Does the contagion effect of the Balance of Payment crisis exist?

Ukrainian case

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Abstract. This paper aims at discussing and testing hypotheses about the contagion effect of the Balance of Payment (BoP) crisis on Ukrainian data. A review of the last highlighted discussions about the contagion effect and its impact on economy by applying traditional or spatial econometrics technique is made in paper. The main innovation of this paper is an attempt to test the contagion effect for Ukraine. Observing the evolution of the BoP crisis from the 1990s up to now, it is clear that the contagion effect becomes a main trigger of crisis. In order to measure the impact of the contagion effect on crisis, the exchange market pressure index (EMPI) is calculated for Ukraine and its main partner countries. Estimation output shows that impact from the neighboring countries on Ukraine is much stronger during and after crisis episodes than before. Another approach based on received impulse function after VAR model estimation presents impact of the contagion effect.

In-sample forecast of the EMP index of Ukraine, based on different specifications, supports an idea about including external factors that help to express influence of the contagion effect. Finally, paper shows that contagion effect is one of the main triggers of the Balance of Payment crisis. Today the BoP crisis could not embrace just one country, and it becomes at least a problem for the whole region.

Keywords: Balance of Payment crisis, contagion effect, exchange market pressure index, etc

JEL Codes: F47, E47

1. Introduction

International trade growth with simultaneous increase of financial flows between countries creates conditions for economic growth, more efficient cooperation and allows involving more investments. Nowadays, it is hard to imagine any successful economy without being deeply integrated internationally. At the same time, deeper cooperation creates additional risk of contagion, especially it falls within the Balance of Payment (BoP) crisis. Strong international cooperation, trade and financial in-and outflows regulated by administrative tools could cause misbalances in the external sector. As usual, these misbalances can be regulated by market mechanisms or administrative tools. The probability of the Balance of Payment crisis increases when external misbalances are too big, the external pressure growth and it is strengthened by price, political or some other shock. Impacts of the Balance of Payments crisis vary a lot: one just can cause a decrease in international reserves without impact on macroeconomic equilibrium; another could be resulted in national currency devaluation and can be a trigger of financial and banking crisis. The main challenge for
researchers who examine the BoP crisis is determination and estimation of main factors of the crisis. The Balance of Payment crisis is relatively new because of the globalization impact, but old as they are based on economic fundamentals. At the same time evolution of the BoP crisis shows weakening of fundamentals and strengthening of contagion effect as the main factor of the crisis. It means that any country anymore cannot protect itself from the BoP crisis by its own policy, they should minimize impact of the contagion effect.

Estimation and modeling of the BoP crisis spreading faced a problem that there is no universal definition of this process (Favero, Giavazzi 2002). The definition “contagion effect” is borrowed from medicine science guided by the idea that currency crises elsewhere in the world can spread among countries like a contagious disease. Contagion effect differs from interdependence by fact that impact thought traditional links during crisis period occurs much stronger than during tranquil period. But links cannot be formalized during the crisis period like in tranquil so it is much harder to measure contagion effect.

2. Evolution of the BoP crisis

Before starting discussion about the contagion effect of the Balance of Payment crisis and channels of its spreading, I would like to show brief evolution of the Balance of Payment crisis. From the 1990s the world has witnessed three typical BoP crises. During the autumn of 1992, a wave of speculative attacks hit the European Monetary System and its periphery. Before the end of the year, five countries (Finland, the UK, Italy, Sweden and Norway) had floated their currencies. Despite attempts by a number of countries to fix the European Monetary System by devaluation (in Spain, Portugal and Ireland), the system was unsalvageable.

The Latin America crisis started in 1994, when Mexican peso was attacked and floated shortly after an unsuccessful devaluation. Argentina, Brazil, Peru and Venezuela could not pass up the Balance of Payment crisis. But not all Latin countries were attacked — Chile was the most visible exception. While there was little devaluation, the attacks were not without effect. Argentina macroeconomic policy in particular tightened dramatically precipitating a sharp recession.

The “Asian Flu” began with continued attacks on Thailand in the late spring of 1997 and continued till the July 1997. At the beginning crisis had attacked Malaysia, the Philippines, and Indonesia. Hong Kong and Korea were attacked somewhat later, the crisis then spread across the Pacific to Chile and Brazil. The contagion effect lingered on until at least the flotation of the Brazilian real in January 1999. All three waves of attacks were largely regional phenomena. Once a country had suffered a speculative attack – Thailand in 1997, Mexico in 1994, Finland in 1992 – its trading partners and competitors were disproportionately likely to be attacked themselves. Not all major trading partners devalued – indeed, not all major trading partners were even attacked.

The another example of the Balance of Payment crisis, that occurred in a frame of the Global financial crisis was sharp devaluation in a list of emerging countries in 2008 – Poland, Ukraine etc. The price collapse in commodity markets simultaneously with capital outflow due to liquidity tightening cause the Balance of Payment crisis in emerging countries. It resulted in sharp devaluation that became a trigger of the banking and debt crisis.

Evolution of the Balance of Payment crisis during the last decades shows a lot of changes. Compare with beginning of 1990s where fundamentals and self-behavior were the main triggers of the BoP crisis, contagion effect was discussed as the main driver after the Asian crisis. It is a reason why this paper aims on examine hypothesis that contagion effect exists.

The literature review shows different approaches and evolution of the understanding what constitutes the contagion effect. Despite of the pleiad of researchers examining the question of contagion in different
For volatility observations, this problem is addressed using a limited information technique developed by Rigobon in 1999. He stressed the importance of two steps: identifying the channels through which shocks are normally propagated across markets (e.g., Baig and Goldfajn, 1998; Forbes and Rigobon, 1999; Rigobon, 1999). The wake of expected devaluations, leading to actual devaluations, might help to understand contagion. First, self-managers may generate contagion effects. Loisel and Martin (2001) provide a theoretical framework to gather information and by increasing the cross-market correlation coefficient is a biased measure to identify contagion. Secondly, the political nature of the exchange rate regime might help to understand contagion. Feldstein (1997) argues that the political and economic objectives in Europe are actually conflicting. Drazen (1999) identifies two types of political factors that might help to understand contagion. Firstly, incomplete information about government objectives and the political nature of the exchange rate regime could be a potential explanation to the appearance of speculative attacks. Secondly, if maintaining a fixed exchange rate is tied together with achieving political integration within members of some international union then devaluation by one member will increase speculative pressures on the others.

Masson (1998) redefines the contagion suggesting that ‘true’ contagion is possible only in context of multiply equilibrium. Forbes and Rigobon (1999) take a more econometric based approach to show that the cross markets correlation coefficient is a biased measure to identify the contagion. Calvo and Mendoza (2000) argue that globalization of securities markets may promote contagion by reducing incentives in order to gather information and by increasing the number of arbitrary market portfolios. Herd behavior by portfolio managers may generate contagion type of effects. Loisel and Martin (2001) provide a theoretical framework where self-fulfilling expectations are generating a currency crisis when workers demand higher wages in the wake of expected devaluations, leading to actual devaluations.

Assumption about non-linear connection during contagion was tested in a number of recent papers (e.g. Baig and Goldfajn, 1998; Forbes and Rigobon, 1999; Rigobon, 2000). Most of papers proceed in three steps. First, the channels through which shocks are normally propagated across markets are indentified. Rigobon in 1999 has stressed the importance of modeling interdependence to avoid a spurious detection of contagion: the same argument applies to the detection of non-linear interdependence. Rigobon (2000) solves this problem using a limited information technique constructed by splitting the sample into high- and low-volatility observations (Favero, Giavazzi 2002).

We can discuss the contagion effect during currency crisis in case it spreads from the initial target, for any reason. There are at least two different types of explanations why the contagion spreads when
Transmission mechanisms are not mutually exclusive. The first relies on macroeconomic or financial similarity. A crisis may spread from the initial target to another if the two countries share various economic features such as weak banking systems, over-valued exchange rates or inadequate reserves. Currency crises may be regional if macroeconomic features of economies tend to be regional. The alternative view is that devaluation gives a temporary boost to a country in its competitiveness, in the presence of nominal rigidities. In this way, a currency crisis that hits one country (for any reason) may be expected to spread to its trading partners (Glick, Rose 1999).

Also, researchers paid special attention on estimation techniques. McMillen (1992) proposes an EM-algorithm based estimation procedure. The idea is to replace the latent continuous variable with its expected value and then to apply standard well-established continuous variable spatial methods, for example, maximum likelihood estimation. Pinkse and Slade (1998) develop a generalized method of moments (GMM) based on procedure applicable only to spatial error models. Similarly to McMillen (1992), LeSage (1999) also replaces the latent continuous variable with its expected value, solving thereafter a spatial continuous model with a Gibbs sampling approach. Following the work of Vijverberg (1997) on the simulation of multivariate normal probabilities of high-order dimension, Beron and Vijverberg (1999) extend the original approach, recursive importance sampling to probit models in spatial contexts.

3. Structure of the contagion effect

The review of papers dedicated to the contagion effect shows multiplicity of approaches in modeling contagion. Despite of absence of unique definition of the contagion effect, majority of scientist agree about the general structure of transmission mechanism in contagion effect. Generally, they can be grouped into two categories: financial interdependence and real interdependence. At least two different causes can lead to financial interdependence. Firstly, a crisis may be transmitted due to direct financial linkages because financial institutions may have large cross-border holdings. Second, indirect financial linkages, in particular presence of a common lender and decisions by institutional investors, recently received a lot of attention. A crisis in one country may induce a common lender to call loans and refuse to provide new credit, not just to countries that have already experienced a crisis but also to others, thus spreading the crisis across countries (Caramazza, Ricci and Salgado 2000). Similarly, institutional investors may be forced to withdraw their funds not only from a crisis country but also from other markets in order to raise cash for margin calls and to rebalance portfolios (Kodres and Pritzker 1999).

Another channel - real interdependence, it can either be explained through bilateral trade or through trade competition in third markets. Crisis in one country is more likely to spread to another economy if they both have a large degree of bilateral trade (income effects) or are strong competitors in third markets (price effects). Gerlach and Smets (1995) provided a theoretical model analyzing these links, while Eichengreen, Rose and Wyplosz (1996), Glick and Rose (1999), and Fratzscher (1998) found some empirical evidence of real linkages importance in spreading recent crises across markets.

Another paper (Frexedas, Vaya 2005) presents more detailed structure that consists from five channels of contagion: the first one is derived from the common shock, the second one occurs as a result of similarity in economic fundamentals in different countries, the third contagion link originates from the trade relationships, the fourth - from the political links between countries, and the fifth - from the financial links between countries.
4. Does Contagion Effect exist in Ukraine? Estimation

The main practical contribution of the paper is to verify assumption whether contagion effect has impact on Ukraine. As it is mentioned above contagion effect means breaking traditional links that work during tranquil period and establishing some another transmission mechanism where impact from the external sector increases a lot. Before making analyses of the Balance of Payments crisis and impact estimations of the contagion effect, we should formalize what is this particular crisis and how it can be measured.

The key research question is identification of the dependent variable for investigation and estimation of econometrics models. In papers related to the first and the second generations of the BoP crisis exchange rate devaluation is considered to be the BoP crisis. But nowadays it became not so easy to answer the question what is the BoP crisis in condition when policy of monetary targeting passed away and central banks more often abandon the exchange rate targeting. Change in interest rate would be more reliable signal about the BoP crisis than changes in exchange rate in countries where policy of inflation targeting was implemented. During the speculative attack, governments of emerging countries should decide very often to devaluate exchange rate or to spend reserves on its support on the market. The one of two scenarios would be selected depending on quantity of reserves and political factors (how soon elections would come, commitment before international organizations etc.).

In order to solve this problem in early 1990s, researchers widely started to use the Exchange Market Pressure Index (EMPi). In table 1, you can see two modifications of the EMP indexes used the most widely. The first one is a change in reserves and exchange rate. It is often used in models for emerging countries where interest rate is a weak transmission channel and this instrument does not increase accuracy of results. The second one consists from three components: exchange rate, international reserves and interest rate. This approach is efficient for countries with inflation targeting or where interest rate varies a lot.

Table 1. Components of the Exchange Market Pressure Indexes

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<tr>
<th>EMPi Components</th>
<th>Authors</th>
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Graphic analysis shows that exchange market pressure that includes interest rate could formalize the BoP crisis on Ukrainian data more precisely than without it. The index is estimated according to the formula

\[ EMP_{i,t} = \frac{1}{\sigma_{rm}} \frac{\Delta r m_{i,t}}{r m_{i,t}} - \frac{1}{\sigma_{e}} \frac{\Delta e_{i,t}}{e_{i,t}} - \frac{1}{\sigma_{i}} \frac{\Delta i_{i,t}}{i_{i,t}} \]

where \( rm_{i,t} \) – reserves of the National bank of Ukraine in international currency;
\( \sigma_{rm} \) – standard deviation of reserves of the National bank of Ukraine;
\( e_{i,t} \) – real effective exchange rate;
$\sigma_e$ – standard deviation of REER.

$i_{i,t}$ – interest rate of the interbank market

$\sigma_i$ - standard deviation of the interest rate of the interbank market

To model the Exchange Market Pressure Index, typical model is used. It includes fundamental changes, changes on commodity markets and in partner countries (Fratzscher, 2002). The general model is presented below:

$$EMP_{UA} = \beta_0 + \beta_1 EMP_{RUS} + \beta_2 EMP_{PLN} + \beta_3 us\_interest\_rate + \beta_4 * CRU\_steel\_index + \beta_5 * WTI + \beta_6 * CPI + \beta_7 CA + \beta_8 * GDP + \beta_9 * PFTS + \beta_{10} * interest\_rate + \beta_{11} * cred + \varepsilon$$  

where $emp_{rus}$, $emp_{pln}$ - Exchange Market Pressure Index calculated for Russia and Poland that shows impact of crisis from neighboring countries;

3 month LIBOR interest rate is taken to include interest rate of the USA - one of the main market players on the global level;

CRU index represents trend on the metal market that is important for Ukraine as export-oriented country where metal export has the highest share;

WTI price is an indicator of the commodity market energy sources. High energy consuming of Ukrainian industry means that volatility of energy prices impacts on Ukrainian import as well;

Current account deficit measured as percentage from GDP is an indicator of the external position strength;

CPI, interest rate and GDP represent fundamentals and internal economic state;

PFTS index shows how attractive our market is for foreign investors.

Three models are used to test hypothesis about significance of contagion effect and impact of external sector. All independent variables mentioned in approach (2) are used in the model one. The model two contains only internal factors; model three contains internal factors and commodity market indicators without impact of partner countries. The estimation is presented in the Table 2.

According to Schwarz criterion, model one that includes all groups of factors gives the most precise results. The model 1 does not vary a lot from model 3 which differ just by partner country’s EMPs. Both of them demonstrate higher accuracy of estimation than model 2 based only on fundamentals. Picture 1 presents in-sample forecast of the Exchange Market Pressure Index based on models analyzed above. The forecast is done on the sample 2007.04-2012.12. We conclude that model 2 does not fit the reported value of the exchange market pressure well. It shows necessity to include external factors and EMPs of partner countries to the model.

Table 2. Estimation output

<table>
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<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
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<tbody>
<tr>
<td>$EMP_{Russia(-2)}$</td>
<td>$-0.18$</td>
<td>$0.09$</td>
<td></td>
</tr>
<tr>
<td>$EMP_{Poland}$</td>
<td>$0.10$</td>
<td>$0.10$</td>
<td></td>
</tr>
<tr>
<td>$EMP_{UA(-1)}$</td>
<td>$0.20$</td>
<td>$0.13$</td>
<td>$0.47$</td>
</tr>
</tbody>
</table>
Despite model 1 works in the best way, model 3 also can be used for EMP index forecasting. It means that importance of EMP indexes of partner countries is not crucial in general model. So we can conclude about strong links of external sector and propensity to crisis. Estimation the model with EMP indexes of partner countries do not help to improve prediction power, but variables are significant with 10% interval. It shows that shocks on commodity markets or change of investor’s expectation impact all countries almost simultaneously.

Table 3 contains estimation results of the model composed only by the EMP indexes of partner countries only as independent variables in order to check hypothesis about significance of partner country’s impact on Ukraine. Estimations made on different sample period. Model estimation on the whole period shows (Table 2) that EMP indexes of Poland and Russia are significant for Ukraine. In contrary, impacts of the European Union EMP index and the US interest rate are not significant. It is important to note that running the same model on the sample before crisis shows that all independent variables are insignificant. But even EU exchange market pressure and US interest rate are significant during crisis period. P-value of the Polish and Russian Exchange Market Pressure Index increases in the same way as coefficients proving the fact that impact of partner countries becomes much stronger during crisis. The fact that EMP indexes of
partner countries are insignificant during tranquil period and become more significant during crisis shows that contagion effect has strong impact on Ukraine.

Table 3. Estimation output, model based only on EMP indexes of partner countries

<table>
<thead>
<tr>
<th></th>
<th>All periods</th>
<th>Before crisis</th>
<th>During and after crisis</th>
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<tbody>
<tr>
<td>EU(-2)</td>
<td>0.05</td>
<td>0.42</td>
<td>-0.09</td>
</tr>
<tr>
<td>PLN</td>
<td>0.14</td>
<td>0.01</td>
<td>0.09</td>
</tr>
<tr>
<td>RUS</td>
<td>0.15</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>EMPUA(-1)</td>
<td>0.38</td>
<td>0.00</td>
<td>0.24</td>
</tr>
<tr>
<td>D(USA 3M, I(-2))</td>
<td>0.42</td>
<td>0.26</td>
<td>-0.04</td>
</tr>
<tr>
<td>Schwarz criterion</td>
<td>3.20</td>
<td></td>
<td>3.15</td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>2.04</td>
<td></td>
<td>2.10</td>
</tr>
</tbody>
</table>

The impulse function was estimated to measure and analyze the strength of impact. The Vector Auto Regressive model (VAR) has been built on the EMP index of Ukraine, Russia and Poland. The stationary of indexes is proved by Dickey-Fuller test. VAR model contains two lags. Impulse reaction from 1 standard deviation shock from Russian EMP index cross “0” few times and cannot be analyzed. Because of crossing confidence band impulse function of Russia 1 standard deviation shock cannot be useful. The impulse function of 1 s.d shock of Polish EMP does not cross confidence band and could be observed on the picture below (Fig. 2).

![Impact of 1 S.D of Polish EMP on Ukraine EMP](image)

**Fig. 2 Response of Ukrainian EMP on the 1.s.d shock of Polish EMP**

5. Conclusion

The problem of examining contagion effect is still actual for all emerging countries. Therefore, Eastern Europe is not an exclusion in this list. Deep integration of Eastern European countries via trade links and foreign capital entry to banking and real sectors makes such emerging countries as Ukraine, Poland, Romania etc. more disposed to be "infected" by the contagion effect of the Balance of Payment crisis. Evolution of the BoP crisis shows that economic fundamentals don't play leading role in its prediction.
anymore, but investor’s behavior and inflow of capital is closely connected with world conjuncture. As a result, the BoP crisis in partner countries could cause the contagion effect and the regional BoP crisis.

This paper proves that contagion effect has impact on Ukraine. Existence of contagion effect is proved by the fact that there is no impact of crisis in partner country during tranquil period in comparison with clear response of the Ukrainian EMP index to the one standard deviation shock of Polish EMP index during crisis period. But regression analysis proves that exclusion of partner countries allows to estimate the EMP index as well as without using this exclusion. The main trigger of the BoP crisis is a price shock on commodity markets. In Ukrainian case decline of ferrous metal prices could be a trigger as well as liquidity turbulences in developed countries accompanied by interest rate increase. It makes an Ukrainian sector not so much attractive for foreign investors as during tranquil period.

All this evidence shows that any shock of partner countries (especially EU members) would have impact on Ukraine with high probability during crisis period. Simultaneously, the danger of importing the BoP crisis to Ukraine from partner country is low if it is not global and is not caused by price decline on commodity markets. Therefore, it makes no sense to develop the Early Warning System for monitoring the EMP indexes of partner countries. Moreover, main attention should be given to commodity markets and liquidity issue because contagion effect occurs and can be crucial just during crisis period. Usually, institutions will apply administrative tools anyway during crisis that allows to decrease the negative impact from neighbour countries.

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5. References


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