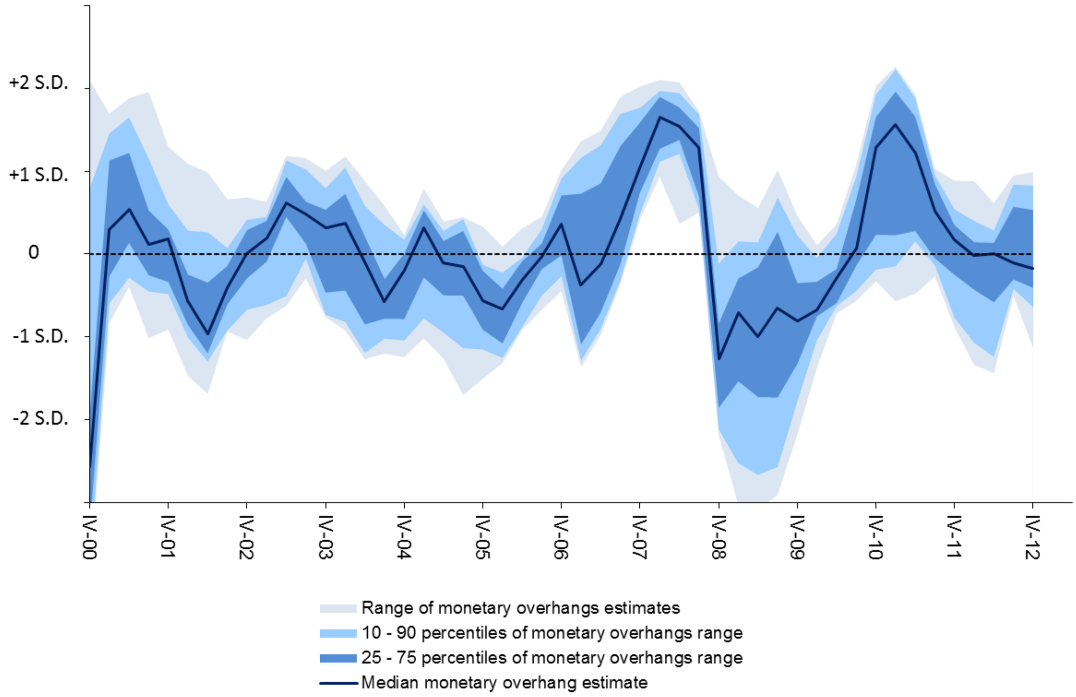
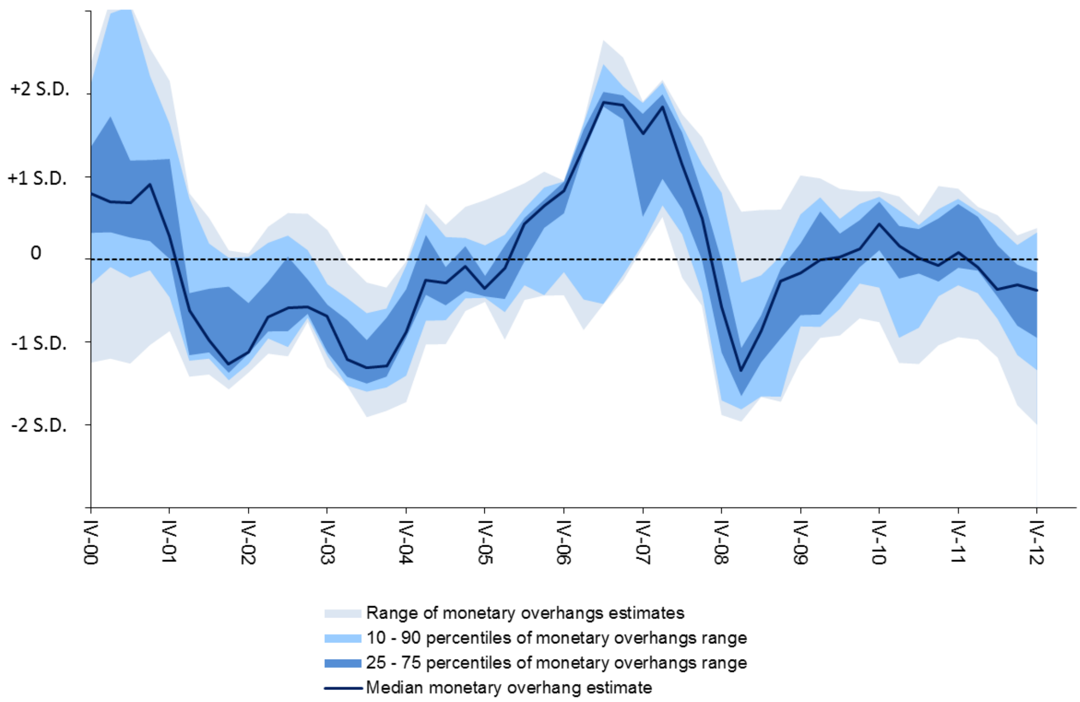


Figure 10 Monetary overhangs in NFC sector estimated for trend values of scale variables (standard deviations)



5 Conclusions

The analysis of monetary developments is a crucial element of the monetary policy-maker's analytical work. The information extracted from the dynamics of monetary aggregates may be valuable for identification of risks to price, financial and general macro-economic stability. Money demand models are conventionally regarded as a basic tool for this purpose. Unfortunately, estimating a robust money demand function is far from being a trivial task. The environment of rapid financial deepening, currency substitution and dramatic macroeconomic fluctuations generates a need to enhance the model's specification and to look for additional explanatory variables. Together with relatively short time series this implies frequent revision of money demand model set-ups and/or parameterizations.

This means that for practical reasons it may be undesirable to rely on a single model that may prove unstable with time. Instead, in this paper we present a collection of money demand models that can be used simultaneously to increase the robustness of the analysis. We assume a general money demand function specification comprising scale and opportunity costs, as well as auxiliary wealth and uncertainty variables. We estimate such models for various monetary aggregates across different institutional sectors, which is a novelty for the Russian case.

The results here comprise a collection of manifold money demand equations containing different combinations of explanatory variables. Using alternative scale variables and variables from the auxiliary categories (i.e. wealth and uncertainty) proves to be relevant, in particular for the NFC sector. Comparing the validity of these models on the basis of statistical criteria is virtually implausible. Therefore it may be preferable to use the whole set of the models simultaneously. For example, the distribution of monetary overhangs calculated on the basis of the estimated models appears to be a meaningful indicator of monetary stance in the Russian economy.

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Annex

Figure A1 Money variables used in the model.

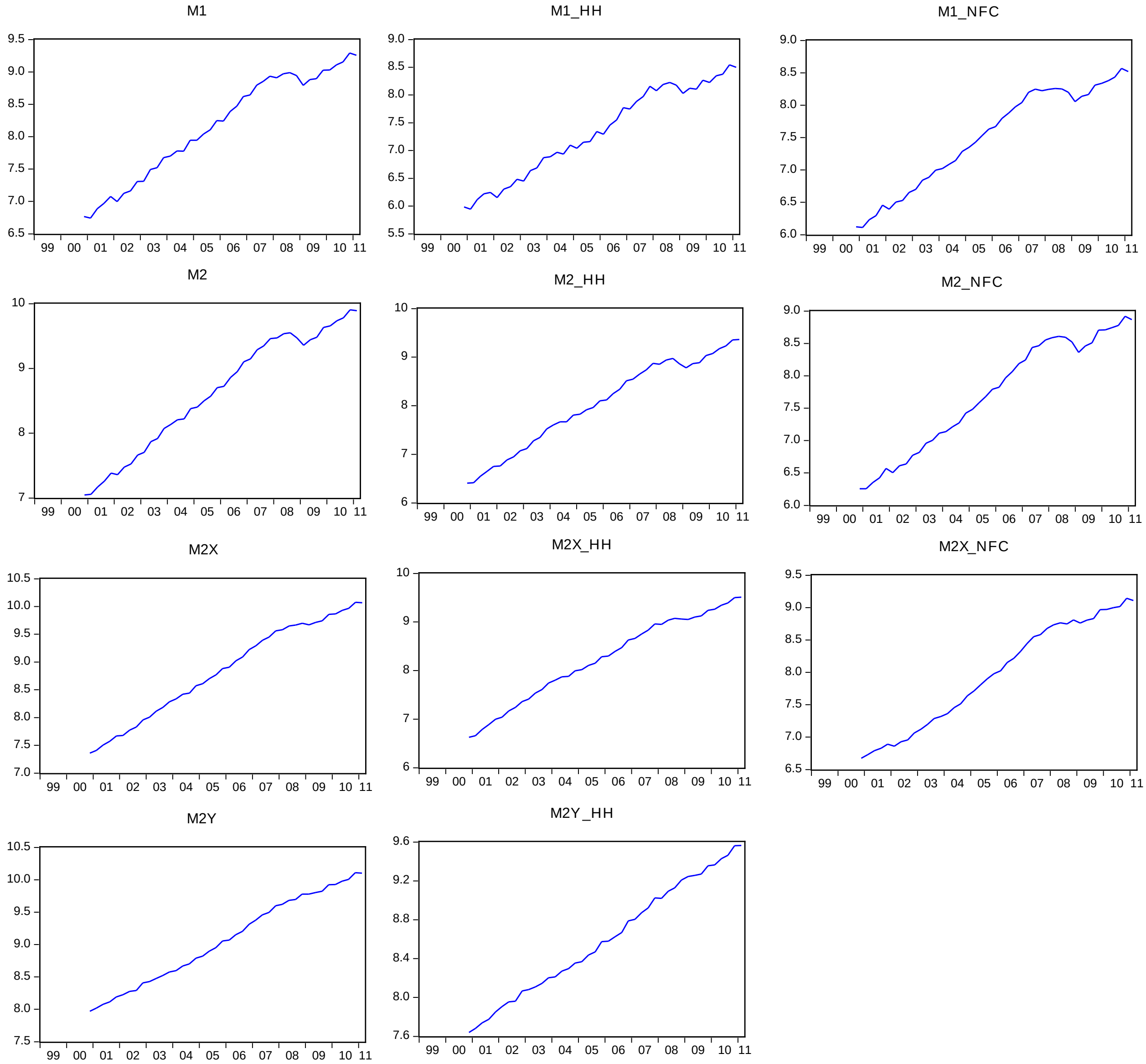

Figure A2 Scale variables used in the model.

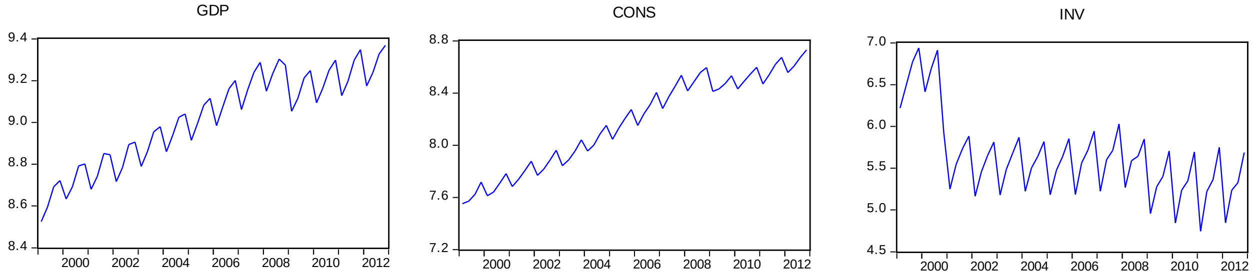

Figure A3 Price level variables used in the model.

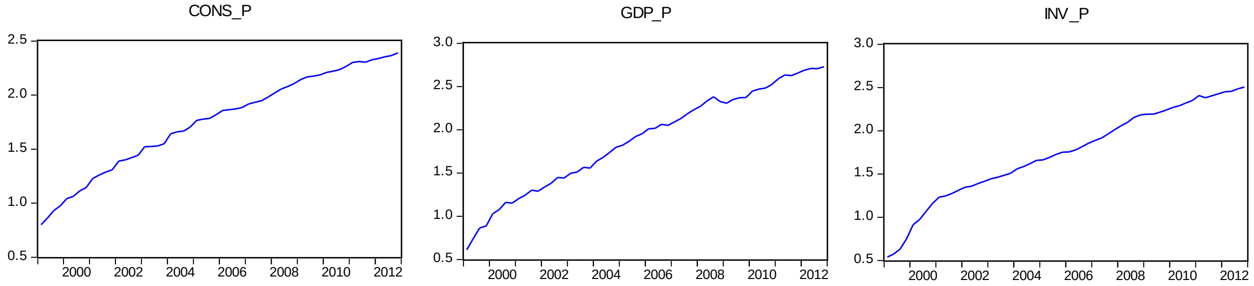

Figure A4 Wealth variables used in the model.

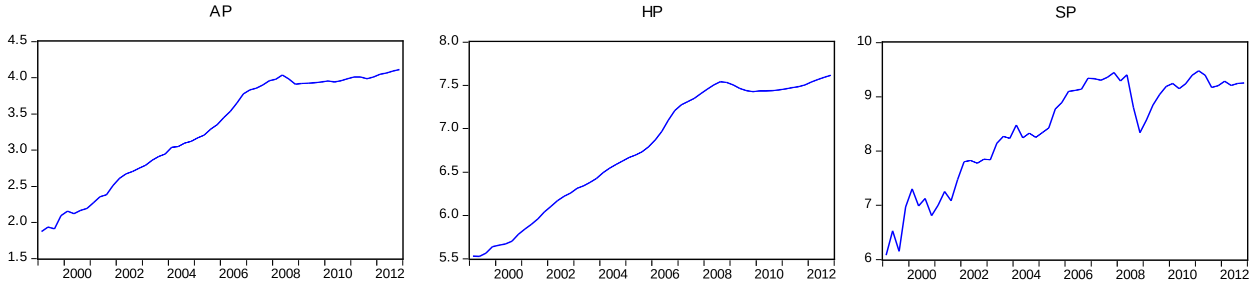

Figure A5 OC variables used in the model.

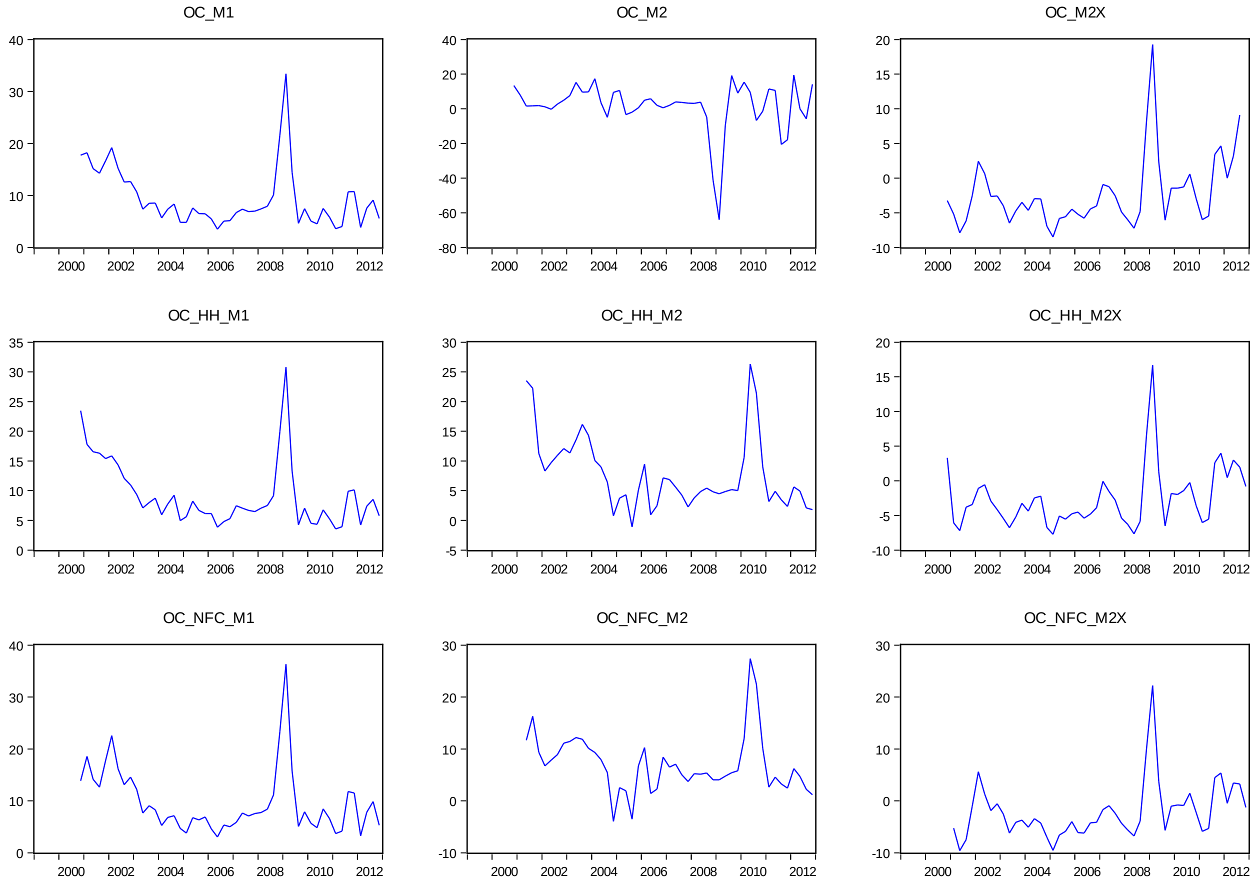

Figure A6 Uncertainty variables used in the model.

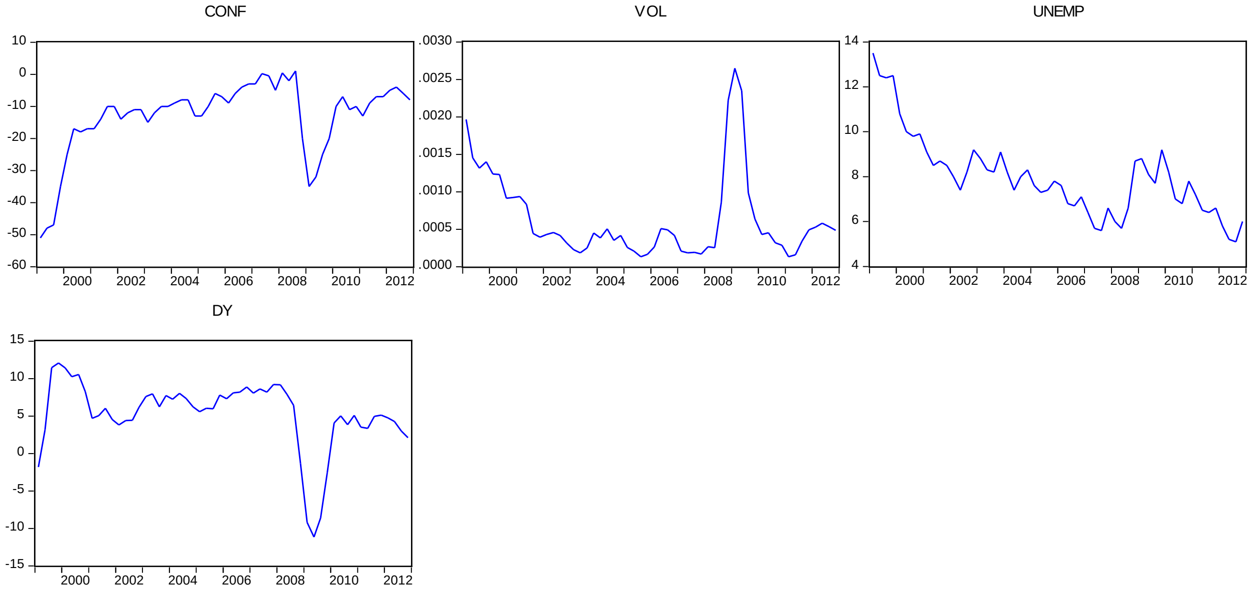

Table A1 Cointegration test results: Johansen test trace statistic (p-value)

We test specification of Johansen cointegration test with intercept (no trend) in cointegrating equation, 4 lags and seasonal dummy variables. Variables included in each model are reported in Tables A2–A7.

Sector	Estimation method	Aggregate	Rank		
			None	1	2
Households	S2S	M1	167.1 (0.00)	17.8 (0.21)	7.9 (0.01)
		M2	262.3 (0.00)	134.4 (0.00)	69.5 (0.00)
		M2X	65.3 (0.00)	24.3 (0.19)	7.5 (0.51)
		M2Y	30.9 (0.04)	6.3 (0.66)	0.1 (0.78)
		M2Xadj	65.7 (0.00)	24.4 (0.18)	8.8 (0.39)
		M2Yadj	76.4 (0.00)	38 (0.00)	18.5 (0.02)
	FM-OLS	M1	98.1 (0.00)	41.3 (0.00)	14.6 (0.07)
		M2	37.1 (0.01)	16 (0.04)	2.8 (0.09)
		M2X	57.2 (0.01)	25.1 (0.16)	11.5 (0.18)
		M2Y	30.9 (0.04)	6.3 (0.66)	0.07 (0.78)
		M2Xadj	60.4 (0.00)	28.5 (0.07)	3.9 (0.91)
		M2Xadj	57.3 (0.01)	25.2 (0.15)	7.8 (0.48)
		M2Yadj	35.13 (0.01)	9.16 (0.35)	0.07 (0.78)
NFC	S2S	M1	60.1 (0.00)	27.7 (0.08)	8.4 (0.41)
		M2	57.4 (0.00)	20.9 (0.35)	6.0 (0.69)
		M2X	111.9 (0.00)	54.6 (0.01)	31.2 (0.03)
		M2Xadj	113.2 (0.00)	54.7 (0.01)	29.2 (0.06)
	FM-OLS	M1	47.8 (0.0)	29.7 (0.00)	15.4 (0.00)
		M2	88.9 (0.00)	53.61 (0.00)	27.89 (0.00)
		M2X	72.9 (0.00)	65.5 (0.00)	44 (0.00)
		M2X	181.3 (0.00)	87.6 (0.00)	38.3 (0.00)
		M2Xadj	43.6 (0.00)	17.1 (0.03)	5.1 (0.02)

Sector	Estimation method	Aggregate	Rank		
			None	1	2
Aggregate	S2S	M1	91.8 (0.00)	45.7 (0.00)	16.1 (0.04)
		M2	180.3 (0.00)	102.8 (0.00)	63.7 (0.00)
		M2	174.9 (0.00)	113 (0.00)	58.4 (0.00)
		M2X	64.6 (0.00)	32.4 (0.02)	6.6 (0.62)
		M2Xadj	65.6 (0.00)	25.3 (0.15)	6.4 (0.65)
		M2Yadj	71.8 (0.00)	42.9 (0.00)	16.1 (0.04)
	FM-OLS	M1	150.7 (0.00)	79.3 (0.00)	48.3 (0.02)
		M2	70 (0.00)	28.4 (0.07)	13.6 (0.09)
		M2X	95.9 (0.00)	35.4 (0.01)	11.2 (0.2)
		M2Y	33.1 (0.02)	12 (0.16)	1.8 (0.18)
		M2Xadj	65.6 (0.00)	25.3 (0.15)	6.4 (0.65)
		M2Xadj	69.5 (0.00)	31.1 (0.03)	5.5 (0.74)
		M2Xadj	89.1 (0.00)	35.4 (0.01)	12.1 (0.15)
		M2Yadj	37.6 (0.01)	17.1 (0.03)	1.6 (0.19)

Table A2 Coefficient of money demand models for household sector (all coefficients are significant at least at the 10% level), S2S estimation method

Variable	Model					
	M1	M2	M2X	M2Y	M2Xadj	M2Yadj
M	1	1	1	1	1	1
GDP	2.71	3.63	2.8	-	2.12	0.84
CONS	-	-	-	0.64	-	-
AP	-	0.26	-	-	-	-
OC	–0.011	0.01	0.052	0.086	0.039	0.06
CONF	-	–0.016	–0.032	-	-	–0.007

Table A3 Coefficient of money demand models for household sector (all coefficients are significant at least at the 10% level), FM-OLS estimation method

Variable	Model						
	M1	M2	M2X	M2Y	M2Xadj	M2Xadj	M2Yadj
M	1	1	1	1	1	1	1
GDP	2.497	-	2.154	0.490	2.965	2.211	0.651
CONS	-	2.187	-	-	-	-	-
HP	-		0.292	-	-	0.265	-
OC	–0.009	0.011	0.028	0.038	0.014	0.025	0.028
DGDP	–0.007	-	-	-	-	-	-
UNEMP	-	-	-	-	0.062	-	-

Table A4 Coefficient of money demand models for NFCs sector (all coefficients are significant at least at the 10% level), S2S estimation method

Variable	Model			
	M1	M2	M2X	M2Xadj
M	1	1	1	1
GDP	-	2.064	2.281	2.16
INV	1.295	-	-	-
SP	0.185	-	0.462	0.541
HP	-	0.624	-	-
OC	–0.006	0.002	0.049	0.05
UNEMP	-	-	0.095	0.097

Table A5 Coefficient of money demand models for NFCs sector (all coefficients are significant at least at the 10% level), FM-OLS estimation method

Variable	Model				
	M1	M2	M2X	M2X	M2Xadj
M	1	1	1	1	1
INV	0.804	1.340	1.354	1.281	1.402
SP	0.598	0.369	0.119	0.085	0.089
OC	–0.007	0.005	0.006	0.005	-
UNEMP	-	-	0.029	-	-
VOL	-	-	-	57.457	-

Table A6 Coefficient of aggregate money demand models
(all coefficients are significant at least at the 10% level), S2S estimation method

	Model							
Variable	**M1**	**M2**	**M2**	**M2X**	**M2Y**	**M2Xadj**	**M2Xadj**	**M2Yadj**
M	1	1	1	1	1	1	1	1
GDP	2.353	2.934	2.758	2.654	0. 907	2.471	2. 746	1. 395
HP	-	0.526	-	-	-	0.132	-	-
AP	-	-	0. 523	-	-	-	-	-
OC	–0.001	0.007	0.003	0.021	0.033	0.018	0.019	0.025
CONF	–0.006	–0.01	-	-	-	-	-	–0.013
UNEMP	-		0.015	0.022	0.077	-	0.025	-

Table A7 Coefficient of aggregate money demand models
(all coefficients are significant at least at the 10% level), FM-OLS estimation method

	Model							
Variable	**M1**	**M2**	**M2X**	**M2Y**	**M2Xadj**	**M2Xadj**	**M2Xadj**	**M2Yadj**
M	1	1	1	1	1	1	1	1
GDP	2.049	3.023	2.674	1.465	2.379	2.807	2.746	1.377
HP	-	-	-	-	0.187775	-	-	-
AP	0.196171	-	-	-	-	-	-	-
OC	–0.007	0.002	0.006	0.014	0.009	0.008	0.006	0.014
CONF	–0.003	–0.007	–0.007	-	-	-	–0.008	-
UNEMP	-	-	-	-	-	0.047	-	-

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