University of Economics in Katowice

Journal of Economics and Management

ISSN 1732-1948 Vol. 20 (A) • 2015

Duygu Ayhan
Faculty of Business
Dokuz Eylul University
aduygu.ayhan@deu.edu.tr

Evrim Turgutlu
Faculty of Business
Dokuz Eylul University
evrim.gursoy@deu.edu.tr

Dynamics of international reserve accumulation in Turkish economy

Abstract

Many of the emerging market economies embody macroeconomic and structural vulnerabilities due to large deficits, high inflation, slowing growth and heavy reliance on short-term capital inflows. Therefore, accumulation of international reserve holdings has been frequently used by authorities to serve as an insurance against the volatility of the capital flows and strengthen the fragile nature of these economies. Turkish economy, classified as one of the most fragile of the emerging economies, has been experiencing a similar process of international reserve accumulation. The chronically high current account deficit and low savings rate boost the importance of international reserves. Thus, the aim of this paper is to investigate the determinants of international reserves in Turkey. The dataset covers the 2000-2013 period. Consequently, we find that the international reserve accumulation is mainly explained by current account balance, per capita income and past crisis experience.

Keywords: emerging markets, fragility, international reserves, cointegration, Turkish economy.
JEL Classification: F32, C22, E58.

Introduction

Many of the emerging market economies have serious macroeconomic risks such as high budget deficit and public debt burden, slowing economic growth rates, overshooting targeted inflation rates, current account deficit and heavy reliance on short-term capital flows, undervalued currencies and recently, exposure to domestic financial instability. These fragilities may lead to a full-blown financial or economic crisis triggerred by "sudden-stops" in capital inflows and in turn result in a deep

recession. Today, international reserve accumulation serves as a key tool for exchange rate management. Moreover, it enhances the political credibility of monetary authority against financial instabilities[1]. Recent emerging market crises have been characterized by rapid reserve depletion and countries that had large reserves did better in withstanding contagion effect than those with smaller reserves. Theoretically, precautionary demand for international reserves arises as a self-insurance to avoid sudden-stops against volatile international capital flows [Fischer 2001; Bird, Rajan 2002; Aizenman, Lee 2007).

Global reserves have more than tripled over the last decade and reached about $ 7,4 trillions [IMF 2013]. It is striking that almost two-thirds of the total global reserves are held by emerging market and developing economies. The rapid and profound accumulation of international reserves by many developing countries has been dominated particularly by precautionary motives against possible domestic and external instabilities, crisis, sudden-stop of capital inflows and macroeconomic fragilities.

The pioneering study of demand for international reserves belongs to Heller [1966]. He considers the benefits and the opportunity cost of holding reserves. He argues that the demand for international reserves should be negatively related to the marginal propensity to import, i.e., the change in imports-to-change in GDP ratio because a higher propensity to import implies a lower demand for international reserves. However, Frenkel [1974] argues that the average propensity to import, i.e., the imports-to-GDP ratio, measures trade openness and should have a positive effect on the demand for international reserves because of the precautionary holding to accommodate external shocks through trade channels.

Ford and Huang (1994) investigate the demand for reserve holding in China since 1950s. They find that last period's change in domestic income level affects reserve holding negatively in the short run. In the long run, there is a proportionality between both. Considering a sample of 125 developing countries over 1980-1996, Aizenman and Marion [2003] suggest that the size and volatility of international transactions, the exchange-rate arrangements, corruption and external borrowing affect the reserve holdings. High sovereign risk, fiscal liabilities and the volatility of shocks during crisis lead to a large precautionary demand for reserves.

Aizenman and Lee [2007] test whether precautionary or mercantilist motives explain reserve accumulation for the sample of 49 countries during 1980-2000. They find that trade openness variables and past financial crises are important in explaining reserve holdings. By studying a panel of 140 countries for the period

[1] By holding reserves, a central bank in an emerging economy aims to protect the domestic banking system and to minimize the depreciation of national currency [Obstfled, Shambaugh and Taylor 2008].

1980-2004, Obstfled, Shambaugh and Taylor [2008] show that there is a correlation between reserves-to-GDP ratio and (reserves/GDP) the variables financial development (M2/GDP), financial openness and exchange rate policy.

Cheung and Ito [2009] evaluate 119 economies during 1975-2004 and state that the determinants of international reserve holdings differ among developed and developing economies. For developing economies, propensity to import, international reserve volatility, the ratio of net debt liabilities to GDP, level of external debts, M2 and the ratio of net portfolio liabilities explain the reserve hoarding behavior. Cheung and Qian [2009] analyze 10 Asian economies from 1980 to 2004. They find that per capita output, average import propensity and financial openness positively affect the international reserve holdings, whereas exchange rate volatility has a negative impact.

Delatte and Fouquau [2011] investigate the panel of 20 emerging economies during 1981-2004. They find that the deterioration of the external position of the USA mainly explains the reserve hoarding and central banks in emerging markets are passive in building-up the reserves. They support the mercantilist view suggesting that large foreign reserve holdings are a direct result of export promotion and countries accumulate reserves to defend trade competitiveness. Lin [2011] examines 20 largest reserve-holding advanced and emerging countries for the period 1980-2008 and states that economic growth does not Granger cause growth of foreign reserves in both country groups. Therefore, reserve accumulation is the result of trade surplus and nevertheless international trade is not the only source of economic growth.

Using a panel of 130 countries from 1980 to 2008 Vujanovic [2011] finds that domestic financial depth (M2) and the levels of trade (imports plus exports) are the main factors affect the level of reserves in the long run. Exchange rate volatility, exchange rate regime, changes in GDP and financial openness permanently affect the reserve holdings. Shuaibu and Mohammed [2014] estimate the determinants and sustainability of international reserve accumulation in Nigeria during 1970-2010. Long-run reserve holdings are affected by the variability of export earnings, the one period lagged value of international reserves, GDP per capita and CO_2 emission. Short-run reserve demand is related to changes in GDP per capita, oil price, degree of openness of the economy, opportunity cost of holding reserves and the one-period lagged value of international reserves. Aizenman, Cheung and Ito [2014] analyze the effect of the 2008 global financial crisis on international reserves holdings of 95 developed and developing countries from 1999 to 2012. During the pre-crisis period (1999-2006), higher reserves are due to the gross saving in both developing and emerging markets. There is a negative effect of outward direct investment on reserve hoarding and

commodity price volatility causes precautionary demand for reserves. During the crisis period (2007-2009) gross saving and the propensity to import has a robust positive effect on reserve accumulation. In the post crisis period (2010-2012), the saving rate has an important impact in the level of reserves.

The motiviation behind this study is to examine the determinants of international reserve demand in Turkish economy over the period 2000-2013. Turkish economy has been recently classified as one of the most fragile emerging economies[2]. In the aftermath of 2001 economic and financial crisis, stock of international reserves in Turkey increased from about $22 bn in 2000 to $112 bn in 2014 [CBRT 2014]. The chronically high current account deficit and low domestic savings rate rise the importance of reserve accumulation in Turkish economy. Our paper contributes to the existing literature by evaluating the factors that influence the decision to hold international reserves in one of the most fragile economies. The results may highlight a basic story for the emerging economies with similar characteristics.

The following section presents the data and model. Section 3 explains the methodology and empirical results and last section concludes the study.

2. Data and model

We use quarterly time series data to explain the dynamics of international reserves in Turkey over the 2000-2013 period. We use two different measures of international reserves: total reserves and net reserves (i.e. total reserves excluding gold). RES and NRES denote the ratio of international reserves to gross domestic product (GDP). The main macroeconomic explanatory variables consist of ratio of current account balance to GDP (CAB), GDP per capita (PcGDP), the ratio of hot money to GDP (HOTM) and the ratio of short term external debt to GDP (EXTDBT). The detailed description of the variables and the data sources are reported in the Data Appendix.

The common practice in the related literature is focusing on the precautionary motives behind the accumulation of international reserves. In the absence of a deep and sound financial system to handle an international disequlibrium, countries hold some international reserves. To the extent that a country has large current account deficit to GDP ratio, it will be more fragile in case of sudden-stops of capital inflows. Hence, the this ratio, CAB, is our first covariate. We

[2] "Fragile Five" economies are classified as Brazil, India, Indonesia, South Africa, and Turkey. This classification was first mentioned by an analyst of Morgan Stanley in August 2013 to group the countries that have dangerously become dependent on foreign investment finance domestic growth targets.

expect to have a negative coefficient for this variable indicating that the country loosens the precutionary reserve accumulation as current account deficit gets smaller. The next variable, PcGDP, indicates the size of the economy [see for example Lane, Burke 2001; Aizenman, Marion 2003; Edison 2003; Cheung, Ito 2009]. There are different views about the impact of PcGDP on international reserves. The international reserves of a country increase as country gets larger hence as the volume of international transactions increases. This view implies a positive coefficient for the variable. However, from the precautionary view, an increase in PcGDP implies lower demand for international reserves and results in a negative coefficient for the variable[3].

Turkish economy has a heavy reliance on foreign capital. Its chronically high current account deficits have been financed through capital inflows. These capital inflows have been mostly in the form of short-term capital which we can consider as hot money. Hence, expecting a positive relationship between these capital inflows and international reserves, the variable HOTM is included in the model. International reserves as external assets controlled by monetary authorities for direct financing of external payment imbalances [IMF 2000]. The recent discussion on the adequecy of international reserve holdings has focused on one popular measure, namely Greenspan-Guidotti rule [Greenspan, 1999] which is simply the ratio of international reserves to short-term foreign debt. To account for the impact of short-term debt on the international reserves, we have included the ratio of short-term external debt to GDP (EXTDBT) as one of the covariates. A negative and significant coefficient is a common finding in the related literature [see for example Jeanne, Ranciere 2006; Delatte, Fouquau 2011].

The descriptive statistics for the above mentioned variables are reported in Table 1.

Table 1. Descriptive statistics

Variable	Mean	Median	Standard deviation	Maximum	Minimum
RES	37.203	40.006	11.556	50.865	0.852
NRES	34.235	37.575	13.458	48.135	–9.200
CAB	–4.500	–4.932	3.453	4.117	–11.623
PcGDP	1878.855	1982.855	713.493	3049.985	698.076
HOTM	1.637	2.127	3.994	7.549	–11.194
EXTDBT	35.664	32.745	10.040	64.623	21.853

Note:
RES: International reserves to GDP; NRES: International reserves net of gold to GDP; CAB: Current account balance to GDP; PcGDP: Per capita GDP; HOTM: The amount of hotmoney to GDP; EXTDBT: Short-term external debt to GDP

[3] Cheung and Ito [2009] follow the view of the Baumol [1952] square-root rule for transaction demand and expect PcGDP variable to have a negative coefficient.

Our analyses are based on the following models:

$$RES_t = \beta_0 + \beta_1 CAB_t + \beta_2 PcGDP_t + \beta_3 HOTM_t + \beta_4 EXTDBT_t + \beta_5 CRS1 + \beta_6 CRS2 + \varepsilon_{1t} \quad (1)$$

$$NRES_t = \beta_0 + \beta_1 CAB_t + \beta_2 PcGDP_t + \beta_3 HOTM_t + \beta_4 EXTDBT_t + \beta_5 CRS1 + \beta_6 CRS2 + \varepsilon_{2t} \quad (2)$$

Model 1 assumes that the dependent variable is ratio of total international reserves to GDP and international reserves net of gold over GDP is the dependent variable in the second model. Turkish economy has witnessed two crisis over the sample period. CRS1 dummy variable is included in the model to control the impact of the domestic financial crisis in the end of 2000, beginning of 2001. The effect of the global financial crisis is controlled by including CRS2 dummy in the model[4]. The detailed definition of these variables are given in the Data Appendix.

3. Methodology and empirical results

Time series data require special treatment since they are usually non-stationary. Hence, first we apply conventional Augmented Dickey-Fuller (ADF) unit root test. The results are reported in Table 2. All series are stationary at their first--differences, namely I(1).

Table 2. Augmented Dickey–Fuller unit root test results

Variables	Level	First difference
RES	–1.854 (0)	–6.382* (1)
NRES	–1.485 (0)	–6.460* (1)
CAB	–2.351 (4)	–3.682** (4)
PcGDP	–2.655 (4)	–3.707* (4)
HOTM	–2.588 (3)	–14.021* (0)
EXTDBT	–0.830 (0)	–2.908* (4)

Note:
*,** and *** indicate statistical significance at 1, 5 and 10 % level, respectively. The critical values are based on MacKinnon [1991].

The existence of a long-run relationship between the variables mentioned in models (1) and (2) are examined using Johansen cointegration method [Johansen 1988; Johansen, Juselius 1990]. Johansen cointegration method is based on the estimation of a vector autoregressive (VAR) model. Each variable, except the crisis dummies, in the model is assumed to be endogeneous. Johansen cointegration

[4] CRS1 is a dummy variable taking value 1 for the financial crisis periods specified as 2000q4 and all quarters of 2001 whereas CRS2 is a dummy variable to control the global financial crisis taking the value 1 for 2008q3,2008q4 and for all quarters of 2009.

method determines the number of cointegrating relationships among these varaibles. Two test statistics can be estimated using this method. These are maximal eigenvalue test and trace test. These are based on the eigenvalues of the residual moment matrix obtained from the VAR model estimation[5]. The results for the cointegration tests are reported in Table 3 and Table 4.

Table 3. Johansen cointegration test results: **RES = f(CAB, PcGDP, HOTM EXTDBT)**

Panel	Eigen.	Trace Statistic	5% critical value	Pr.
PANEL A				
$H_0: r = 0\ H_1: r = 1$	0.774*	138.300	69.818	0.019
$H_0: r \leq 1\ H_1: r = 2$	0.512*	63.934	47.856	0.001
$H_0: r \leq 2\ H_1: r = 3$	0.264***	28.004	29.797	0.079
$H_0: r \leq 3\ H_1: r = 4$	0.168	12.666	15.494	0.127
$H_0: r \leq 4\ H_1: r = 5$	0.066	3.464	3.841	0.062
PANEL B	Normalized cointegration coefficients			
Variable	Coefficient	Standard error		
CAB	–0.559*	0.017		
PcGDP	–0.010*	0.002		
HOTM	0.295	0.249		
EXTDBT	–0.445	0.326		
CRS1	4.842***	2.661		
CRS2	2.729	2.154		
Constant	68.731*	8.863		

Table 4. Johansen cointegration test results: **NRES = f(CAB, PcGDP, HOTM EXTDBT)**

Panel	Eigen.	Trace Statistic	5% critical value	Pr.
PANEL A				
$H_0: r = 0\ H_1: r = 1$	0.512	74.858**	69.818	0.019
$H_0: r \leq 1\ H_1: r = 2$	0.264	36.093	47.856	0.392
$H_0: r \leq 2\ H_1: r = 3$	0.232	19.488	29.797	0.458
$H_0: r \leq 3\ H_1: r = 4$	0.082	5.179	15.494	0.789
$H_0: r \leq 4\ H_1: r = 5$	0.009	0.525	3.841	0.468
PANEL B	Normalized cointegration coefficients			
Variable	Coefficient	Standard error		
CAB	–0.605*	0.212		
PcGDP	–0.011*	0.002		
HOTM	0.282	0.251		
EXTDBT	–0.583	0.369		
CRS1	5.665***	3.168		
CRS2	2.599	2.168		
Constant	71.038*	11.377		

Notes:
*,** and *** indicate statistical significance at 1, 5 and 10 % level, respectively.

[5] In the VAR estimation, choice of lag length is important. Using the Akaike Information Criterion (AIC) we have chosen the optimal lag length for the models.

Johansen cointegration test results for the model where total international reserves (RES) are used as the dependent variable indicate that there are cointegrating vectors representing the long run relationship among the varaibles. In accordance with the research question of the paper, we report the estimated parameters by only normalizing the cointegrating vector on RES. These estimated parameters are reported in Panel B of Table 3[6]. At first glance, one can observe that only CAB, PcGDP and CRS1 have statistically significant coefficients. Over the sample period, Turkish economy has constantly faced with current account deficit problem. Hence, the positive coefficient of the variable CAB implies that, contraction in the current account deficit as a ratio of GDP has led to decline in the international reserve holdings of the Turkish economy. This is in conformity with our prior expectations and the precautionary concern behind the accumulation of reserves based on the logic that the demand for international reserves increases as the balance of payments imbalances become more significant. The results reported in Table 3 also indicate that PcGDP has a negative and significant. This is also in conformity with the precauitonary concerns for accumulating international reserves. The estimated parameters of HOTM and EXTDBT are not statistically significant. However, the dummy controlling the severe financial crisis in Turkey over the end of 2000 and the early periods of 2001, namely CRS1, has a positive ans significant coefficient.

The cointegration results for the model with net reserves (total reserves net of gold) as the dependent variable are reported in Table 4. Trace test statistic indicates only one cointegrating vector in this system. The findings are in conformity with the results presented in Table 3.

Existence of a cointegrating vector is evidence for the long-run relationship among variables in the system. However, this long-run relationship may face with short-term shocks. Hence, investigating how short-term deviations from the long run equilibrium are corrected may provide important information about the short-term dynamics. Following the Granger representation theorem [Engle, Granger 1987], vector error correction model (VECM) represented as below is estimated:

$$\begin{aligned} \Delta RES_t = {} & \alpha_0 + \sum_{i=1}^{k-1} \alpha_1 \Delta RES_{t-i} + \sum_{i=1}^{k-1} \alpha_2 \Delta CAB_{t-i} + \\ & + \sum_{i=1}^{k-1} \alpha_3 \Delta PcGDP_{t-i} + \sum_{i=1}^{k-1} \alpha_4 \Delta HOTM_{t-i} + \sum_{i=1}^{k-1} \alpha_5 \Delta EXTDBT_{t-i} + \\ & + \alpha_6 \Delta CRS1 + \alpha_7 \Delta CRS2 + e_{1t} \end{aligned} \tag{3}$$

[6] The signs of the estimated coefficients are adjusted so as to leave dependent variable on the left-hand side of the equation.

$$\Delta NRES_t = \alpha_0 + \sum_{i=1}^{k-1} \alpha_1 \Delta RES_{t-i} + \sum_{i=1}^{k-1} \alpha_2 \Delta CAB_{t-i} + \\ + \sum_{i=1}^{k-1} \alpha_3 \Delta PcGDP_{t-i} + \sum_{i=1}^{k-1} \alpha_4 \Delta HOTM_{t-i} + \sum_{i=1}^{k-1} \alpha_5 \Delta EXTDBT_{t-i} + \\ + \alpha_6 \Delta CRS1 + \alpha_7 \Delta CRS2 + e_{2t} \quad (4)$$

The coefficient of one-lagged error correction term, EC_{t-1}, measures how deviations from long-run equilibrium are corrected. A negative and significant coefficient implies that the impact of short-run shocks erode and long-run equilibrium is achieved, finally[7]. Number of lags are specified so as to ensure that there is no autocorrelation problem in the model.

The results for the VECMs are reported in Table 5 and Table 6. Both of the error correction terms have negative and statistically significant coefficients. The estimated coefficient of error correction terms for both models indicate that about 40% of disequilibrium is corrected in each quarter so that it takes about 2.5 quarters to establish long-run equilibrium after a shock. This finding is also important to ensure that there is a valid long-run equilibrium relationship among the variables denoted in the models.

Table 5. Results from the vector error correction model: **RES = f(CAB, PcGDP, HOTM, EXTDBT)**

Variable	Coefficient	Standard error
1	2	3
EC_{t-1}	–0.4070*	0.131
ΔRES_{t-1}	0.1930	0.217
ΔRES_{t-2}	0.3490	0.271
ΔRES_{t-3}	0.1600	0.268
ΔRES_{t-4}	0.3700	0.248
ΔRES_{t-5}	0.6020	0.908
ΔCAB_{t-1}	–0.7210	0.935
ΔCAB_{t-2}	–2.0640*	0.850
ΔCAB_{t-3}	–1.6470*	0.787
ΔCAB_{t-4}	–1.1560	0.820
ΔCAB_{t-5}	–1.9230**	0.941
$\Delta PcGDP_{t-1}$	0.0130	0.010
$\Delta PcGDP_{t-2}$	–0.0005	0.010
$\Delta PcGDP_{t-3}$	–0.0003	0.011
$\Delta PcGDP_{t-4}$	0.0110	0.010
$\Delta PcGDP_{t-5}$	0.0150	0.013
$\Delta HOTM_{t-1}$	0.2180	0.645
$\Delta HOTM_{t-2}$	–0.4360	0.702

[7] Number of cointegrating relationships are important in the specification of the VECM. Number of lagged error correction term is determined according to the number of cointegrating vectors.

Table 5 cont.

1	2	3
$\Delta HOTM_{t-3}$	–0.4920	0.598
$\Delta HOTM_{t-4}$	0.2970	0.650
$\Delta HOTM_{t-5}$	0.8190***	0.536
$\Delta EXTDBT_{t-1}$	0.6950	0.984
$\Delta EXTDBT_{t-2}$	–0.6100	0.693
$\Delta EXTDBT_{t-3}$	–0.4780	0.782
$\Delta EXTDBT_{t-4}$	1.0290***	0.701
$\Delta EXTDBT_{t-5}$	0.3980	0.600
Constant	–1.9460***	1.060
Diagnostic statitics		
R^2	0.5640	
LM (AR-4) Chi-square statistics	31.254 (Pr. = 0.247)	

Note:
*, ** and *** indicate statistical significance at 1, 5 and 10 % level, respectively.

Table 6. Results from the vector error correction model: **NRES=f(CAB, PcGDP, HOTM, EXTDBT)**

Variable	Coefficient	Standard error
1	2	3
EC_{t-1}	–0.4390*	0.138
$\Delta NRES_{t-1}$	0.2460	0.221
$\Delta NRES_{t-2}$	0.3800	0.278
$\Delta NRES_{t-3}$	0.2780	0.270
$\Delta NRES_{t-4}$	0.4630***	0.250
$\Delta NRES_{t-5}$	0.7630	0.688
ΔCAB_{t-1}	–0.9580	–0.993
ΔCAB_{t-2}	–2.0640**	0.872
ΔCAB_{t-3}	–1.5740***	0.813
ΔCAB_{t-4}	–0.9720	0.833
ΔCAB_{t-5}	–1.7670***	–1.807
$\Delta PcGDP_{t-1}$	0.0140	0.010
$\Delta PcGDP_{t-2}$	–0.0001	0.010
$\Delta PcGDP_{t-3}$	0.0030	0.282
$\Delta PcGDP_{t-4}$	0.0140	0.019
$\Delta PcGDP_{t-5}$	0.0160	0.013
$\Delta HOTM_{t-1}$	0.2460	0.663
$\Delta HOTM_{t-2}$	–0.4620	0.723
$\Delta HOTM_{t-3}$	–0.4290	–0.699
$\Delta HOTM_{t-4}$	0.4030	0.663
$\Delta HOTM_{t-5}$	0.8700	0.546
$\Delta EXTDBT_{t-1}$	0.6750	0.922
$\Delta EXTDBT_{t-2}$	–0.6200	0.716
$\Delta EXTDBT_{t-3}$	–0.3330	0.802
$\Delta EXTDBT_{t-4}$	1.1060	0.717

Table 6 cont.

1	2	3
$\Delta EXTDBT_{t-5}$	0.3450	0.503
Constant	–1.9630	1.564
Diagnostic statitics		
R^2	0.5570	
LM (AR-4) Chi-square statistics	32.755 (Pr. = 0.424)	

Note:
*, ** and *** indicate statistical significance at 1, 5 and 10 % level, respectively.

In summary, the findings of the paper indicate that the major determinants of the international reserve accumulation behavior of the Turkish economy have been economic development, huge current account deficit and past crisis experince. The determinants mainly reflect the precautionary demand for reserve holdings. A rise in current account deficit causes a higher demand for reserve holdings. Similarly, past crisis experince leads to demand more international reserves. Besides, when an economy becomes more developed, reserve accumulation decreases. Consequently, our study is consistent with the view that per capita GDP or economic transactions is important in explaining reserve holdings those reported by Ford and Huang [1994], Cheung and Qian [2009], Shuaibu and Mohammed [2014]. Past financial crises experience is another variable affects the reserve accumulation in precautionary view as shown by Aizenman and Lee [2007].

Conclusions

The recent and rapid accumulation of international reserves by many emerging central banks aims to protect the domestic banking systems, provide a strong exchange rate management against financial shocks and smooth domestic absorption in case of possible crises. The emerging economies are mainly motivated by the experience of the recent financial crises and, costly and frequent future sudden-stops in capital inflows (as an insurance). It is expected that reserve hoarding provides a signal of prudence and stability and enhance macroeconomic fragilities.

This study uses theVAR method to examine the macroeconomic determinants of international reserve holding for Turkish economy during 2000-2013. The basic fact that emerges from this study is that per capita GDP, current account balance and 2001 financial crisis experience are the main determinants of reserve accumulation. All the findings support the precautionary demand for reserves in an emerging economy.

International reserve accumulation is an important liquidity enhancing policy that provides a self-protection against future crises. Therefore, emerging economies

need to pursue policies that result in a sustained increase in their owned reserves against financial shocks thay may cause a full-blown economic crisis.

References

Aizenman J., Marion N. (2003), *The high demand for International Reserves in the Far East*: *What's going on*? "Journal of the Japanese and International Economies", Vol. 17, pp. 370-400.

Aizenman J., Lee J. (2007), *International reserves: Precautionary versus mercantilist views, theory and evidence*, "Open Economic Review", Vol. 18, pp. 191-214.

Aizenman J., Cheung Y., Ito H. (2014), *International reserves before and after the global crisis: Is there no end to hoarding*? "NBER Working Paper" August, No. 20386.

Bird G., Rajan R. (2002), *Too much of a good thing? The adequacy of international reserves in the aftermath of crises*, "CIES Discussion Paper", No. 0210.

Baumol W.J. (1952), *The transactions demand for cash: An inventory theoretic approach*, "Quarterly Journal of Economics" November, Vol. 66, pp. 545-56.

Cheung Y., Ito H. (2009) *Cross-sectional analysis on the determinants of international reserves accumulation*, "International Economic Journal", Vol. 23, No. 4, pp. 447-481.

Cheung Y., Qian X. (2009), *Hoarding of international reserves: Mrs Machlup's wardrobe and the Joneses*, "Review of International Economics", Vol. 17, No. 4, pp. 824-843.

CBRT (2014), *Central Bank of Republic of Turkey's gross foreign exchange reserves*, http://evds.tcmb.gov.tr/yeni/cbt-uk.html.

Delatte A., Fouquau J. (2011), *The determinants of international reserves in the emerging countries: A nonlinear approach*, "Applied Economics", Vol. 43, No. 28, pp. 4179-4192.

Edison H. (2003), *Are foreign exchange international reserves in Asia too high*? [in:] *World Economic Outlook, public debt in emerging market*, International Monetary Fund, Washington, DC. September, Chapter II, pp. 78-92.

Engle R.F., Granger W.J. (1987), *Cointegration and error correction: Representation, estimation, and testing*, "Econometrics", Vol. 55, pp. 251-276.

Fischer S. (2001), *Opening remarks*, Policy Issues Forum, April 28, IMF – World Bank International Reserves, Washington, DC.

Ford J.L., Huang G. (1994), *The demand for international reserves in China: An error correction model with domestic monetary disequilibrium*, "Economica New Series", Vol. 61, No. 243, pp. 379-397.

Frenkel J.A. (1974), *Openness and the demand for international reserves* [in:] R.Z. Albier (ed.), *National monetary policies and the international financial system*, University of Chicago Press, Chicago, pp. 289-298.

Greenspan A. (1999), *Currency reserves and debt*, Federal Reserves System (remarks), Washington, D.C.

Heller H.R. (1966), *Optimal international reserves*, "Economic Journal", Vol. 76, pp. 296-311.

IMF (2000), *Debt- and reserve-related indicators of external vulnerability*, prepared by the Policy Development and Review Department in consultation with other Departments, March 23, Washington, D.C.

IMF (2013), *Promoting a more secure and stable global economy*, Appendix I: International Reserves, Annual Report of the Executive Board for the Financial Year Ended, April 30, Washington, D.C.

Jeanne O., Ranciere R. (2006), *The optimal level of international reserves for emerging market countries: Formulas and applications*, "IMF Working Paper", WP/06/229.

Johansen S. (1988), *Statistical analysis of cointegration vectors*. "Journal of Economic Dynamicsand Control", Vol. 12, No. 2-3, pp. 231-254.

Johansen S., Juselius K. (1990), *Maximum likelihood estimation and inference on cointegration – with applications to the demand for money*, "Oxford Bulletin of Economics and Statistics", Vol. 52, No. 2, pp. 169-210.

Lane P.R., Burke D. (2001) *The Empirics of Foreign International Reserves*, "Open Economies Review", Vol. 12, pp. 423-434.

Lin M. (2011), *Foreign reserves and economic growth: Granger causality analysis with panel data*, "Economics Bulletin", Vol. 31, No. 2, pp. 1563-1575.

MacKinnon J.G. (1991), *Critical values for cointegration tests* [in:] R.F. Engle, C.W.J. Granger (eds), *Long-run economic relationships*, Oxford University Press, Oxford, pp. 267-276.

Obstfeld M., Shambaugh J. and Taylor A.M. (2008), *Financial stability, the trilemma and international reserves*, "NBER Working Paper" August, No. 14217.

Shuaibu M., Mohammed T. (2014), *Determinants and Sustainability of international reserves accumulation in Nigeria*, "Zagreb International Review of Economics & Business", Vol. 17, No. 1, pp. 27-46.

Vujanovic P. (2011), *Understanding the recent surge in the accumulation of international reserves*, "OECD Economics Department Working Papers", No. 866.

Data Appendix. Definitions and sources

Variable	Definitions	Source
Dependent variables		
RES	Total international reserves (including gold)/current GDP	CBRT
NRES	Total international reserves net of gold/current GDP	CBRT
Explanatory Variables		
CAB	Current Account Balance/GDP	CBRT
PcGDP	GDP per capita	CBRT
HOTM	Hot money to current GDP	CBRT; own calculations*
EXTDBT	Short term external debt to current GDP	CBRT
Dummy Variables		
CRS1	Dummy variable for the financial crisis (1 for 2000q4 and all quarters of 2001)	Own calculations
CRS2	Dummy variable for the global financial crisis (1 for 2008q3,2008q4 and for all quarters of 2009)	Own calculations

* Gathered from the portfolio investments/liabilities entries which have the characteristics of short term capital in the balance of payments data.

Source: [CBRT 2014].