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The Balance of Payments Dynamics in the Period of Crisis

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Abstract

The paper analyses the key factors of balance of payments dynamics for countries with different exchange rate regimes. We consider the differences in approaches to the analysis of balance of payments effects, and provide an overview of recent studies on current account and capital account dynamics. We present an estimates based on quarterly data on 40 countries with floating exchange rate regime and 38 countries with intermediate exchange rate regimes from 2006 to 2010. In the period of crisis, the response of trade balance is opposite depending on exchange rate regime. Data also support the hypothesis of reversal effect of BOP. The hypothesis about interest rate to be a policy instrument in crisis period is not supported.

Keywords: balance of payments, current account, capital account, exchange rate regime

1. Introduction

Monetary policy is closely connected with the dynamics of balance of payments (BOP). If a country chooses a floating exchange rate regime, the BOP determines the dynamics of the national currency exchange rate, which, in turn, influence the macroeconomic performance of the country. In this case the dynamics of BOP is an important indicator of monetary policy.

In case of intermediate exchange rate regimes the situation is more complicated. On the one hand, monetary authorities prevent significant exchange rate volatility, that is, it becomes possible to have short-term payment imbalance. On the other hand, the monetary authorities have to think about the future monetary stability, for which they need to adjust monetary policy to reduce the imbalance (Summers, 1996; Taylor, 2002). In this case, BOP is not only an indicator, but also the target of monetary policy. The described effect was observed in developing countries during the global financial crisis in 2008-2009. For example, several CIS countries (Ukraine, Belarus, Tajikistan, Kyrgyzstan, and others) were forced to devalue their currencies only to reduce the emerging negative payment imbalances.

Under floating exchange rate regime, the shocks of current and capital accounts are linked with fluctuations in the equilibrium exchange rate. On the contrary, under intermediate exchange rate regime, Central Bank stabilizes both BOP and exchange rate. As a result, the exogenous shocks of current and capital accounts are more closely connected with the exchange rate dynamics, than in intermediate regime (Kharel and Martin, 2010). Consequently, in countries with floating and

intermediate exchange rate regimes under the same environmental conditions in the short term, the joint dynamics of current account and real exchange rate may have a different direction due to the correction of the monetary authorities.

Capital account of BOP plays an important role in periods of problems with liquidity and insolvency (Calvo, 1996; Chang and Turnovsky, 2009). In countries with floating exchange regime, BOP imbalances activate the market mechanism, which leads to changes in the level of interest rates. If monetary authorities prefer to interfere in the establishment of BOP equilibrium, the negative shock of capital outflows can be compensated by adjusting interest rates. High interest rates in this case are working in two directions: a) increase the demand for liquid assets in the domestic country; b) increase the cost of servicing the national debt. Therefore, in countries with intermediate exchange rate regime this effect is uncertain during the crisis period.

The aim of the paper is twofold. Firstly, the purpose is to discuss theoretical aspects of the BOP effects on the monetary policy. The paper examines the differences in approaches to the analysis of the BOP effects; provides an overview of theoretical and empirical researches devoted to the analysis of BOP dynamics. The great attention is paid to the peculiarities of using the monetary instruments to stabilize BOP, depending on exchange rate regime. Secondly, the aim is to investigate the monetary dynamics of countries with different exchange rate regimes in the crisis period of 2008–2009 and to reveal differences in the stabilization behavior of monetary authorities.

The rest of the paper has the following structure. In Section 2 we describe theoretical aspects of BOP dynamics. Firstly, we consider trade balance as an element of the monetary transmission mechanism. We summarize studies that consider the response of the current account of BOP to the price level and the nominal exchange rate. We discuss here the existence of the J-curve effect of the Marshall-Lerner condition.

Then, we consider BOP as an intermediate target of monetary policy. Studies on this problem are based on the assumption of the existence of the sustainable level of current account balance and on the idea of reversal dynamic of trade balance. Depending on exchange rate regime this process may differ significantly.

Finally, we shift our focus to the role of capital account in the analysis of the balance of payments. We consider studies that estimate monetary policy reaction to capital account shocks and conclude that capital account is an intermediate goal of monetary policy in the period of problems with liquidity and solvency.

In Section 3 we provide the results of econometric testing of the BOP effects in crisis period 2008-2009 for countries with floating and intermediate exchange rate regimes. We show the differences in the stabilization policy of these two groups of countries. Firstly, we describe the data used and the procedure of choosing the crisis period that are based on Bai-Perron test. To analyze the relation between exchange rate and current account, we estimate simple linear models using weighted ordinary least squares. We estimate the coefficient at exchange rate to find how it affects trade balance for different group of countries for crisis and non-crisis periods. We also test the hypothesis of reversal effect of BOP for both groups of countries. To reveal the relation between interest rate and capital account, we estimate linear regression as well. We estimate, whether interest rate is considered as policy instrument in crisis and non-crisis period or not. We also present a series of tests to reveal the role of the difference in average values of shocks. We conclude in Section 4.

2. Factors of BOP dynamics

Exchange rate regime is a way for monetary authorities to establish exchange rate relations between national currency and foreign currencies. There are fixed, floating and various types of intermediate exchange rate regimes[1]. A key feature for countries with intermediate and fixed exchange rate is the additional component in BOP — the change in international reserves. This component makes it possible to smooth fluctuations or completely fix the exchange rate in case of BOP imbalance.

Among many papers that analyze the dynamics of BOP, there are several areas of research. The first group of papers is devoted to the study of reaction of trade balance to changes in exchange rate. The second group pays attention to the study of BOP reversal effect. The third one studies the dynamics of capital account, depending on a variety of financial factors.

2.1. Trade balance as an element of monetary transmission mechanism

In an open economy, monetary transmission mechanism largely depends on the terms of trade of the country, that is, the current account of BOP (Gali and Monaselli, 2008; Svensson, 2001, 2003). Trade flows are changing under influence of the relative changes in the prices of tradable goods and the dynamics of capital flows.

The traditional approach to modeling the dynamics of BOP in reduced form is (Rose, 1991; Lee and Chinn, 1998; Boyd at al., 2001; Gomez and Paz, 2005):

$$b_t = x_t - m_t - (s_t - p_t + p_t^*) = x_t - m_t - e_t, \quad (1)$$

where b — trade balance, p — price level in the country, p^* — foreign price level, m —volume of imports, s — nominal exchange rate, x — exports, e — real effective exchange rate. All the variables are log transformed.

Devaluation is usually associated with the improvement of trade balance. However, there is no consensus on how the effects of exports and imports are distributed over time. Orkutt (1950) argued that the trade flow responds differently to small, temporary shocks and large, permanent changes (e.g. devaluation). This means that the adjustment of trade balance to large-scale changes in price level or to changes of nominal exchange rate is faster than the adjustment to small changes. That is why the response of current account of BOP in crisis period (which implies a substantial devaluation) may differ from its reaction in non crisis period.

Later this effect has been studied for countries with different exchange rate regimes. Wilson and Takacs (1979), Janz and Rhomberg (1973) have studied the difference in responses to changes in rates for countries with fixed exchange rate regime. Wilson and Takacs have shown the same response of trade balance to nominal exchange rate and price level changes. Janz and Rhomberg subjected these results to the criticism and demonstrated that the reaction time to changes in nominal exchange rate is smaller than the response time to change in price levels. This idea was further developed by Bahmani-Osco (1986), Bahmani-Osco and Kara (2003), Hacker and Hatami (2004), Boyd at al.(2001), Gomez and Paz (2005).

In addition, these studies also observe the J-curve effect. This phenomenon describes the fact that the initial impact of devaluation is negative for trade balance (reduction of import exceeds export

[1] IMF De Facto Classification of Exchange Rate Regimes April 31, 2008

growth), but over time exports increases due to competitive prices and, ultimately, trade balance is growing significantly. Janz and Rhomberg explain the J-curve effect by different lags, including time lag, decision-making lag, delivery lag and product replacement lag.

The results of Wilson and Takacs also have been expanded. In 1991 Tegene, using vector autoregression approach, came to the conclusion that export and import functions are equally responsive to relative price changes and changes in nominal exchange rate.

The next area of BOP researches is devoted to the devaluation impact on BOP dynamics. The devaluation of national currency is usually associated with the improvement of trade balance, but is accompanied by an adjustment to changes in real exchange rate with a certain time lag. The size of the lag is determined by individual characteristics of each country. It may even be zero for some countries. The study of this effect has also been associated with the problem of the Marshall-Lerner condition: devaluation is accompanied by the growth of trade balance if price elasticity of export and import is greater than one. Empirical studies of trade balance reaction to exchange rate fluctuations have found that the condition is not satisfied in the short term (see, for example, Gomez and Paz, 2005). However, the reaction may depend on the exchange rate regime, the size of the fluctuations, and may be different for the cases of real and nominal devaluation.

The other line of researches links BOP and exchange rate by analyzing how BOP imbalance affects foreign exchange rate over time. Most theoretical works use dynamic approach to the analysis of international payments according to the joint dynamic behavior of the various components of BOP.

The paper of Muller-Plantenberg (2010) summarizes the results of theoretical studies of dynamics of exchange rate and provides models that explain fundamental differences between interaction of exchange rate and international payments depending on imposed restrictions on capital flows and exchange rate regime of the country. Muller-Plantenberg paper is a synthesis of theoretical models of previous studies.

Theoretical models of Muller-Plantenberg have an empirical support. Bussiere and Mulder (1999), Eichengreen (2003), Pontines and Siregar (2008) have shown that variables such as the current account, export growth, international reserves and short-term international debt are good indicators to predict currency crises.

2.2. The balance of payments as an intermediate target of monetary policy

BOP is an intermediate target of monetary policy when the stability of exchange rate regime is under the threat. Studies on this problem, based on the assertion of existence of sustainable level of current account balance – the level at which the country is able to meet all its obligations to foreign loans due to the current and future savings. In the light of this assumption, it is considered that trade deficit is a problem for monetary authorities, threatening the stability of monetary sphere, when the level exceeds sustainable limit. Thus, for the U.S. it is about 5% of GDP (Mann, 2002, Freund, 2000,2005) for New Zealand, Portugal, Singapore - 10% (Summers, 1996), France, Italy, Spain - 3 % (Taylor, 2002).

Change in the direction of BOP dynamics is called the "reversal". Most of the papers devoted to the reversal of BOP, suggest the effect of market adjustment mechanisms in the case of floating exchange rate regimes (Obstfeld and Rogoff , 2005; Freund, 2000; Mann, 2002). In the case of countries with intermediate exchange rate regimes reversal is controlled by monetary authorities,

who are trying to correct the effect of market factors. The effect of reversal then arises in the form of: (a) delayed reaction of components of BOP to the ongoing correction of exchange rate, (b) smoothed response of the Central Bank to payments imbalance.

The imbalance is threatens exchange rate regime in the country, while the reversal is accompanied by depreciation of national currency. The overall effect of devaluation of developed countries was estimated to be 20% (Freund, 2005). Using the definition of currency crisis proposed by Frankel and Rose (1996), the devaluation of the national currency by 25% or more in nominal terms is considered to be a currency crisis, respectively, we can say that the imbalances in BOP can lead to currency crisis (Edwards, 2001). The threat of crisis stimulates monetary authorities of intermediate exchange rate regimes to intervene in the process of reversal.

There are studies for developing countries, showing that the effect of reversal does not necessarily entail a currency crisis. In Milesi-Ferretti and Razin (1998) less than a third of cases in a sample of 105 countries systematically accompanied by a currency crisis.

This effect shows that under the same environmental conditions in the countries in transition mode and floating exchange rate devaluation will occur at different times and at different speeds. Moreover, in the short term, the joint dynamics of current account and real exchange rate may have a different direction due to corrections of monetary authorities.

2.3. The role of capital account in the analysis of the BOP

Capital account of BOP comes to the fore during the problems with liquidity and insolvency. If monetary authorities prefer to influence the establishment of BOP, negative shock of capital outflows is associated with two alternatives: a) the reduction of production in response to decline in investment and b) the use of international reserves to mitigate the impact on domestic demand (Ranciere and Jeanne, 2006). Using, for example, interest rate in order to regulate capital flows can lead to negative consequences (Lahiri, Vegh, 2003; Pak-Hung, 2009) and only tighten the problems in the financial sector.

High interest rates in this case, first, increase the demand for interest-bearing liquid assets in the country, and secondly, increase the cost of servicing the public debt. Thus, the effect is uncertain during the crisis, and is characteristic of countries with intermediate exchange rate regimes.

The relationship between financial variables looks ambiguous. For example, relatively small negative shock (interest rate change) may lead to radical changes in the dynamics of the capital account and have serious consequences for the social sphere (Calvo, 1996; Chang, 2009). With the example of the financial crisis in Mexico in 1994 Calvo showed that in a world where international relations are well developed, the reaction of investors to financial shocks can be disproportionately high, at least in the initial response. The reason for this may be financial vulnerability of the country or expectations of investors.

Financial factors in crisis and non-crisis period may have a completely different impact on capital account of BOP. This conclusion is most typical for countries protecting their exchange rate regime.

3. Empirical analysis of the BOP effects on monetary policy

3.1. The data

In this paper we investigate the joint dynamics of BOP and exchange rate of 78 countries which produce more than 93% of the World Gross Domestic Product. We divide the entire sample into two groups. The first group includes countries that manage the exchange rate of the national currency, and the second group involves countries that do not control the exchange rate. Groups were formed on the basis of the International Monetary Fund (IMF) classification (Table 1).

The first group includes 40 countries with a floating exchange rate regime and two countries with currency board exchange rates regime. We add these two countries because in case of Currency Board the national currency is pegged to free floating currencies that makes differences between these two regimes irrelevant in this particular study. We also treat countries of Euroarea as one observation. The second group consists of 38 countries with intermediate exchange rate regimes (managed floating, crawling peg and currency band).

Data for each country cover the period from the third quarter of 2006 (2006Q3) to the first quarter of 2010 (2010Q1). Econometric testing is carried out on quarterly data forming the panel dimension in 78 countries and 15 quarters. The analysis is based on the dynamics of BOP, balance of trade, interest rates, real effective exchange rates.

Table 1. Classification of the sample countries according to the exchange rate regime

Group I (40)		*Group II (38)*			
Free floating (38)	*Currency Board (2)*	*Conventional fixed peg (17)*	*Crawling peg (3)*	*Currency band (1)*	*Managed floating (17)*
Australia	Bulgaria	Argentina	Bolivia	Costa Rica	Armenia
Brazil	Hong Kong	Belarus	China		Colombia
Canada		Belize	Nicaragua		Georgia
Chile		Croatia			India
Czech		Denmark			Indonesia
Republic		Fiji			Kyrgyzstan
Euroarea		Kazakhstan			Malaysia
Hungary		Latvia			Moldova
Iceland		Lesotho			Pakistan
Israel		Macedonia			Paraguay
Mexico		Morocco			Peru
New Zealand		Russian			Romania
Norway		Federation			Singapore
Philippines		Samoa			Thailand
Poland		Solomon Islands			Uganda
South Africa		Trinidad and			Ukraine
South Korea		Tobago			Uruguay
Sweden		Tunisia			
Switzerland		Venezuela			
Turkey					
United					
Kingdom					
USA					
Japan					

Note: The number of countries included in each group is in parentheses.

BOP statistics

We use the IMF quarterly statistics on capital, financial and current account. It is important to note that the methodology of compiling BOP have significant differences among countries we consider. For example, some countries do not separate financial account into a particular group. Therefore, we consider the sum of capital and financial accounts to avoid problems with the comparability of methodologies.

Trade Balance

Quarterly trade balance data are also taken from the IMF statistics. To fill the gap in case when there were no data on trade balance, we use the following calculations:

$$TB_{i,t} = \frac{EX_{i,t} - IM_{i,t}}{\overline{er}_{i,t}}, \quad (1)$$

where $TB_{i,t}$ — quarterly trade balance of country *i* in period *t* (millions US dollars), $EX_{i,t}$ $(IM_{i,t})$ — quarterly export (import) of country *i* in national currency, $\overline{er}_{i,t}$ — average exchange rate for the quarter.

Interest rate

Proxy for the interest rate is the annual discount rate at the end of the quarter. In the absence of discount rate for any particular country, we use refinancing rate (percent per annum); in the absence of refinancing rate, we use repo rate (percent per annum).

Real effective exchange rate

For countries where this indicator was not availiable in the IMF database, we calculate the rate on the basis of country's import structure. For calculations we use the structure of import into the country in 2009. We consider this structure to be constant during the period under consideration. We calculate the real exchange rate of domestic currency and the currencies of countries-importers:

$$REER_t = \frac{NEER_t}{P_t^*} P_t, \quad (2)$$

where $REER_t$ — real effective exchange rate (domestic currency against the unit of foreign currency), $NEER_t = \prod_{j=1}^{N} \left(e_{j,t}\right)^{\alpha_j^*}$ — nominal effective exchange rate, $P_t = CPI_t$ — price level in the domestic country, $P_t^* = \prod_{j=1}^{N} \left(CPI_{j,t}\right)^{\alpha_j^*}$ — average price level of importers; $\alpha_j^* = \frac{\alpha_j}{\sum_{j=1}^{N} \alpha_j}$ — share of the importer j based on the import structure; $e_{j,t}$ — nominal exchange rate (domestic currency against the unit of foreign currency).

Econometric test requires stationarity of the considered series. Dickey-Fuller test indicate the presence of a unit root in all of the series, which demonstrates that they are not stationary. In addition, the graphs of the dynamics of indices also show signs of the presence of a unit root - there is no return to the average level. That is the reason why we use first differences of the data (quarterly changes).

Description and symbols of all the variables which we use in the econometric analysis are described in Table 2.

Table 2. Variables desciption

Identification of the variable	*Description of the variable*
ΔTBt	Quarterly change in trade balance of the country
Δ(KA+FA)t	Quarterly change in capital and financial account of the country
ΔCAt	Quarterly change in current account of the country
ΔRt	Change in interest rate, percentage points
ΔREERt	Logarithm of changes in the real effective exchange rate
GDPj	Gross domestic product of country j in 2009

3.2. Identification of the crisis period

One of the main issues of this paper is to describe features of monetary policy in countries with different exchange rate regimes. Special attention is paid to the period of crisis. To do this we first need to determine time bounds of the crisis – when it started and when it ended.

In order to detect start and end points of crisis period, let us suppose that these points refer to structural breaks in relations between key macroeconomic variables and there were no other structural breaks. Then we need to break the sample into three homogeneous periods, when these relations stayed the same – period before crisis, crisis period and period after crisis.

We use the idea of Bai-Perron test to pick these periods out. The idea is simple – one just needs to look over all possible ways of breaking into periods, run regression and choose the way which gives the highest likelihood. We run this procedure for several specifications of regression and with different variables. All the specifications give the similar dates of the crisis – it started in the fourth quarter of 2008 and ended in the second quarter of 2009. The corresponding subsamples we use for inference are presented in Table 3.

Table 3. Subsamples of homogeneous periods

Period Name	*Dates*	*Length of the period*
Period Before Crisis	2006 Q3 – 2008 Q3	9 quarters
Crisis Period	2008 Q4 – 2009 Q2	3 quarters
Period After Crisis	2009 Q3 – 2010 Q1	3 quarters

A question arises if these periods are truly characterized by different joint dynamics of key macroeconomic variables. We run Wald test and Likelihood Ratio (LR) test to check this out. For simplicity we present test statistics only for the trade balance regression:

$$\Delta TB_t = Const. + \alpha_{reer}\Delta REER_t + \alpha_{TB}TB_{t-1} + \varepsilon_t, \quad (3)$$

where ΔTB_t is a quarter trade balance change, adjusted to the GDP, $\Delta REER_t$ is a logarithm of the real effective exchange rate growth, TB_{t-1} is lagged value of trade balance, adjusted to GDP, α_{reer} and α_{TB} are parameters of interest, ε_t is macroeconomic shock in period *t*. Since other specifications give the similar test statistics, presented results are robust to model specification.

Table 4. Test statics for structural break tests (H_0: no structural breaks*)*

Periods to compare	*Wald stat.*	*LR stat.*
Before Crisis vs. Crisis	139.90 (0.000)	123.76 (0.000)
Before Crisis vs. After Crisis	13.30 (0.004)	12.51 (0.006)
After Crisis vs. Crisis	428.31 (0.000)	109.39 (0.000)

Note: p-values in parentheses.

The null hypothesis of the structural break tests states that coefficients in equation (3) are the same for two periods. The null hypotheses are rejected for all reasonable significance levels (Table 3). Thus the dynamics of variables differ for these three periods and we cannot join them to estimate parameters of interest. However critical values of the tests are underestimated since we choose crisis period by maximizing likelihood. In addition, test statistics for the structural break between non-crisis periods are low enough. This result may say in favor of the hypothesis that parameters are the same for non-crisis periods. That is why further, we also present results for non-crisis periods, which consist of period before crisis and period after crisis.

Average values of key variables are presented in Table 5. The comparison of non-crisis and crisis periods states that there was a significant capital outflow in a period of crisis. On average trade balance change was negative in non-crisis period, and positive in crisis period. Real effective exchange rate came down in crises and rose in non-crisis period. It is interesting to note that after the crisis, real effective exchange rate growth differ for before crisis and after crisis periods – on average it was 0.58% and 0.81% respectively. Interest rates dynamics were negative (the average decrease is 0.56% per quarter), while in non-crisis period, their change was close to zero.

Table 5. Average values of variables (all countries)

Variable	*Before Crisis*	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
ΔTB	-5.04	-1.81	-4.19	11.44	-0.81
ΔKA+ΔFA	4.85	2.18	4.17	-11.53	0.73
ΔCA	-4.06	-4.92	-4.27	11.34	-0.86
ΔR (%)	0.14	-0.41	-0.01	-0.56	-0.13
ΔREER (%)	0.81	0.58	0.75	-1.00	0.37

Average values of variables for two groups of countries – with floating exchange rate regime and with intermediate exchange rate regime – are presented in Tables 6 and 7 respectively. The average dynamics of trade balance, as well as the dynamics of current account, are almost the same for these two groups, irrespectively of the period we consider.

The distinguishing feature of most countries with one of intermediate exchange rate regimes is its high dependence on export. Tables 6 and 7 indicate high capital outflow in crisis period and especially for countries with floating exchange rate regime. This fact says in favor of hypothesis that reaction to shocks is higher for countries with floating regime, than for countries with intermediate regime.

The dynamics of real effective exchange rate for these two groups of countries are different as well. In pre-crisis period, countries with intermediate regime demonstrate higher growth of the exchange rate – 0.99% – while for countries with floating regime average growth were 0.51%. In crisis, exchange rate growth fell down to -0.43% and -1.91% for intermediate and floating regimes respectively. In post-crisis period, exchange rate dynamics were restored for countries with floating regime – its growth came to 1.66%. At the same time, in countries with intermediate regime, exchange rate continued to fall down by 0.09% per quarter.

Table 6. Average values of variables (countries with floating exchange rate regime)

Variable	*Before Crisis*	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
ΔTB	-1.95	-0.21	-1.48	10.92	1.18
ΔKA+ΔFA	8.68	-3.33	5.57	-16.81	0.70
ΔCA	-3.20	1.12	-2.11	13.06	1.21
ΔR (%)	0.08	-0.24	-0.01	-1.06	-0.24
ΔREER (%)	0.51	1.66	0.82	-1.91	0.24

Table 7. Average values of variables (countries with intermediate exchange rate regime)

Variable	*Before Crisis*	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
ΔTB	-7.03	-2.88	-5.93	11.77	-2.08
ΔKA+ΔFA	2.29	6.03	3.23	-8.01	0.76
ΔCA	-4.62	-8.98	-5.72	10.18	-2.24
ΔR (%)	0.19	-0.52	-0.01	-0.25	-0.06
ΔREER (%)	0.99	-0.09	0.7	-0.43	0.46

Analyzing the dynamics of interest rates, one may point out the tendency to decrease for both groups of countries. However, in crisis, the decrease of interest rate came to 1.06% per quarter for countries with floating regime. This decrease is four times as high as the average by all periods we consider. For countries with intermediate regime, the decrease of interest rates is not so dramatic. This may be explained by the fact that the sample consists of developing countries whose goal is to attract capital. That is why they try to avoid interest rates decrease, which may negatively affect investment image of the country.

3.3. Testing the BOP Effects

To detect differences in macroeconomic relations in crisis and non-crisis periods, we use simple linear models of trade balance and estimate them with OLS. Estimation results help to explain trade balance reaction to shocks of export, import and capital account.

We concentrate our attention to two interrelations. First, we estimate how exchange rate affects the dynamics of current account. And second, we estimate how interest rate affects the dynamics of capital account. Dependent variables in two corresponding regressions are trade balance change (ΔTB) and a sum of capital and financial accounts changes Δ(KA+FA) respectively. We include logarithm of real effective exchange rate growth (ΔREER) as an explanatory variable in the first regression and interest rate change (ΔR) – in the second regression.

It is obvious that economies of the countries in sample differ in scale. As a consequence, shocks both of capital and current account also differ in scale, or in other words have different variance. When estimating equations with OLS, this leads to the problem of heteroskedasticity.

The problem of heteroskedasticity is caused by differences in scales of economies and/or countries foreign trading activity. That is why to solve the problem and to obtain more effective estimates, we use weighted ordinary least squares. We use two ways of weighting – on GDP and on sum of export and import. But in the second case standard errors become higher (estimates are less precise). That is why we present estimates, obtained by weighting all observations on inverse to nominal GDP of 2009.

Trade balance and Exchange Rate

To reveal the influence of exchange rate on trade balance, we estimate the following linear model:

$$\Delta TB_t = Const. + \alpha_{reer}\Delta REER_t + \alpha_{TB}TB_{t-1} + \varepsilon_t . \quad (5)$$

The model has an autoregressive component – trade balance of the previous quarter – that is needed to take the so-called reversal effect into account. The reversal effect is a property of BOP dynamics that consists in its reversion to zero (or some average) level when it goes too far from this level. If this effect exists, we will see a negative estimate of the parameter α_{TB}.

A problem may arise if the trade balance series are not stationary. Formal tests state that trade balance series have unit root. But this result may be caused by a short length of the series that do not allow Dickey-Fuller test to reject null hypothesis. In this paper we consider trade balance series as stationary.

Panel character of the data implies the existence of individual effects of countries. In other words, we may assume that each country has its own stationary level of trade balance that may differ from other countries. In that case, taking first difference removes these individual effects from the regression equation, and the models we estimate are equal to the models with individual effects of trade balance. We do not present estimates of individual effects since they are not informative in the context of this research.

Tables 8, 9 and 10 present estimation results for the whole sample and for two groups of countries separately. These results allow us to say that:

a) the whole sample results confirm the hypothesis that exchange rate affects trade balance positively;

b) for countries with intermediate exchange rate regime, the estimate of coefficient at real effective exchange rate is significantly less than zero in crisis period, but larger than zero for non-crisis period;

c) for countries with floating exchange rate regime, exchange rate affects trade balance positively for all periods.

Table 8. Estimation results, trade balance regression (all countries)

Dependent Variable: ΔTB_t, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	-0.0000* [0.0003]	-0.0000 [0.0006]	-0.0000*** [0.0003]	0.0011 [0.0008]	-0.0000 [0.0003]
$\Delta REER_t$	0.0336** [0.0169]	0.1225*** [0.0222]	0.0736*** [0.0129]	0.0333** [0.0137]	0.0928*** [0.0090]
TB_{t-1}	-0.0100 [0.0088]	-0.0291 [0.0205]	-0.0210*** [0.0079]	-0.2380*** [0.0208]	-0.0652*** [0.0082]
R^2	0.01	0.19	0.06	0.57	0.16
Log likelihood	-4876.7	-1769.9	-6654.0	-1894.8	-8662.9
Number of observations	496	178	674	186	860

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

The estimates allow us to conclude that for countries with intermediate regime, changes in trade balance may push Central Bank to correct exchange rate.

It is worth noting that data support the hypothesis of reversal effect of BOP — estimates of the coefficient at lagged trade balance is significantly negative in both crisis and non-crisis periods. Thus, if trade balance goes too far from its average level, we may expect its reversal dynamics. And the more this deviation is, the more likely reversal will happen. The fact that the estimates are insignificant for some subsamples and some periods (pre-crisis and post-crisis) may be caused by small number of observations that leads to high standard errors.

Table 9. Estimation results, trade balance regression (countries with intermediate regime)

Dependent Variable: ΔTB_t, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	0.0033* [0.0017]	-0.003 [0.0029]	0.0024 [0.0015]	0.0064* [0.0037]	0.0047*** [0.0015]
$\Delta REER_t$	0.0844 [0.0627]	-0.455*** [0.0782]	-0.079* [0.0446]	0.4109*** [0.0511]	0.1727*** [0.0359]
TB_{t-1}	-0.035 [0.0299]	-0.087 [0.0614]	-0.012 [0.0286]	-0.385*** [0.0492]	-0.172*** [0.0266]
R^2	0.04	0.27	0.01	0.57	0.1
Log likelihood	-2924.9	-1053.6	-4010.1	-1129.4	-5197.9
Number of observations	304	107	411	114	525

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

Table 10. Estimation results, trade balance regression (countries with floating regime)

Dependent Variable: ΔTB_t, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	-0.0010*** [0.0005]	0.0000 [0.0005]	-0.001*** [0.0004]	0.0013 [0.0011]	0.0000 [0.0004]
$\Delta REER_t$	0.0293 [0.0211]	0.1637*** [0.0174]	0.0836*** [0.0150]	0.019 [0.0159]	0.0891*** [0.0110]
TB_{t-1}	-0.025** [0.0124]	-0.022 [0.0186]	-0.033*** [0.0103]	-0.236*** [0.0330]	-0.061*** [0.0118]
R^2	0.03	0.59	0.14	0.68	0.23
Log likelihood	-1924.9	-685.3	-2626.6	-739.1	-3432.5
Number of observations	192	71	263	72	335

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

When analyzing these results, one may suggest a hypothesis that different reaction of trade balance to exchange rate may be caused by different shocks (positive or negative), which came to these two groups of countries. In other words, if countries with intermediate exchange rate regime suffered from large positive shocks of trade balance and countries with floating exchange rate – from large negative shocks, we would expect the results, obtained above. In that case the negative impact of exchange rate is not necessary.

In order to verify this hypothesis, we include dummy variable for exchange rate regime – floating or intermediate – and estimate the equation on the whole sample. If the reaction to exchange rate in these two groups of countries is the same and differences are just a result of dissimilar shocks, then we may expect the significance of dummy variable. In this regression the coefficient at exchange rate regime denotes the difference in average values of shocks between countries with floating regime and with intermediate regime. Zero value of this coefficient is consistent with the hypothesis that average shocks are the same and monetary policy were truly different for these two groups of countries. In other words Central Banks react differently to the same shocks, depending on exchange rate regime.

The equation we estimate is:

$$\Delta TB_t = Const. + \alpha_{reer}\Delta REER_t + \alpha_{fl} floater + \varepsilon_t, \quad (6)$$

where *floater* is a dummy variable that takes zero value for countries with intermediate regime and unity for countries with floating regime.

In the period of crisis, exchange rate regime is insignificant. Thus the hypothesis about difference in average values of shocks is rejected and shocks are not the reason why reaction to exchange rate is different (Table 11).

Table 11. Estimation results, trade balance regression with dummy for exchange rate regime

Dependent Variable: ΔTB_t, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	0.0027** [0.0012]	-0.002 [0.0021]	0.0006 [0.0010]	-0.013*** [0.0033]	-0.002** [0.0011]
$\Delta REER_t$	0.0152 [0.0156]	0.1208*** [0.0222]	0.0610*** [0.0125]	0.0734*** [0.0159]	0.0907*** [0.0093]
Floater	-0.003*** [0.0012]	0.0024 [0.0022]	-0.001 [0.0011]	0.0202*** [0.0034]	0.0036*** [0.0012]
R^2	0.02	0.18	0.05	0.38	0.11
Log likelihood	-4873.8	-1770.3	-6656.9	-1929.5	-8689.6
Number of observations	496	178	674	186	860

*Note: *, **, *** –* significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

Capital Account and Interest Rate

To analyze the relation between interest rate and capital/financial account, we estimate following equation:

$$\Delta(KA+FA)_t = Const. + \Delta R_t + (KA+FA)_{t-1} + \varepsilon_t . \quad (7)$$

Estimates, obtained on the whole sample, support the hypothesis that Central Banks use interest rate as policy instrument in both crisis and non-crisis periods. Moreover in the period of crisis, the estimate of the coefficient at interest rate is twice as high as in non-crisis period – it equals 0.074 and 0.033 respectively (Table 12). When considering countries by exchange rate regime, estimates says about positive relation for countries with intermediate regime (Table 13), but do not reveal any dependence for countries with floating regime (Table 14).

Table 12. Estimation results, capital account regression (all countries)

Dependent Variable: $\Delta(KA+FA)_t$, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	-0.000* [0.0003]	-0.000 [0.0006]	-0.000*** [0.0003]	0.0011 [0.0008]	-0.000 [0.0003]
ΔR_t	0.0336** [0.0169]	0.1225*** [0.0222]	0.0736*** [0.0129]	0.0333** [0.0137]	0.0928*** [0.0090]
$\Delta(KA+FA)_{t-1}$	-0.010 [0.0088]	-0.029 [0.0205]	-0.021*** [0.0079]	-0.238*** [0.0208]	-0.065*** [0.0082]
R^2	0.01	0.19	0.06	0.57	0.16
Log likelihood	-4876.7	-1769.9	-6654.0	-1894.8	-8662.9
Number of observations	496	178	674	186	860

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

The estimates allow us to conclude that for countries with intermediate exchange rate regime, a shock of capital account may be a signal for Central Bank to correct interest rate in economy. At the same time, for countries with floating exchange rate regime there is no such a phenomenon. In other words, the hypothesis about interest rate to be a policy instrument in crisis period is not supported by the data.

Table 13. Estimation results, capital account regression (countries with intermediate regime)

Dependent Variable: $\Delta(KA+FA)_t$, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	-0.009** [0.0044]	0.0225*** [0.0071]	-0.001 [0.0035]	0.0221*** [0.0080]	0.005 [0.0032]
ΔR_t	0.0661*** [0.0130]	0.0047 [0.0171]	0.0449*** [0.0105]	-0.009 [0.0095]	0.0047 [0.0063]
$\Delta(KA+FA)_{t-1}$	-0.160** [0.0702]	-0.705*** [0.1667]	-0.194*** [0.0632]	0.0828 [0.0810]	-0.131*** [0.0489]
R^2	0.12	0.16	0.08	0.11	0.02
Log likelihood	-2764.3	-1027.9	-3806.7	-1201.2	-5028.2
Number of observations	251	96	347	108	455

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

Table 14. Estimation results, capital account regression (countries with floating regime)

Dependent Variable: $\Delta(KA+FA)_t$, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	0.0006 [0.0013]	0.0067*** [0.0023]	0.0012 [0.0012]	-0.019*** [0.0039]	0.0000 [0.0012]
ΔR_t	0.0013 [0.0022]	-0.092*** [0.0177]	0.0002 [0.0023]	-0.008** [0.0033]	0.002 [0.0017]
$\Delta(KA+FA)_{t-1}$	-0.331*** [0.0725]	-0.330*** [0.1230]	-0.313*** [0.0658]	-0.565*** [0.1335]	-0.272*** [0.0587]
R^2	0.12	0.34	0.09	0.32	0.08
Log likelihood	-1868.8	-752.3	-2637.8	-809	-3461.5
Number of observations	168	67	235	72	307

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

Here we also check the hypothesis about different shocks of capital account for countries with different exchange rate regimes. As we do above for trade balance regression, we estimate an equation with dummy variable for exchange rate regime:

$$\Delta(KA+FA)_t = Const. + \Delta R_t + floater + \varepsilon_t \qquad (8)$$

Estimation results are in Table 15.

Table 15. Estimation results, capital account regression with dummy for exchange rate regime

Dependent Variable: $\Delta(KA+FA)_t$, Weights: $1/GDP_{2009}$					
	Before Crisis	*After Crisis*	*Non-Crisis Period*	*Crisis Period*	*All Periods*
Const.	-0.001 [0.0041]	-0.004 [0.0069]	-0.001 [0.0035]	0.0239*** [0.0079]	0.0045 [0.0033]
ΔR_t	0.0026 [0.0020]	-0.064*** [0.0129]	0.0013 [0.0020]	-0.001 [0.0027]	0.0021 [0.0014]
Floater	0.0018 [0.0043]	0.0084 [0.0072]	0.0015 [0.0037]	-0.034*** [0.0082]	-0.005 [0.0034]
R^2	0.00	0.14	0.00	0.13	0.01
Log likelihood	-5303.1	-1807.2	-7123.9	-2021.5	-9160.5
Number of observations	479	163	642	180	822

*Note: *, **, **** – significance at 10%, 5% and 1% levels respectively. Standard errors in square brackets.

In crisis period, dummy for exchange rate regime is insignificant. Thus, different shocks are not a reason why reaction to interest rate was different. It supports the opinion that Central Bank reaction to incoming shocks was different and stabilization policy was different depending on exchange rate regime.

4. Concluding Remarks

This paper investigates BOP effects in the period of crisis of 2008-2009. Inference is based on two subsamples. First subsample consists of 40 countries with floating exchange rate regime. Second subsample consists of 38 countries with intermediate exchange rate regimes. The period of crisis – from IV quarter 2008 to II quarter of 2009 – is chosen as period with unusual dynamics of investigated variables.

Estimation results allow us to tell about differences in Central Bank policy for countries with different exchange rate regimes. For countries with one of intermediate regimes, data support the hypothesis about negative relation between trade balance and real effective exchange rate in the period of crisis. After crisis, this negative relation became even clearer. At the same time, for countries with floating exchange rate, this relation stayed positive.

The hypothesis of reversal effect is supported for both groups of countries – if trade balance goes too far from its average level, we may expect its reversal dynamics.

The results for capital and financial account confirm the main conclusion – Central Bank policy is highly influenced by exchange rate regime of the country. In crisis, statistically significant relation between capital account and interest rate is observed only for countries with intermediate exchange rate regime.

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