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Alexei Medvedev

International investors, contagion and the Russian crisis

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Alexei Medvedev

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Abstract

This paper provides detailed empirical assessment of the role of non-residents in the development of the Russian financial crisis in 1997-1998. We establish that non-residents behaved differently during the crisis and significantly contributed to the collapse of the state bonds market. In particular, we find that contagious selling on the part of foreign investors caused the sharp downturn in May 1998 in the wake of the Indonesian crisis. At the same time, however, we question the commonly held view that non-residents were largely responsible for market pressures at the initial stage of the crisis. The paper also includes an alternative explanation of contagious outflow of foreign capital. We combine CAPM and findings of Forbes and Rigobon (2001) to show that international portfolio investors are more sensitive to pure external shocks than pure domestic ones.

Keywords: Currency crises, foreign investors, Russian financial crisis, CAP model

1 Introduction

The Russian financial and currency crisis has been extensively studied by Russian and Western economists.[1] Researchers typically refer to the multi-dimensional character of the crisis, noting factors ranging from institutional weaknesses of Russian economy to inconsistencies in domestic fiscal and exchange rate policies. The two most popular themes on the major causes of Russian crises are exchange rate misalignment and debt crisis. Montes and Popov (1999), for example, argue that the strong ruble was a major obstacle to economic growth and led to deterioration of exports, the volume of which decreased in 1997 for the first time during transition. The IMF, on the other hand, attributes the Russian crisis to the excessive burden of public debt in the form of short-term securities (IMF WEO December 1998, p. 18). The conclusion is that the Russian crisis was a "first generation" currency crisis caused by a fundamental inconsistency between domestic fiscal policy and a fixed, or managed, exchange rate that ultimately led to speculative attack on the national currency. Classical first-generation models imply that foreign reserves gradually decline to a level that invites speculative attack. In Russia's case, however, issue of short-term state bonds obscured the depletion of the currency reserves and fundamentals did not solely determine the timing of the crisis.[2]

Despite the diversity of views, there is wide acceptance that the Russian crisis had an important international aspect. The general belief is that non-residents strongly contributed to the collapse of Russian financial market and that liberalization of the domestic market was a crucial mistake. Starting from the end of 1996, the Central Bank of Russia (CBR) relaxed restrictions on capital transaction for non-residents, which led to a massive inflow of foreign capital into state bonds (the GKO-OFZ market). By the end of 1997, the share of non-resident holders of state bonds reached 40% (excluding CBR) and was sufficient to allow them to influence market conditions. Empirical evidence on the role of non-residents in precipitating Russian crisis is still incomplete, however. Medvedev and Kolodiajnyi (2001) provide a limited comparison of the behavior of residents and non-residents during the period of crisis, but our results are inconclusive as to whether foreigners significantly contributed to the collapse of the GKO-OFZ market. Novikov (1999) studies the importance of different types of risk of Russian securities to the investment decisions of foreigners, but provides no comparison between do-

mestic and foreign investors. Moreover, the paper focuses solely on the pre-crisis period.

The main purpose of the present paper therefore is to provide an empirical assessment of the role of non-resident investors in bringing about the Russian financial crisis. We further hope to contribute to the discussion on the costs and benefits of financial integration for emerging markets. A unique database of daily investors' transactions covering a long period before the crisis provides the basis for our empirical study.[3] The results suggest that non-residents behaved differently than residents, and significantly contributed to the development of the crisis. In particular, we found that contagious selling by foreign investors caused the near collapse of the bond market in May 1998. We question, however, the common view that non-residents were largely responsible at that time for the market pressures in the initial stage of the crisis.

The paper also includes a discussion of possible explanations of our main findings. Based on the existing literature, we suggest that a change in sentiment ("wake-up call") may explain the destabilizing behavior of non-residents. It is widely held that a crisis in one emerging economy will induce investors' reassessment of other countries' perspectives. We propose an alternative argument, also consistent with data, whereby the contagious outflow of foreign investment, although it looks like a sudden change in sentiment, may in fact reflect the natural difference between local and international investors. We argue that international portfolio investors are typically more sensitive to external shocks and less sensitive to pure domestic shocks.[4] Forbes and Rigobon (2001) showed that higher volatility of one of two markets naturally results in higher correlation between them. We develop this argument using CAPM to show that increase in global market volatility results in outflow of international portfolio investors from risky markets.

The rest of the paper consists of two parts. First, we present an empirical study that focuses on the behavior of non-residents in the state bond market before and during the crisis. It employs a variety of statistical techniques to assess significance of observed regularities including two event studies of extreme cases, which provide essential results. The test of the effect of the crisis on the difference in behavior between residents and non-residents is rather technical, and non-specialist readers are free to skip this part of the discussion. We employ an empirical model of investor behavior similar to that proposed by Welch (1999) to test for herding behavior among market ana-

lysts. It appeared that this model could be also used to compare behavior of two groups of market participants. The second part of the paper is divided into two subsections. The first subsection reviews various arguments proposed by existing literature to explain destabilizing behavior of foreign portfolio investors and their relevance to the Russian bond market. The second section presents a formal framework to provide an alternative explanation of contagious outflow of foreign investment. We discuss its implications and relevance to the Russian case.

2 Empirical study

The empirical part of the paper focuses on the behavior of non-residents in the GKO-OFZ market before and during the financial crisis. We start with an analysis of the time path of several market indicators and provide general information about the evolution of the crisis. We then describe and test an empirical model of investor behavior. Our primary purpose is to test the effect of the crisis on the difference in behavior between residents and non-residents. Event studies differ in definition of extreme events. We first consider episodes (days) of largest gross sales by non-residents, then focus on episodes (time intervals) of largest price adjustment during the crisis period.

2.1 General observations

The Asian crisis of 1997 rocked financial markets globally. Surprisingly, world financial turmoil did not significantly affect Russia until the crisis reached industrial economies and dragged down the US and European stock markets at the end of October 1997. Indeed, the exchange rate pressures in emerging markets of the Eastern Europe in May 1997 and the sharp decline of stock markets of ASEAN-4 countries in July 1997 did not cause a loss of confidence in the Russian economy. At the end of August, the interest rate on short-term state bonds (GKOs) was at a historical minimum of 13% (see Fig. 1). The sudden sharp decline of financial markets across the world at the end of October 1997 followed renewed turbulence in Asian markets and led to pressures in domestic financial markets. The CBR expended about USD 5bn of its foreign reserves on interventions in the bond market and foreign exrkets. change markets.

Non-residents were first officially allowed to invest in Russian state bonds at the end of 1996. However, it was not until early 1998 that all restrictions were lifted. During the first three quarters of 1997, the inflow of foreign capital into the state bond market amounted to USD 15bn and the share of non-residents reached 40% (CBR excluded). The portfolio of non-residents was highly concentrated within relatively small group of leading investment banks, of which Credit Suisse First Boston was by far the largest holder. Indeed, the role Credit Suisse First Boston among non-resident investors was analogous to that of Sberbank, the dominant force among local market participants. The CBR managed the liquidity in the GKO-OFZ market, smoothing the yield curve or interest rate differentials between long and short-term issues. Starting from 1998, the task of liquidity management was delegated to primary dealers. These were leading Russian banks responsible for maintaining the liquidity of specific issues. At the same time, they enjoyed access to additional CBR refinancing facilities.

In Fig. 2, we show the time path of the market ratio of non-residents[5] (*SHARE*) and *DUR*, the share of non-residents whose portfolio had shorter average maturity (duration) than the median value across all investors in the sample. *DUR* measures the difference in the structure of portfolio between residents and non-residents. In the case of no difference, the value of *DUR* is expected to be insignificantly different from 0.5. If we denote the number of non-resident holders of state bonds as n, then the 90%-fluctuation band for *DUR* is $0.5 \pm 1.65\frac{0.5}{\sqrt{n}}$.[6] In order to assess the significance of the difference in portfolio duration between residents and non-residents, we also show this fluctuation band in Fig. 2.

As can be seen from the graph, the share of non-residents increased dramatically during the first half of 1997. It also rose immediately before the Asian contagion of October-November 1997. Perhaps surprisingly, the share of non-residents did not decrease between October 1997 and August 1998, and even had slight upward tendency. The only evidence of an outflow of foreigners is in several spot decreases in the share of non-residents during the crisis period. These occasions are marked with the numbers 1, 2, 3 and 4. The single case of sharp increase in the share is marked with number 5. The fact that we observe only short-run adjustments in the share of non-residents during the period of crisis provides little information about the role of foreign

investors. Therefore, we include the two event studies that follow this section to clarify the role of foreign investors.

Comparison of duration of residents' and non-residents' portfolios reveals several interesting facts. During the period of crisis, residents and non-residents tended to have more similar portfolio structures than before the crisis. Partly, this is explained by CBR buying of long-term bonds in November-December 1997, which significantly reduced the range of terms. As evident from Fig. 2, during first half of 1997 non-residents increased their exposure mainly in long-term securities. The data suggest that both non-residents and residents increased their demand for long-term bonds, which was satisfied by CBR selling of its OFZ-PD portfolio.[7] Initially, non-residents held lengthier portfolios, which is reflected by the high value of *DUR* in the second quarter of 1997. The growth in the duration of the non-residents' portfolio eventually halted, while residents continued to lengthen their portfolios and ultimately ended up holding comparatively longer issues. In Fig. 2, we note a sharp decrease in *DUR* during the first half of July 1997. This seems to be the only impact of the crisis of ASEAN-4 countries on the Russian state bonds market.

Following financial turbulence of October-November 1997, both non-residents and residents reduced the maturity of their portfolios and the gap essentially vanished. As noted, this may partly be explained by the smaller range of securities after the CBR intervened in the long-term segment of the market. The gap again widened at the end of March 1998 after the forced resignation of the government generated political uncertainty (see Fig. 2). Surprisingly, it was not foreigners who turned pessimistic, but rather residents who turned overoptimistic. The finance ministry managed to place long-term bonds via primary auctions mainly among residents who probably expected their prices to go up significantly after the resolution of the political crisis. With the turbulence of May 1998, the maturity of residents' portfolio again converged to that of non-residents. The gap was insignificant throughout the remaining period (see Fig. 2).

2.2 Behavior of non-residents before and during the crisis

Before going over to the event study, we take advantage of the available high-frequency data to provide a general rigorous comparison of behavior of

residents and non-residents in the secondary market for state bonds. In particular, we want to know if non-residents behaved differently than residents, and if this difference was more pronounced during the period of crisis than before. The data also allows us to investigate the effect of events in external capital markets on the behavior of non-residents. For this purpose, we apply an empirical model that incorporates the measure of the difference in behavior between residents and non-residents as an unobserved time-dependent parameter.

During each trading day, every participating non-resident investor can be described as a net buyer or a net seller. These two states are assigned indicators 1 and –1, respectively. We assume that investors that did not participate in the trade during the day did not reveal their states. This approach differs from that adopted in Medvedev and Kolodyazhny (2001), where an investor was assumed to be a "net buyer," "net seller" or "indifferent." The drawback of the latter approach is that one has to take into account the difference in trading activity between various market participants. One also has to restrict the focus to investors that held a non-zero GKO-OFZ portfolio throughout the period under investigation.

Since actions of investors during two consecutive days are not independent, we consider the transition from one state to another between two consecutive days as a basic observation. By doing so, we model non-residents' behavior as the two-state Markov process. This approach is similar to the use of first differences in linear regression to eliminate autocorrelation of residuals. By assumption, there exists a matrix of unconditional transition probabilities $\{p^0_{ij}\}$ (i,j =-1,1 – state indicators) that contains information about time correlation of non-residents' actions and is analogous to the covariance matrix of residuals in linear regression. For z_t, we denote the average action of resident investors (dealers) defined as an average of state indicators across all residents that revealed their states during this day. This variable takes a value in the range (-1,1) and measures the trade tendency of resident investors. If non-residents' behavior does not differ from residents' then we expect that non-residents had a stronger tendency to buy than suggested by general regularities if $z_t > 0$, and vice versa when $z_t < 0$. By "general regularities" we refer to the matrix of unconditional probabilities, which suggests some general picture of investors' actions, taking into account their states in the previous day. If non-residents behaved differently and even tended to follow polar strategies, then we expect that the relationship is not significant and even

negative. To formalize this approach, we introduce the following specification of the functional relationship between the probability of transition from state *i* in day *t-1* to state *j* in day *t* (p^t_{ij}) and z_t:

$$p^t_{ij} = \frac{p^0_{ij}\left(1+(z_t - j)^2\right)^{-\theta_t}}{p^0_{i1}\left(1+(z_t - 1)^2\right)^{-\theta_t} + p^0_{i-1}\left(1+(z_t + 1)^2\right)^{-\theta_t}} \quad (1)$$

The time-dependent parameter θ_t measures the tendency of non-residents to match the behavior of resident investors. It should be noted that this model does not test for the influence of the behavior of residents on the actions of non-residents. It only provides a measure of the empirical relationship. According to (1), greater θ_t implies a stronger positive relationship. If $\theta_t < 0$, then non-residents and residents were generally on different sides of the market. This form of functional relationship is adopted from Welch (1999), who used it to test for herding behavior among security analysts. However, the substance of our approach is different. Welch (1999) investigates the tendency of market analysts to follow an observed consensus (average prediction), which is consistent with a hypothesis of herding behavior. In our paper, we employ the same methodology for measuring the empirical, rather than direct, relationship between strategies of residents and non-residents. To fit the model to our purposes, we assume a deterministic equation for parameter θ_t:

$$\theta_t = \theta_0 + \theta_1 D_t \quad (2)$$

D_t takes zero value before the crisis and takes unit value afterwards. If coefficient θ_0 proves to be significantly negative or insignificant, then we can conclude that non-residents behaved differently before the crisis. Since we lack a benchmark value to compare against, in case of its positive significance we will say that there is no evidence of such a difference. Irrespective of the value of the intercept, negative significance of the coefficient before the crisis dummy will evidence increased difference during the period of crisis. Again, we use the same methodology of estimation as Welch (1999). First, we determine unconditional probabilities by calculating their sample values based on all available observations of transitions for the sample of non-residents in the database. We then estimate coefficients of the model by maximizing the following likelihood function:

$$L = \prod_{t} \prod_{i \to j} p_{ij}^{t} \quad (3)$$

For each observable transition, p^t_{ij} is calculated from (1). Significance of estimates of coefficients will be tested using the asymptotic property of maximum likelihood estimates:

$$-2(\ln(L_R) - \ln(L_{UR})) \approx \chi^2(r) \quad (4)$$

Where r – the number of restrictions. Welch (1999) showed that estimates of coefficients are unbiased.

Phase IV of the Asian crisis, which had an impact on the GKO-OFZ market, began in mid-October 1997 (IMF WEO, May 1997). Consequently, it is natural to consider mid-October as a strict break point between periods that we are referring to as "the period before crisis" and "the period of crisis." The former period starts from January 1, 1996, which is the earliest date in our database, and lasts ten-and-a-half months. From May 1998 to August 1998, the GKO-OFZ experienced significant swings (see Fig. 1). To be fair, we can even say the market actually collapsed in May. At this point, we are merely interested in evaluating behavior of non-residents during the period that led to the collapse of the market, so it seems natural to drop May-August 1998 from the period of estimation in our empirical model. Hence, the second period starts in mid-October 1997 and ends in April 1998. Although it is shorter, it provides us with more observations (1,739 against 1,527) due to bigger number of active foreign traders.

Thus, based on 3,266 observations, we estimate the symmetric matrix of unconditional probabilities:

$$p^0_{ij} = 0.60 \text{ if } i=j \text{ and } p^0_{ij} = 0.40 \text{ if } i \neq j \ \ (i,j = -1,1) \quad (5)$$

The results of the model estimation are[8]

$$\theta_t = 0.48 - 0.67D \quad (6)$$
$$(0.034) \quad (0.015)$$

There is no evidence of different behavior on the part of non-residents before the crisis. However, a difference arises during the crisis. The empirical model

allows us to study the effect of external news on the difference in behavior between non-residents and residents. We assume that daily variations in major stock indexes provide proper quantification of common news, so we take one as an explanatory variable in our regression. Here, we use the S&P 500 index, which covers 500 major stocks traded on US stock exchanges. To allow for the asymmetrical effect of "bad" and "good" news, we introduce the following two variables:

$N_t^+ = \Delta\ln(S\&P500_t) - \Delta\ln(S\&P500_{t-1})$, if $\Delta\ln(S\&P500_{t-1})<0$ and $\Delta\ln(S\&P500_t)>0$; and 0 otherwise.

$N_t^- = \Delta\ln(S\&P500_{t-1}) - \Delta\ln(S\&P500_t)$, if $\Delta\ln(S\&P500_{t-1})>0$ and $\Delta\ln(S\&P500_t)<0$; and 0 otherwise

Both variables are always non-negative. The first has a positive value only in the case where there was positive growth following negative growth on the previous day. Similarly, the second variable takes positive value only if there is a reversal from positive growth on the previous day to negative growth. The new specification for dynamics of θ_t is:

$$\theta_t = \theta_0 + \theta_1 D_t + \theta_2 N_t^- + \theta_3 N_t^+ \qquad (7)$$

If "bad" news and "good" news had a symmetrical effect on the relative behavior of non-residents, then coefficients θ_2 and θ_3 should not be significantly different. Naturally, we expect that these coefficients are negative, i.e. the arrival of external news increased the difference in behavior between residents and non-residents. Although US markets open after the end of the day's trading session in Russia, we assume no lag in news variables. This approach seems reasonable, because we do not check for effect of US market on the behavior of non-residents per se. Rather, we use the changes in its stock index as a proxy measure for the type and size of news prevailing in the corresponding day. Indeed, lagged variables proved insignificant.

$$\theta_t = \underset{(0.031)}{0.55} - \underset{(0.023)}{0.64} D_t - \underset{(0.036)}{38.52} N_t^- + \underset{(0.349)}{15.75} N_t^+ \qquad (8)$$

$\Pr(\theta_2 = \theta_3) = 0.012$

Results of the test reveal significance and asymmetrical effect of external news on the behavior of non-residents. "Good" news seems to have had insignificant influence, whereas "bad" news proved to be a significant factor.

Based on the evidence provided by the empirical model, we conclude that the difference in behavior between residents and non-residents increased during the crisis as compared to the pre-crisis period. The methodology does not allow assessing the extent of this difference, so we leave this for the event studies. The fact that external news had an impact on the behavior gap suggests that non-residents were more sensitive to international shocks. Two event studies presented in next sections are intended to provide more accurate information on the nature of major shocks and the pattern of investors' response to them.

2.3 Event study I

So far, we have found that during the crisis non-residents behaved differently compared to residents, but it remains unclear whether this difference is significant. Crises usually are driven by discrete events, so an event study seems to be the most appropriate way of gathering information here. As noted in section 2.1, there are several occasions of short-term decrease in the share of non-residents in the GKO-OFZ market (see Fig. 2). This observation suggests that we should take closer look at the episodes of sharp outflow of foreign capital. Our first event study therefore focuses on the daily episodes of large sales of state bonds by non-residents. We describe the flow of funds both on the aggregate and representative investor level. The second event study complements the first by providing information on the behavior of investors during episodes of large decreases in market prices in the crisis period. We also identify the major factors (external or domestic) behind these extreme episodes.

Let us first consider those trading days on which gross sales of non-residents exceeded RUR 1bn.[9] This gross outflow of foreign capital should be balanced either by gross inflow of foreign capital, gross inflow of resident capital or CBR interventions. Dates, major events and structure of flows appear in Table 1. All the 17 days that satisfy the above condition on gross foreign capital outflow are split into five groups according to common causes. The first four groups correspond to episodes of short-term decrease in the

share of non-residents (marked in Fig. 2 with the numbers 1,2,3 and 4). Interestingly, the structure of inflows hardly varies. Gross outflows were mitigated mainly by inflow of domestic capital. Except for the first six days associated with the same episode (October-November 1997), non-residents were the major source of outflows. The near-equal share of residents and non-residents in total gross outflows during the first six days in the sample is probably due to CBR interventions aimed at easing downward pressures. High bond prices provoked selling by both residents and non-residents. The last column of the table provides information about changes in market prices, which allows us to establish causality between outflow of foreign capital and inflow of domestic capital.[10] As it is evident from the table, non-residents' sales were sometimes provoked by increased demand for bonds on the part of domestic investors, but in most cases, the flows were driven by negative shock to the foreign demand for bonds.

Three of the five episodes are associated with negative external news. The first episode is related to a strong spillover effect of renewed Asian turbulence to all major financial markets. Its effect can be perceived from the fact that it took almost a month for equities in mature markets to recover to their pre-shock levels. The two Indonesian currency crises in January and May 1998 resulted in a less severe spillover globally, but its impact on the Russian market was much greater. The first one led to increase in GKO interest from about 30% in the end of 1997 to 44% in the end of January. The second one led to the near collapse of the bond market with the yield on long-term bonds climbing to three-digit levels.

The empirical analysis based on the aggregate information does not reveal the difference at the level of representative investors. Since we know that the market portfolio was highly concentrated, rather than uniformly distributed across investors, we may suppose that aggregate flows reflected transactions of few large market participants. If there had been no difference in behavior between residents and non-residents at the individual level, then any representative investor-type argument would have a hard time explaining these empirical findings. We also should take into account the fact that leading domestic banks were primary dealers, i.e. they were constrained by certain obligations to maintain market liquidity. This technical feature may account for involuntary accumulation of assets by primary dealers during mass sales by foreign institutions. In Table 2, we present some statistics that allow comparing behavior of representative market participants. For each investor

in our database, we estimated his *ex post* probability of being a net seller on a day with a large outflow of foreign capital. Since the first six days in our sample correspond to the period of massive interventions by monetary authorities, we excluded them when calculating the probabilities.[11] If, on n_s days out of 11, an investor was a net seller and on n_b days was a net buyer, then the estimated *ex post* probability is equal to $\frac{n_s}{n_s + n_b}$. We then take the mean of this measure across different groups of investors, skipping those market participants for which $n_s + n_b \leq 5$. The latter condition is adopted to reduce the variance of the measure within investor groups. The sample of non-residents satisfying the condition above includes 11 investors from Cyprus, 17 UK investors, a French investor, a Dutch investor and a Czech investor. While only in rare cases do we have information about ownership of Cyprus companies, we suspect most are offshore Russian companies. After the introduction of 15% tax on interest income earned on GKOs in January 1997, investment in state bonds via offshore structures became highly attractive alternative for Russian banks. Exclusion of Cypriot investors and the investor registered in Czech Republic leads to a higher estimated probability of participation in selling bonds and a lower standard deviation.

The main conclusion we draw from the information given in the table is that, on average, dealers had a stronger tendency to increase their holdings in state bonds during days characterized by large outflows of foreign capital. This means the flow-of-funds picture suggested by Fig. 2 was not entirely a result of forced accumulation of inventories by primary dealers or attributed to actions of large non-residents. The number of primary dealers varied over time, peaking in mid-1997 (43) and slowly declining during the period of crisis. Using the fact that primary dealers were intermediaries in the trade, we singled out the first ten dealers that had the largest average trade turnover during the 11 days under consideration.[12] We found that these top dealers had a significantly lower tendency to sell bonds during observed episodes, even compared to other dealers. This result supports our hypothesis that major Russian investors may have been forced to purchase bonds during mass selling by non-residents due to existing obligations related to liquidity maintenance. However, as it is evident from other statistics, this is not an entire explanation of observed difference in behavior between residents and non-residents.

2.4 Event study II

The event study highlighted five episodes when the GKO-OFZ market came under downward pressures. The analysis focused on days characterized by extreme gross outflow of foreign capital. Now we provide some information on flows of domestic and foreign capital over longer intervals during which prices exhibited significant corrections and analyze the pattern of response of residents and non-residents to major shocks.

There is no single way to determine the boundaries of each episode, so we do not apply any strict rule for this procedure. We base our choice mainly on the information obtained from different sources of contemporaneous market analysis and the observation of price dynamics. We single out five time intervals, four of which are associated with the episodes highlighted by the first event study (see Fig. 1). The last episode covers the period of temporal rebound of the bonds market after IMF and Russian government reached an agreement on the emergency financial aid. The information is summarized in Table 3.

In all the four episodes of downward price adjustment, the net outflow of foreign capital exceeded domestic outflows. The first episode is notably different from the other in that non-residents withdrew funds mainly at the time of redemption, whereas residents were selling bonds in the secondary market. Although the total net outflow of foreign capital was relatively larger, dealers accounted for major part of outflows from the secondary market. Since the prices of bonds were formed in the secondary market, this observation implies that residents were major contributors to the surge in interest rates in late October-November 1997. There is a crucial difference between selling bonds in the secondary market and in the primary market during financial turbulence. In the first case, investors have to assume losses; in the second case, bonds are exchanged at par value. Hence, we can not exclude the possibility that larger outflow of foreign capital during the first episode was simply a result of larger share of redeemed bonds held by non-residents. According to Fig. 2, by the beginning of the crisis, residents held comparatively lengthier portfolio, which is consistent with the explanation. Further evidence supporting our hypothesis is the fact that dealers started to sell bonds in early October, which is reflected by an increasing share of non-residents during most of October 1997.

A test of the difference in share of buyers between non-residents and dealers revealed that at the individual level the picture is similar to that suggested by aggregate flows. Since the test results may be highly biased by the presence of offshore Russian companies, we calculated the ratio of buyers for the sample of UK investors only. These were mainly well-known investment banks that controlled about 90% of total non-residents' portfolio. The third and the fourth episodes are of particular interest for two reasons. The test produces rather convincing results for both episodes and unlike during the first episode, there is no big difference in the size of outflow of domestic and foreign money via primary market. This evidence allows us to conclude that non-residents strongly contributed to the near-collapse of the market in May-July 1998 (see Fig. 1). The fifth episode relates to positive news about IMF approval of a rescue package for Russia. As is evident from the table, this news boosted foreign capital inflow with domestic investors mainly selling bonds (see also Fig. 2, marked by 5).

The following statements summarize our main findings so far:

- Empirical tests based on transactions data suggest that residents (dealers) and non-residents behaved differently during the crisis but not before the crisis. On the other hand, we found significant difference in their portfolio structure before the crisis, with residents tending to hold longer maturity bonds. This difference vanishes during the crisis.

- The share of non-residents slightly increased during the crisis, but there were large spot sales. The responses of residents and non-residents to shocks were different. Non-residents were more sensitive to negative external news and some domestic news, i.e. local uncertainty over the IMF emergency loan.

- Overall, non-residents strongly contributed to the negative developments in November 1997 – August 1998. There is, however, evidence that residents were mainly responsible for market pressures at the initial stage.

3 Discussion

We start with possible explanations for the difference in behavior between residents and non-residents during the Russian financial crisis. In the next section, we analyze existing arguments provided by recent empirical and theoretical studies. We argue that the empirical findings are consistent with the change in investor sentiments (a "wake up call"). In the second section, we introduce a formal framework for explaining this phenomenon without resorting to multiple equilibria. We review the implications of the model and its relevance to the Russian case.

3.1 International vs. domestic investors

Empirical observations suggest that the contribution of non-residents to the development of Russia's financial crisis was greater than that of domestic investors. Despite the extensive theoretical literature on the causes of contagion,[13] the subject of why international investors behave differently is somewhat neglected. The existing literature on contagion falls roughly into two categories. The first includes theories that do not distinguish domestic and international investors. These explain contagion via bilateral or third-party (trade) links between countries or as self-fulfilling expectations. The second category of research focuses on the specific features of international portfolio investors, arguing that they are responsible for propagation of crises. In this section, we consider arguments from the latter category and discuss their relevance to the case of Russian crisis. Here are the major arguments:

- Asymmetry of information between domestic and foreign investor about market fundamentals;
- Exposure of international investors to a variety of markets creates financial linkages, which are strengthened by the extensive use of leverage;
- A "wake up call" effect, whereby a crisis in one country induces reassessment by international investors of their prospects in other countries.

The first argument relies on market imperfections in the form of *information asymmetry*. International portfolio investors are considered less informed about specific market fundamentals, which makes them highly sensitive to any piece of information, whether related directly to the market or not. A fall of prices in the local market may induce selling as foreign investors may consider price movements as a reflection of actions of informed investors (positive feedback trading).[14] The turbulence in capital markets of other countries may also trigger selling by international investors in the local market as they take it as a negative signal (contagious selling). Calvo and Mendoza (1996) even provide a rationale for international portfolio investors to remain ignorant about local market fundamentals. They demonstrate that with a growing number of independent markets or diversification opportunities, the incentives to collect costly information diminish.

Empirical studies of the behavior of international investors generally support the hypothesis of asymmetrical information. Kim and Wei (1999) study the behavior of investors in the Korean stock market before and during the crisis of 1997. They show that foreign investors were positive feedback traders during the crisis. Compared to residents, foreign investors exhibited greater herding behavior.[15] They also find evidence of similar behavior within country groups. A similar study by Choe, Kho and Stulz (1999) using a different set of data revealed no significant positive trading by non-residents during the crisis. Their findings suggest that non-residents did not destabilize the Korean stock market during the period of crisis. Kaminsky *et al*. (2000) investigated behavior of US funds in Latin America and showed that they engaged in momentum trading (positive feedback trading) before the crisis, and even more intensively during the crisis. The paper also revealed that US funds followed contagion trading. Kaminsky *et al*. do not provide any comparison between behavior of domestic and foreign investors, so it is unclear if the impact of such a behavior on local markets was significant. Based on a unique database of daily international flows into and out of 44 countries, Froot *et al*. (2001) establish that positive feedback trading largely explains the quarterly and monthly correlation between international flows and asset prices.

The argument that international investors are less informed about local market fundamentals, though appealing, is difficult to apply to a state bonds market. All the information relevant to the market for state bonds is publicly available (mainly economic indicators), so there should not be significant information asymmetry between market participants Gravelle (1999). Moreo-

ver, in the case of the GKO-OFZ market, over 90% of the non-resident portfolio was concentrated within a group of leading investment banks with relatively large positions in the Russian market. This makes it even harder to assume that they were less informed about market fundamentals than their Russian counterparts. Our data does not allow us to distinguish between the transactions of non-residents with their own portfolios and portfolios of their clients. For example, investment banks may have simply executed bond sales at the request of their clients, which would have no reflection on the strategies of these banks. Our empirical findings, derived from the analysis of the sample of days of the largest sales by foreigners, suggest that if true it is only partial explanation. Indeed, we show that the frequency of participation of non-residents in few massive spot sales was significantly higher than that of domestic investors. Since the majority of these cases are associated with decreasing prices, negative shocks to non-resident demand rather than positive shocks to local investor demand caused these sales. It is unlikely that negative news could have resulted in immediate withdrawal of money by clients, because it typically takes some time before clients respond to changes in market conditions. The massive spot sales probably reflect non-resident dealings with their own portfolios rather than the portfolios of their clients.

The second argument states that extensive *exposure of international investors to a variety of financial markets* creates financial linkages that facilitate transmission of crises. The idea is that losses incurred in one market may force investors to raise liquidity from other markets. This transmission mechanism is strengthened though extensive borrowing by international portfolio investors. A fall of asset values due to an adverse shock in one market may trigger margin calls that require reductions of exposure in all markets (IMF WEO, December 1998, pp. 51-52). In fact, even in the absence of margin requirements, it is optimal to reduce risky portfolio as soon as its expected return falls below the cost of borrowing (Schinasi and Smith (1999)). Kaminsky and Reinhart (2000) empirically investigate propagation of crisis between emerging economies and find that bilateral or third party trade links do not fully explain the extent and size of contagion. In particular, they note that recent transmissions of crises from Mexico to Argentina and from Thailand to Indonesia are better explained in terms of common foreign creditors – US banks in the first case and Japanese banks in the second. As it was established in the previous sections, two of three cases of contagion are related to the currency crisis in Indonesia, including the one that brought about

the near-collapse of the GKO-OFZ market in May 1997. Foreign financial institutions that invested in Russian state bonds certainly had assets of other emerging markets, including Indonesia. However, the total exposure of these institutions to emerging markets was relatively small, so it is highly unlikely that a crisis in an emerging market would result in overall difficulties for foreign institutions. For example, the total exposure of Credit Suisse First Boston, the largest foreign investors in the GKO-OFZ market, to countries with ratings less then A was below 5% as of 31 December 1997 (see CSFB annual report 1997/1998, p. 34).

The "wake up call" hypothesis states that contagious reversal of foreign capital flows is attributed to a change in investor sentiment or risk aversion. Along with trade and financial linkages, the IMF considers a shift in investors' sentiments as one of possible explanations of the latest contagious crises in emerging markets (IMF WEO, May 1999, p. 69). The theoretical explanations of this effect are based on multiple equilibria models. The change in sentiments is modeled as a jump from "good" to "bad" equilibria.[16] Among the variety of multi-equilibrium type models, only one accounts for the difference between foreign and domestic investors. The argument presented states that international portfolio investors are prone to herding behavior because of existing payoff externalities. For example, if a fund manager's payoff depends on his performance relative to the benchmark, then he has incentives to follow others.[17] This argument may account for the difference between domestic and foreign investors (different benchmarks), but it does not follow that foreign investors should necessarily be more sensitive to any type of news.

It may be tempting to say that foreign institutions are more sensitive to any kind of news because of the broader range of available alternative investment opportunities. In fact, this reasoning is faulty. This can easily be demonstrated with the help of CAPM.[18] Consider a stylized, perfectly integrated, risky market that is totally independent of other financial markets in the world. If the market is small, then its independence implies zero covariance with the world portfolio. Hence, according to CAPM there should be no risk premium on its securities. It is clear that any increase in the risk will have no effect on the premium, since international investors care only about covariance (systemic) risk, which is zero by assumption[19]. However, this increase would surely have effect if the market were segmented.

3.2 The "alarm clock" mechanism and the Russian case

The literature related to the implications of financial integration sometimes creates confusion about such notions as integration, correlation and contagion. For example, Bekaert and Harvey (1995) argue that correlation has nothing to do with integration, and Forbes and Rigobon (2001) maintain that increased correlation does not evidence contagion. The term contagion is the most confusing and its definition varies from the mere fact of transmission of shocks to a specific mechanism. In this paper, we use the term contagion to refer to the transmission of a negative shock from one economy to another. We explain this phenomenon by combining arguments in the literature. Surprisingly, they seem to have not been applied simultaneously before.

Forbes and Rigobon (2001) show that increased volatility in one of two markets naturally leads to increased correlation between both, i.e. the observed increase in correlation between financial markets does not necessarily reflect changes in market interdependence. Their argument can be incorporated in CAPM framework to show that contagious outflow of foreign investors does not necessarily reflect a change in investor sentiments. Indeed, if we consider the global market versus, say, the Russian market, then following Forbes and Rigobon (2001), increased volatility of the global market results in increased correlation between the Russian and global market. CAPM suggests that international investors care only about systemic risk. Hence, they are more sensitive to increased correlation than local investors (see Appendix B for a formal proof) and sell domestic securities more aggressively. More generally, the total risk of domestic securities can be modeled as a sum of fundamental (domestic) and systemic (international) risk. It can be shown (see Appendix B) that in case of perfectly integrated market, an increase in the fundamental risk leads to reduction of residents' holdings of securities, whereas an increase in the systemic risk results in the opposite effect.

The implication of the formal framework is consistent with our findings that non-resident holders of Russian state bonds were more sensitive to negative news from Indonesia. We also find evidence that non-residents were less sensitive to pure domestic risks. It is emphasized in the literature on the Russian crisis that the unfavorable external conditions, such as declining world oil prices, also contributed to the crisis. In the first quarter of 1998, the trade balance fell to USD 0.7bn compared to USD 5.9bn in the first quarter of 1997. In the empirical part of the paper, we noted that the market share of

non-residents showed slight tendency to increase during the period of crisis (see Fig. 1). However, this trend decline in the share of domestic investors is also consistent with lower sensitivity of non-residents to the fundamental risk. Indeed, the worsening of fundamentals was not fully reflected in the bonds prices since IPI priced only systemic risk, hence local investors considered bonds as undervalued on average and were more inclined to reduce their portfolios. This is, of course, not a unique explanation. For example, reduction of residents' market share could be attributed to the shortage of liquidity faced by them as the crisis developed. The state bonds market was the most liquid market in Russia, where it was relatively less costly to raise liquidity.

The empirical study also suggests that non-residents were more sensitive to some domestic news, meaning that the argument seems to be still incomplete. Indeed, event studies highlighted two episodes associated with domestic events (the last two items in Table 3), during which non-residents reacted more aggressively to both negative and positive news. The first episode corresponds to the period of uncertainty over IMF lending, while the second is related to the successful resolution of this uncertainty.

Russia's state bond market had several features that distinguished from a stock market. In particular, the short nature of the debt forced the government to roll the debt over constantly by redeeming old issues and selling new ones. A contagious temporal fall in prices is not as big problem for the stock market as for the state bond market, where a short-run fall in prices may translate directly into market risk. Indeed, the government has to sell new debt at low prices, while assuming an ever-larger burden of debt service for the future. The level of official reserves is obviously crucial in mitigating this type of spillover effect, since the government can temporally use them to finance redemption. On the other hand, insufficient reserves make the market vulnerable to speculative attacks, and hence creates a dependence on the world market conditions. So far, our formal reasoning relied on the assumption that the structure of interdependence between domestic and the global market was not related to domestic fundamentals, which is not necessarily true, especially for the case of state bonds market.[20] This reasoning may explain why non-residents seemed more obsessed with the size of official reserves than domestic investors.

4 Conclusions

In this paper, we provided both empirical analysis of the role of non-residents in the development of the Russian financial crisis and assessment of existing arguments as to how well they explain the main findings. Our empirical findings suggest that non-residents behaved differently during the period of crisis and were more sensitive to external factors, as well as certain domestic factors. We argued that these facts were consistent with the change in investor sentiment (a "wake up call" effect). The conventional literature explains this effect by a jump from "good" to "bad" equilibrium. We suggested a simple formal framework that helps to account for contagious outflow of foreign investors and does not resort to multiple equilibria. In particular, we found out that international portfolio investors are more sensitive to turbulence in financial markets of other countries, but less sensitive to pure domestic shocks. This conclusion is consistent with the fact that non-residents reacted more aggressively to Indonesian crises and that their market share had slight tendency to grow during the period of crisis. However, the argument fails to explain apparent higher sensitivity of non-residents to news surrounding the IMF emergency loan. We suggested that the size of foreign reserves also was an important determinant of systemic risk of this market.

There is no an unambiguous answer to the question of whether financial integration is beneficial to any economy. The theory-based argument that international portfolio investors are less responsive to pure domestic shocks suggests that financial integration may help to mitigate the impact of weak fundamentals rather than amplify it. Russia is a peculiar example of an emerging economy that faced both sides of the coin called financial integration. Due to initially low systemic risks, Russia benefited from financial integration in 1997, when bond yields hit the historical minimum of 13%. On the other hand, it suffered severe contagion in 1998 after a series of Indonesian crises.

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Notes

[1] See Komulainen (1999), Montes and Popov (1999), Sutela (1999), Vavilov et al. (1999)) among others.

[2] See Calvo (1997)

[3] The database is described in Medvedev and Kolodiajnyi (2001). It includes information on daily transactions of non-residents and dealers.

[4] In fact, this is not an unexpected result. See similar views expressed in Levy-Yeyati and Ubide (2000) p. 88

[5] Based on the sample of investors in the database.

[6] If n is not too small, DUR can be approximated by normal binomial distribution.

[7] OFZ-PDs were originally issued by the finance ministry specifically to securitize its liabilities to the CBR.

[8] Hereafter, we represent the significance as probabilities shown in parentheses.

[9] Here gross sales are defined as the total of net sales across net sellers.

[10] Except, of course, the first episode, where the CBR intervened in the bond market.

[11] As previously noted, official interventions blur the difference between strategies of market participants.

[12] Here, daily turnover is measured as the minimum of money value of purchases and money value of sales.

[13] See, for example, Claessens et al. (2001) for the review.

[14] See Brannan and Cao (1997) for formal model.

[15] Authors measure herding behavior by the degree of concentration of selling and buying in different securities. A high degree of concentration is consistent with imitative herding behavior.

[16] See Claessens et al. (2001) p. 27 for a overview of these models.

[17] See, for example, Calvo and Mendoza (1996) for the formal model.

[18] See, for example, Stulz (1999).

[19] Medvedev and Kolodiajnyi (2001) take alternative approach employing CAPM without risk free asset and assuming zero systemic risk. It was shown that under some plausible assumptions, non-residents appear to be more sensitive to change in expected return.

[20] The formal framework is obviously incomplete, since it does not clarify the nature of linkages but simply treats them as exogenous.

[21] We also assume that investors can borrow at this rate.

[22] This assumption implies that the global market shares only small portion of its total risk with the domestic market, however we obviously do not assume that the common risk is small as a share of total country's risk. The assumption is made to ensure that the global price of risk is not affected by increased in volatility.

[23] Condition (A3) and the assumption about small relative size of the local market imply that the structure and risk of the market portfolio is not affected by increased volatility. So the global price of risk λ and price index q_1 can be assumed constant.

Appendix A. Graphs and Tables

Figure 1. Interest rate on short-term bonds (GKO)

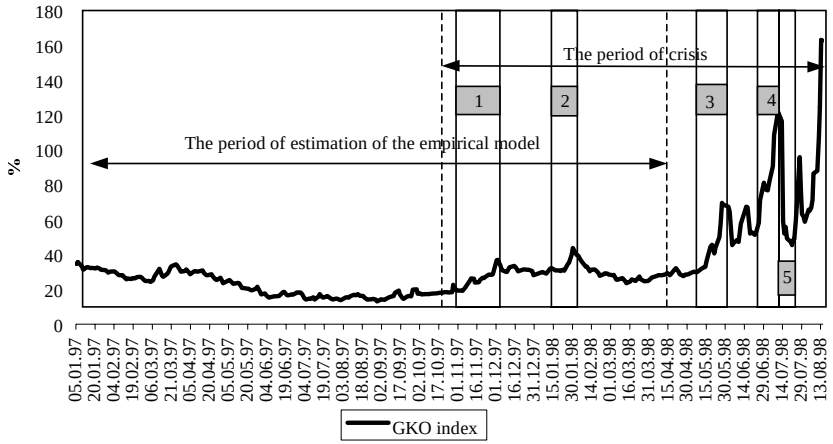

Figure 2. Comparison of dealers and non-residents with respect to duration and market value of GKO-OFZ portfolio.

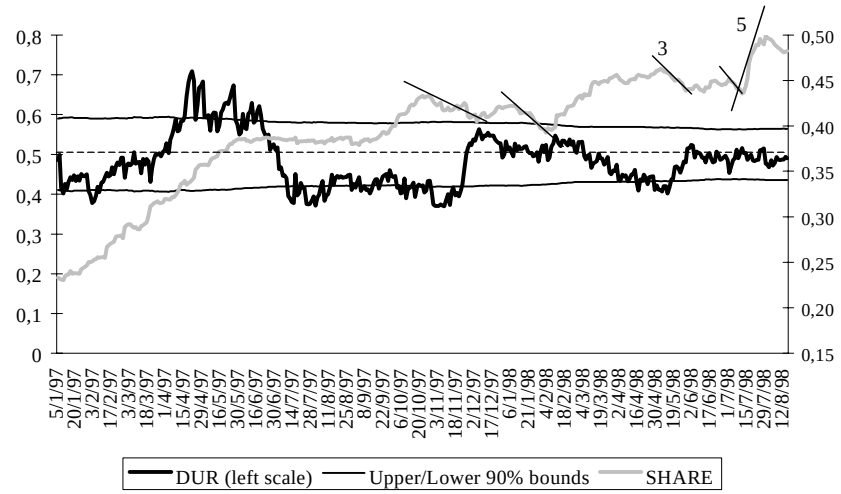

Table 1. Event study No. 1: days with largest gross outflow of foreign capital.

No.	Date	Major events	Gross sales (%)		Gross purchases(%)		Prices decreased
			non-res.	dealers	non-res.	dealers	
1	*Oct 28*	**Asian crisis**: Renewed turbulence in Asian financial markets spills over resulting in declines on all major stock markets. All Asian economies experience sharp devaluations.	51	49	11	89	✓
	Oct 30		47	53	32	68	
	Oct 31		47	53	28	72	
	Nov 13		32	68	39	61	
	Nov 25		55	45	28	72	✓
	Nov 27		49	51	23	77	
		average	*47*	*53*	*27*	*73*	
2	**Jan 26**	**Crisis in Indonesia**: Black Thursday (Jan. 8) followed by rupiah's free fall. Rupiah depreciates 55% in January.	80	20	4	96	✓
	Jan 29		73	27	8	92	✓
	Feb 3		74	26	29	71	
	Feb 6		66	34	31	69	
		average	*73*	*27*	*17*	*83*	
3	**May 14**	**Crisis in Indonesia**. Tough fiscal measures result in social unrest. Rupiah falls sharply; depreciates 28% in May.	74	26	29	71	✓
	May 15		83	17	37	63	✓
	May 26		78	22	7	93	✓
	June 4		48	52	59	41	
		average	*71*	*29*	*33*	*67*	
4	**Jul 7**	**Uncertainty over financial aid to Russia**. Russia negotiates rescue package of USD 10-15bn	72	28	22	78	✓
	Jul 10		83	17	20	80	✓
		average	*78*	*22*	*21*	*79*	
5	**Aug 5**	**Turbulence in US stock market**. Decline in equity prices culminates in 3.5% drop on Aug. 4.	94	6	15	85	✓

Table 2. Test for difference in share of sellers between different classes of investors.

	# investors in the sample	Average probability of being net seller
1. Non-residents	31	0.51 (0.22)[1]
1a excl. Cyprus and Czech Republic	19	0.60 (0.16)
2. Dealers	200	0.36 (0.18)
3. 10 top dealers[2]	10	0.26 (0.14)
(1a)>(2)	6.20**	
(2)>(3)	2.35*	

[1] Standard deviation shown in parentheses.

[2] The first 10 dealers, having the largest average turnover during observed 11 days. Here the daily turnover was measured as the minimum of money value of purchases and money value of sales. */** means significance at 5%/1% level based on one-tail critical values for t-statistics.

Table 3. Event study No. 2: Major episodes of downward adjustment in prices.

No	Definition	Total flows		Primary market		Secondary market		Share of buyers			
		non-res.	dealers	non-res.	dealers	non-res.	dealers	(1) non-res.	(1a) GBR	(2) dealers	(1a)< (2)[1]
1	28.10.97-02.12.97	-3.0	-1.8	-2.1	0.2	-0.9	-2.0	0.30	0.14	0.35	0.011
2	12.01.98-30.01.98	-1.1	0.8	-0.2	0.1	-0.9	0.7	0.55	0.48	0.60	0.106
3	12.05.98-02.06.98	-1.9	-0.2	-0.9	-0.8	-1.0	0.6	0.37	0.14	0.51	0.000
4	26.06.98-10.07.98	-1.1	-0.2	-0.3	-0.5	-0.8	0.3	0.43	0.19	0.51	0.001
											(1a)> (2)[1]
5	14.07.98-23.07.98	1.7	-1.8	-0.3	-0.6	2.0	-1.2	0.60	0.56	0.27	0.001

[1] below are estimated probabilities that this inequality does not hold.

Appendix B. Description and implications of the model

Consider a simple one-period capital asset pricing model applied to the global market. The global portfolio consists of a variety of risky assets and risk-free assets yielding r_f.[21] The optimal portfolio of risky assets (hereafter global portfolio) yields a random return, which we denote as r_m. All uncertainty is associated with the prices of assets at the end of the period, which we assume to be normally distributed. There are two types of market participants: international portfolio investors (IPI) and local investors. An IPI has access to the global market so their portfolio is the optimal portfolio of all existing assets (risky and risk-free). Local investors can invest in a risk-free asset and a domestic security yielding random return r. By assumption, the local market is small, so domestic security should comprise tiny part of the global portfolio. Let denote as p_i and q_i – price of the domestic security and price index of the global portfolio at the beginning ($i = 1$) and the end of the period ($i = 2$). Then, by definition:

$$r = \frac{p_2}{p_1} - 1 \cong N\left(\frac{E(p_2)}{p_1} - 1, \frac{\sqrt{Var(p_2)}}{p_1}\right) \quad r_m = \frac{q_2}{q_1} - 1 \cong N\left(\frac{E(q_2)}{q_1} - 1, \frac{\sqrt{Var(q_2)}}{q_1}\right) \quad \text{(A1)}$$

Let us specify structural relationship between the price of the domestic security and the price of the global portfolio in the following general form:

$$p_2 = \overline{p} + \delta_p + \mu\varepsilon \quad \text{(A2)}$$
$$q_2 = \overline{q} + \delta_q + \eta\varepsilon$$
$$\mu, \eta > 0,\ Cov(\delta_p, \delta_q) = Cov(\delta_q, \varepsilon) = Cov((\delta_p, \varepsilon) = 0;\ E(\delta_p) = E(\delta_q) = E(\varepsilon) = 0.$$

Here e reflects the common risk factor for the domestic portfolio and the global portfolio with loading m and h; d_p and d_q are independent factors specific to the domestic and the global market. Turbulence in the external market can be transmitted to the domestic market only via an increase in the volatility of the common factor. We assume that a change in its volatility does not significantly influence the total risk of the global portfolio[22] or

$$\mu^2 Var(\varepsilon) << Var(\delta_q) \quad \text{(A3)}$$

According to CAPM the risk premium of the domestic security is proportional to the covariance of the domestic and global portfolio returns:

$$E(r) - r_f = \lambda Cov(r, r_m) \tag{A4}$$

The parameter λ is the global price of risk (see Stulz (1997)). Since, by assumption, the domestic market is comparatively small then the non-residents' demand for securities is perfectly elastic with respect to the price. This means that allocation of a fixed supply of securities between residents and non-residents is determined by the former, whereas the price is set by the latter.

Local investors choose an optimal combination of risk-free assets and domestic securities by maximizing the following expected utility function:

$$E(U) = E(A_2) - \frac{\gamma}{2}\frac{Var(A_2)}{A_1} \tag{A5}$$

Here A_1 and A_2 are the values of assets of a representative local investor at the beginning and the end of the period, correspondingly, γ - (relative) risk aversion. The first-order condition of utility maximization yields the following expression for local investors' demand for domestic security (D):

$$D = \frac{A_1}{p_1}\frac{E(r) - r_f}{\gamma Var(r)} \tag{A6}$$

Using (A1) and (A2) it is straightforward to calculate correlation and covariance between returns on domestic security and the global portfolio:

$$Cov(r, r_m) = \frac{\mu\eta}{p_1 q_1} Var(\varepsilon) \tag{A7}$$

$$Cor(r, r_m) = \sqrt{\frac{\mu^2 Var(\varepsilon)}{Var(\delta_p) + \mu^2 Var(\varepsilon)}}\sqrt{\frac{\eta^2 Var(\varepsilon)}{Var(\delta_q) + \eta^2 Var(\varepsilon)}} \tag{A8}$$

As it follows from (A8) higher variance of the common factor implies higher correlation between domestic and global portfolios. This result replicates the argument of Forbes and Rigobon (2001) that correlation is a conditional measure.

Now using expressions (A2), (A4) and (A7), we transform (A6) into:

$$D = \frac{A\lambda\eta}{\mu\gamma q_1} \frac{\mu^2 Var(\varepsilon)}{Var(\delta_p) + \mu^2 Var(\varepsilon)} \qquad \text{(A9)}$$

It follows from (A9) that a pure domestic shock ($Var(\delta_p)$ goes up) results in a decrease in local investors' holdings of the domestic security, while a pure international shock ($Var(\varepsilon)$ results in the opposite.[23]

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