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Abstract

This paper analyzes the impact of news, oil prices, and international financial market developments on daily returns on Russian bond and stock markets. First, regarding returns, energy news affects returns, while news from the war in Chechnya is not significant. Market volatility does not appear to be sensitive to either type of news. Second, a significant effect of the growth in oil prices on Russian stock returns is detected. Third, the international influence on Russian financial markets depends upon the degree of financial liberalization. The higher the degree of financial liberalization, the stronger is the impact of U.S. stock returns on Russian financial markets. In addition, banking reform and interest rate liberalization efforts seem to dictate the globalization of Russian stock markets, while it is the progress in liberalizing securities markets and non-bank financial institutions that matters more for the globalization of Russian bond markets.

JEL: C5, G12, G15, F36.

Keywords: financial market behavior, financial market integration, stock market returns, bonds market returns, news, emerging markets, transition economies.

I. Introduction

Russia is one of the biggest emerging markets. Other emerging markets, such as those in Asia and South America, are extensively studied. Despite its sheer size, potential importance for global investors, and significant major financial reforms implemented during the early phase of transition, only a few empirical studies examine financial markets in Russia. It is interesting to analyze Russian financial markets for several reasons. First, financial market behavior in Russia can be different than in other emerging markets due to historical, cultural, and institutional factors. Second, Russian markets may offer better diversification benefits (Rockinger and Urga, 2000). Third, since the early 1990s, Russian policy makers have implemented major economic and financial reforms, resulting in the emergence of new financial instruments. A related question in this respect is whether investors in this market react to “news” in a similar fashion as those in advanced market economies. Fourth, because Russia is rich in energy resources, oil price shocks may have destabilizing effects on domestic financial markets. Fifth, a significant drawback with respect to financial market liberalization took place in 1998, and it is interesting to analyze the consequences of this development for the internationalization of Russian financial markets.

This paper contributes to the literature in several significant ways. First, it examines financial market behavior in Russia in response to “news”. To do so, we construct a set of news events that might be of particular importance to investors in Russia and then test market reactions to such information arrival in both stock and bond markets. Information arrival is a building block of many theoretical models of asset price determination. The mixture of distributions model (MODM) and the recent microstructure theories rely on public information arrival to explain movements in asset returns.[1] Although the empirical evidence on linking public information to asset market behavior is still accumulating, the main focus

[1] MODM models are associated with Clark (1973) and Tauchen and Pitts (1983), while microstructure theories are reviewed in O’Hara (1995) and Lyons (2001).

has been on industrial countries.[2] Thus, our paper, providing evidence on the importance of public information arrival contained in energy and war news in Russian financial markets, has implications for this line of literature.

Second, it tests the degree of integration of Russian financial markets into the world markets. As a result of the trade and financial liberalization measures in the mid 1990s, the Russian economy has become linked to the global economy. Therefore, it is important to observe the sensitivity of Russian financial markets to global market developments. This issue has significant implications not only for policymakers but also for global investors. The growing importance of the integration of domestic markets with the world market diminishes opportunities for global investors to reduce overall portfolio risk through diversification, resulting in the possibility of contagion in times of crisis. Regulatory policies may be needed to reduce the potentially negative effects of contagion on the domestic economy (Gelos and Sahay, 2001). To address the issue of spillovers from international financial markets onto Russian markets, we employ data on U.S. stock and bond market returns.[3] We can test whether U.S. financial variables Granger-cause their Russian counterparts. If we find such a relationship, then one can argue that the domestic financial markets in Russia have become vulnerable to global financial developments. We also investigate the existence of spillover effects of U.S. financial market developments on Russian financial market volatility. Finally, we investigate the stability of the linkage between world and Russian financial markets, with an emphasis on the situation after the financial crisis in August 1998.

The Russian economy has rich energy resources. Exports make up about 33 percent of GDP, and about 50 percent of export revenues come from the energy sector, especially oil (Rautava, 2002). As an important source of global risk, changes in the world oil prices are therefore expected to significantly affect economic activity in Russia and may disturb the

[2] Melvin and Yin (2000) and Edmonds and Kutan (2002) provide a review of recent work.
[3] We employ U.S. data in this paper to represent "global" market developments because the U.S. is the most important economy and considered to be a key investor in the Russian economy.

financial market activity [4] As our third objective, this paper thus provides initial evidence about the role of oil price fluctuations in Russian bond and stock markets.

In the next section, we summarize previous work on this topic. Sections III and IV describe the construction of news events, the data used, and the econometric approach. In sections V and VI we report our empirical results for bond and stock markets, respectively. The last section concludes the paper and discusses policy implications of our findings.

II. Related literature and our contribution

Only a few empirical studies examine financial market issues in Russia. Gelos and Sahay (2001) investigate the impact of Russian stock market movements on a set of central and eastern European stock markets during the recent Russian crisis and find significant contagion effects. Using a panel data that includes Russia and five central and eastern European economies, Christoffersen and Sløk (2000) test the predictive power of asset prices for real activity and report that asset price movements Granger-cause output growth. Rockinger and Urga (2000) test the predictability and efficiency of the Russian and central European stock markets. Regarding Russia, they conclude that market returns are highly correlated, indicating significant persistency in returns and predictability. With respect to the market efficiency, they cannot draw strong conclusions.[5] In addition, they report that stock returns exhibit ARCH effects.

In this paper, we investigate the impact information arrival and oil price changes on the Russian stock and bond markets in a consistent econometric set-up. An important feature of our study is the detailed analysis of the influence of world market developments on Russian financial markets. In particular, we study the impact of the 1998 financial crisis on the global integration of Russian markets. We use the financial liberalization index published by the

[4] Rautava (2002) provides evidence that oil price fluctuations have a significant impact on the Russian economy.
[5] They argue that the predictability does not necessarily imply inefficiency because the former may be due to either risk premium or lack of liquidity in the market.

EBRD to examine how the level of financial market liberalization has affected the integration of Russian markets with world markets. Compared to the existing work, our study provides a more comprehensive analysis of Russian financial markets.

III. Construction of news

The construction of news events is the most labor-intensive part of the data preparations. We use two examples of explicit news events in our study.[6] First, we choose a category of *economic* news that is likely to be of great importance to investors. We use energy news because the Russian economy is heavily dependent upon the energy sector. Thus, over the sample period from September 1995 to November 2001, we systematically sieve through the irregularly published public announcements available on the yahoo website of daily news, **http://dailynews.yahoo.com/fc/World/Russia/** and collect relevant news related to the energy sector. We categorize the "news" into three different types: news that is good, neutral, or bad for the energy sector. Table 1 provides an overview of these news categories, their definitions and the number of events in our sample. The news categories are translated into (0,1) dummy variables for the purpose of empirical analysis. We make sure that results are fairly robust with respect to news that is difficult to classify. In all estimations, we use the event dates.

Second, employing the same data source and methodology, we choose an area of *political* news that takes up a lot of space in the international media, namely the war in Chechnya. The hypothesis here is that, if Russia winning the war, it may be good news for the Russian economy, as it might signal an end to the conflict. Moreover, we think that a victory by Chechnya or a continuation of the conflict is bad for Russian financial markets. Based on this classification, we construct again three categories of war news; namely good, neutral, and

[6] Hayo and Kutan (2004) provide an extensive analysis of the effect of IMF news on emerging financial markets, including Russia.

bad. Neutral news captures miscellaneous information about the conflict that can neither be classified as good or bad news.

IV. Data and econometric methodology

The dependent variables in our study are daily closing stock and bond returns for Russia over the time period from 1 September 1995 to 30 November 2001. Daily returns are expresses in percentage terms. The stock data are obtained from the website of the Russian Trading System (RTS) http://www.rts.ru/engl/rts/index_dhist.stm[7], while the bond data are available from Morgan Stanley's "Emerging Market Bond Index" website, http://www2.jpmorgan.com/MarketDataInd/EMBI/embi.html.[8]

To examine the globalization of Russian markets, we include data on U.S. Standard & Poors Stock and the three-month U.S. bond price returns in our estimations. The data are obtained from the Yahoo finance website, http://finance.yahoo.com/ and expressed in percentages as well. In estimations, we use one-day lagged values for U.S returns due to the different time zones in the U.S. and Russia. To measure the impact of oil price changes on financial markets in Russia, we include the daily growth rate (in %) of the crude oil (spot) price.[9] The oil data were obtained from the website of the United States Energy Information Administration.[10]

Descriptive statistics are reported in Table 2. The average returns in the U.S. and Russian stock markets are quite similar, while the nominal daily return on the Russian bond market is much higher than its U.S. counterpart. Russian financial markets, in particular the bond market, are much more volatile than U.S. markets. The standard deviation of Russian

[7] Following previous studies, we utilize the RTS index, which includes stocks of the largest and most liquid companies and reflects the general trends in the Russian stock market quite well.
[8] Due to the Russian crisis in 1998 and the resulting debt default, complete data on the domestic bond market are not available. Therefore, we have decided to use this emerging market bond yield for Russia.
[9] We also experimented with the premium on oil price futures for various time horizons but were unable to uncover any significant relationships.
[10] http://www.eia.doe.gov/emeu/international/crude1.html.

bond returns is more than 25 times higher than that of U.S. bond returns, while the standard deviation is only about three times higher in the case of the stock markets.

Russian and U.S. financial market returns series exhibit excess kurtosis but not much skewness, and the distributions show clear evidence of ARCH effects (Engle, 1982). Rockinger and Urga (2000) also report that stock returns in Russia exhibit ARCH effects. The existence of ARCH effects implies that classical methods of estimation are not efficient. To take the volatility clustering into account, we employ the GARCH model developed by Bollerslev (1986) and some variants of it.

A specification that works well for both bond and stock markets in Russia with regard to capturing ARCH effects is a GARCH (1,1) model. In the actual estimation we proceed using a consistent general-to-specific modelling approach (see Hendry, 1995). This ensures that the inferences based on statistical tests are valid throughout the modelling process.

The general specification is as follows:

$$\begin{aligned}
&\text{Returns}_{\text{t}} = \mu + \sum_{r=1}^{6} \delta_{\text{r}} \text{Returns}_{\text{t-r}} + \sum_{r=1}^{6} \gamma_{\text{r}} \text{S \& P}_{\text{t-r}} \sum_{r=1}^{6} \varphi_{\text{r}} \text{USBonds}_{\text{t-r}} + \sum_{r=1}^{6} \lambda_{\text{r}} \text{Oilprice}_{\text{t-r}} \\
&+ \eta \text{h}_{\text{t}} + \phi \text{News Dummies} + \vartheta \text{Monthly Dummies} + \text{u}_{\text{t}}, \\
&\text{with:} \quad \text{u}_{\text{t}} = \varepsilon_{\text{t}} \text{h}_{\text{t}}^{1/2}, \qquad (1) \\
&\qquad \text{h}_{\text{t}} = \alpha_0 + \alpha_1 (\text{u}_{\text{t-1}} - \kappa_1)^2 + \kappa_2 \tau (\text{u}_{\text{t-1}} - \kappa_1)^2 \beta_1 \text{h}_{\text{t-1}}, \\
&\qquad \tau = 1 \text{ if } \text{u}_{\text{t-1}} < \kappa_1 \text{ and zero otherwise,}
\end{aligned}$$

where α, β, μ, κ_1, κ_2, δ, γ, φ, λ, and ϕ are parameters respectively vectors of parameters, τ is an indicator function as defined in the last line above, and $\varepsilon_t|\Gamma_{t-1}= t[\nu]$; with Γ_{t-1} capturing all information up to t-1, and t[ν] a t-distribution with ν degrees of freedom.

The general specification, as represented by Equation 1, is an autoregressive-distributed lag model with six lags that allows for a number of special features. First, student-t distributed errors (Bollerslev, 1987) are assumed that can provide a better approximation to residuals that are not normally distributed. Second, the variance enters the mean equation

(Engle et al., 1987). We can thereby test whether volatility, a measure of risk, is priced in Russian markets. Asymmetric effects of shocks (Engle and Ng, 1993), defined as last periods forecast errors, are included in the model if κ_1 is significantly different from zero. In addition, asymmetry thresholds (Glosten et al., 1993) are captured when κ_2 is not equal to zero. Finally, we include monthly dummies to control for seasonal effects.

Testing is undertaken by employing the robust standard errors developed by Bollerslev and Wooldridge (1992) to account for the non-normality of the returns (Table 2). Although the sample period runs from 1 September 1995 to 30 November 2001, we employ data until end of August 2001 to save the last two months for out-of-sample analyses (35 observations). This not only allows to evaluate the stability of our estimated models in general but also to test whether the terrorist attacks on the World Trade Center and the Pentagon on 11 September 2001 had a significant impact on the data generating process.

V. Analyzing bond returns

Effects on bond returns

We start off the modelling process with the model for daily bond returns. Here we encountered a problem related to the observation on 23 October 1997, having a strong influence on the outcome of ARCH tests. In view of our large sample size, we see no major disadvantage of adding an impulse dummy to the model that effectively removes this problem.[11] In addition, the out-of-sample tests would reveal any detrimental effects that this might have on the forecasting ability of our model. Then, reducing the number of variables and special features in a consistent testing-down process ($Chi^2(41) = 30$), we arrive at a more parsimonious model, which is presented in column two of Table 3. It is a threshold GARCH(1,1) model with student t(5)-distributed errors. Note that the volatility of returns

[11] There was a meeting of the CIS (Community of Independent States) countries taking place in Moldowa around this time. On this specific day an announcement was made that the leaders of the participating countries are unable to agree to any meaningful perspective of this organisation for the future.

does not exhibit a significant influence on mean returns (GARCH-M) and was therefore removed as part of the testing down process that we employ.

We find that all parameters of the GARCH(1,1) terms are significant, confirming the evidence reported in Rockinger and Urga (2000) for the Russian stock market. A sufficient condition for the conditional variance h_t to be non-negative is that α_0, α_1, and β_1 are non-negative, which is fulfilled here. Moreover, the sum of α_1 and β_1 is significantly less than unity ($Chi^2(1) = 5.18^*$), ruling out that the model is an integrated GARCH (see Nelson, 1990).

The data appear to be closer to a student-t distribution than a normal distribution. In particular, the estimate of the degrees of freedom of the student-t points towards a distribution with five degrees of freedom, which has fatter tails than a normal distribution. However, diagnostic testing (see lower part of Table 3) reveals that this distribution is not able to sufficiently remove the non-normality. Thus, modeling the t-distribution primarily contributes to an improvement in the fit of the model, while we still have to adjust the resulting standard errors using robust standard errors based on Bollerslev and Wooldridge (1992).The other diagnostics tests for the bond equation indicate the estimate model completely accounts for ARCH effects and autocorrelation in returns.

With regard to the remaining variables, we find that the first lag of the dependent variable is significant. This implies that Russian returns are predictable using yesterday's returns. Hence, (weak) market efficiency appears to be violated on Russian bond markets. The degree of persistence is not very high, though, as the lagged dependent variable takes on a value of less than 0.10. It might well be the case, as argued by Rockinger and Urga (2000) that this reflects varying risk premia and thin markets rather than a violation of market efficiency.

In addition, there is a significant influence of U.S. markets. Surprisingly, it is not the U.S. bond market that shows an influence but the U.S. stock market. A one-percentage point increase in S&P returns lead to an increase of Russian bond returns by 20 basis points. Thus, U.S. financial markets Granger-cause Russian bond markets. The economic effects are twice as strong as those of the lagged Russian bond returns.

We find some evidence for threshold asymmetry (Glosten et al., 1993). It implies that negative forecast errors last period have a larger impact on the current volatility of the Russian bond market than positive ones. This can also be interpreted as unspecified negative news, which is being captured in the forecast error, having more influence than unspecified positive news. The problem with this approach is that the forecast error may reflect all sorts of influences, in particular, weaknesses in the econometric model, and not only news. We think that this is a serious problem, and continue our analysis using the explicit news categories as described above.

Starting with energy news, we observe that there is a clear difference in the way the content of news affects bond returns. Neutral energy news influences the market in no significant way. On the other hand, positive (negative) news raises (lower) market returns, suggesting that the content of news plays an important role.

The impact of good and bad news is not only of statistical importance but also of economic one, as good news increases bond returns by about one percentage point and bad news decreases returns by about the same amount. This influence is five times higher than the effect of U.S. S&P returns on Russian returns. We cannot reject the symmetry hypothesis, in absolute terms, of the impact of good and bad news on bond returns ($Chi^2(1) = 0.01$). Given the size of the coefficients, it seems worthwhile to test the estimates against the hypothesis of a unit influence of news on bond returns. We cannot reject these hypotheses ($Chi^2(2) = 0.02$). Therefore, we conclude that good (bad) energy news raises (lowers) daily stock returns by one percentage point.

Moving the analysis to war news in the bonds equation, Table 3 reveals that none of the coefficients are statistically significant. Thus, the Chechnya war news has no noticeable impact on bond market returns. This suggests that investors already discounted the impact of the war news. [12]

Determinants of bond market volatility

A key related question is whether news variables enter the standard GARCH variance equation of bonds returns significantly (see Bollerslev and Ghyssels, 1996).[13] Starting with news, we construct a dummy variable that takes the value of one if either war or energy news occurs. No effect on volatility can be found (robust t-value = -1.00). Then we include each category of news separately in the variance equation, and we neither find a significant impact.[14] Thus, it appears that these news categories affect only mean returns.

Next, we consider other variables that might affect the variance equation. In particular, we assess the impact of the oil price and spillover effects from U.S. financial markets. Again, we do not find any significant impact of these variables on bond market volatility. We also looked at the effects of squared values of these variables, leading to the same negative conclusion.[15]

Dynamic effects of news on bond market

To get a better idea about the dynamic effects of news on financial markets in Russia, we analyze the situation in a plus/minus one day window around the event day (see Table 4). This provides information on bond market returns the day before news come in. For example, news may leak the day before the official announcements. It also allows us to draw some conclusions about the persistence of the effects set in motion by the news events beyond the

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[12] It is also noteworthy to mention that the inclusion of the news variables does not noticeably affect the estimates of the other model parameters.

[13] We also considered modeling within an EGARCH framework (Nelson, 1991) as a further robustness check. It turned out, however, that we do not get converging estimates for this class of models. The reason for these problems can be traced to the presence of the "news" dummy variables, which cause serious problems for the optimization algorithms (Doornik and Ooms, 2002).

[14] In fact, with energy news alone in the variance equation, the model does not converge.

[15] To conserve space, we do not report these regressions in detail. All omitted results are available upon request.

announcement days. War news is insignificant and the following discussion thus centers on energy news.

Starting with good energy news, the bond market is showing average positive returns on the day before the event. On the announcement day, returns increase significantly by one percentage point. One day later, the bond market is below average, indicating a (partial) loss of the gains during the announcement day. Thus, good news does not seem to be anticipated by previous day's prices. Moreover, gains in returns are not sustained over the next day.

In the case of bad energy news, we find that on the day before the announcement, the bond market is significantly below average. On the news day we observe, again in accordance with our previous results, a statistically significant reduction in returns by one percentage point. This loss is then (partially) reversed on the day after the event, as bond markets perform above average. Thus, bad energy news seems to be anticipated by market participants. Expectation formation appears to be positively biased, though, as returns drop even more substantially on the announcement day. The (partial) recovery during the next day may either indicate that the drop on the announcement day was an overreaction or that other news came in that, to a certain extent, compensated the impact of bad energy news.

Stability of estimated model over time

First, given the reduced model for bond returns from Table 3, we want to assess the out-of-sample performance. Figure 1 provides forecasts and their 95% confidence intervals for the months September and October 2001. Note that about one working week of data are missing after 10 September. Although there is one observation (4 September 2001) outside the confidence bands, in general the model performs satisfactory. Thus, the estimated equation appears to be stable even during a time of financial upheaval.

Next, we analyze in-sample stability and changes in correlations over time. We include yearly dummy variables to cover significant changes in returns over the sample period. Looking at the individual estimates, we find that 1998 was a particularly bad year for bond returns while 1999 was a good year. It turns out, however, that these year effects are neither individually nor jointly significant ($Chi^2(6) = 6.36$).

Concentrating on the international integration of the Russian bonds market, we ask whether the influence of the S&P index was changing over the sample. To do so, U.S. returns are interacted with the yearly dummy variables, allowing for a different parameter in every period. We then re-estimate the model in Table 3 and we can reject the hypothesis that the parameter on the S&P index is the same in every year ($Chi^2(7) = 71.2$). It turns out that the bond returns show deviations from the mean effect particularly in 1998 (coefficient: -0.005), but also to a lesser extent in 2001 (coefficient: 0.07). The U.S. influence on the Russian bonds market was not significantly different from zero in these periods. In other words, during these years the Russian bonds market was not reacting to world financial markets.

This finding begs the question of why we observe such a result. A well-known event during the sample period was the Russian financial crisis on 17 August 1998, when the Russian authorities decided to abandon support for the ruble and announced a 90-day moratorium on commercial external debt payments. To test the hypothesis that the international linkage of Russian financial markets weakened as a result of the crisis, we include a dummy variable taking on a value of zero before September 1998 and of one after. This variable turns out to be not significant, however. We then interact this dummy variable with the S&P index and add it to the regression, while keeping the crisis dummy variable in regressions. We find no significant influence on the effect of the S&P index on Russian bond returns. This is perhaps not entirely surprising, given our finding that the coefficient on the S&P index was particularly low in 1998 and 2001. In addition, the inclusion of a step dummy alone is not based on sound economic reasoning and does not address the question of why the crisis should have long-lasting effects.

To address these questions, we propose to use an indicator for financial liberalization published by the EBRD in its *Transition Report*. It takes values from 1 to 4+. Higher values would represent progress towards a higher level of financial market liberalization as found in most advanced economies. Over our sample period period, the values are as given in Table 5.

The hump-shaped time profile of this indicator suggests that the transition of Russian financial markets suffered a severe blow in 1998 that lasted till the end of the sample period in 2001. Thus, instead of further progress, the period after the crisis is characterized by a reduction in bank solvency and a declining activity of banks and other financial institutions in market-oriented lending. All in all, there is a shrinking of financial market activities, both by banks and by enterprises issuing commercial papers. In our view, this deterioration in market activity led to the reduced global integration of Russian financial markets.

Including the financial liberalization index in the base model of Table 3 for the bond market gives no statistically significant results. When this variable is interacted with the S&P index, keeping the S&P index and the transition indicator in the model, provides results significant for the interacted term at a 10% level, while the original S&P index shows a marginal significance level of 0.95. After removing the S&P variable and the transition indicator ($Chi^2(2) = 1.97$) from the model, we get a significantly positive coefficient for the interacted variable in the model (coefficient: 0.095, t-value: 7.34**). This implies that the influence of U.S. returns on the Russian bonds market is stronger when financial liberalization is higher.

To better understand the impact of financial liberalization, we utilize the two components of the financial liberalization index: (1) banking reform and interest rate liberalization and (2) securities markets and non-bank financial institutions. Corresponding to the analysis above, we now generate two interaction variables with the S&P and these sub-indices. Re-running the base model, while including the sub-indices and their interaction with the U.S. financial market, does not allow us to reject that the original S&P index returns, its interaction with the banking liberalization indicator, and the sub-indices themselves are zero. We hence conclude that the S&P returns affects Russian stock market returns strongly only when non-banking liberalization is high. Based on these results, we note that the break-down of security issuance as a means of financing during and after the financial crisis contributed to a reduction in the globalization of Russian bond markets. We also investigated the consequences of interacting the other variables in Table 3 with the liberalization index, but we did not uncover any significant relationships.

Further robustness checks

Given the importance of oil prices for the Russian economy, and the significant impact of energy news on bond returns, one can conjecture that perhaps the volatility of oil prices affects returns as well. To test this hypothesis, we generate estimates of oil price volatility in several ways, namely for oil prices themselves and growth rates, using both a GARCH and an EGARCH specification.[16] As it turns out, none of these four indicators for oil price volatility shows a significant influence on bond markets. These results, also not reported for space considerations, suggest that market participants already discounted the impact of high energy price volatility on bond returns.

VI. Analyzing stock returns

Effects on stock returns

Next, we analyze the Russian stock market (see Table 3). The modeling strategy is similar to the bond market. The sum of the GARCH(1,1) coefficients is again below unity but not significantly so.[17] The testing-down of variables in the general model of the stock market

[16] Given the non-stationarity of oil prices, we reject the sum of GARCH(1,1) coefficients to be below unity.
[17] We re-estimate the reduced model as an EGARCH. This leaves the other results unaffected but now we can statistically reject the hypothesis of an IGARCH at a 5% level. We stick to the original GARCH specification in Table 3, though, as we use a general-to-specific approach and an EGARCH for the general model shows no sign of convergence.

equation leads to a more parsimonious model with regard to the GARCH features than the bond equation ($Chi^2(40) = 37.6$). For stock market, we cannot find any trace of threshold asymmetry. The degree of non-normality is relatively less severe.

Regarding the variables in the model, as consistent with findings of Rockinger and Urga (2000), we observe persistence in stock returns as well. The degree of persistence is larger than in the case of bond returns, but it is not very high. Again, we find evidence for the S&P index to influence Russian markets. This time, a one percentage point increase in U.S. stock market returns raises Russian stock returns by 0.52 percentage points after the first period. This impact is twice as large as in the case of the bonds equation, and more than three times higher than the impact of lagged stock returns.

We now keep the first lag of the oil price growth in the equation, following the testing-down process. A one percent increase in the oil price raises stock prices by about one-tenth of a percentage point. This effect is not strong in economic terms. It is only about 20% of the impact that the U.S. financial markets have on Russian stock returns.

However, this time we do not find any significant news effect in the model. There is neither an asymmetry of forecast errors on the conditional variance nor is there an influence of the explicit news categories referring to energy news and Chechnya war news on stock returns.

Determinants of volatility on stock market

Although we do not find that any of the news categories affect stock returns in the reduced model, it might very well be the case that they influence volatility. Thus, we test for the impact of news, the oil price, and spillover effects from U.S. markets on stock market volatility. Starting with the influence of news on volatility, we neither find an effect of an aggregate news dummy (robust t-value = -0.50) in the variance equation, nor do we discover significant effects related to the disaggregated news categories. The same result holds for oil price growth or its square.

When considering U.S. stock market returns, we discover a significantly negative influence (robust t-value = -2.31*). In other words, higher U.S. returns appear to reduce the volatility of the Russian stock market. This sign is expected because new information arrival decreases the information disparity in the market, reducing potential speculative trading activities and hence volatility. We get significantly positive effects when including squared values of U.S. stock market returns (robust t-value = 2.76**). As the latter measures the volatility of the U.S. market, the positive sign indicates "direct" volatility linkages between the two markets. While the sign of the effects depends on the specification, we find that there are "information" spillover effects from U.S. stock markets developments onto Russian stock market volatility. These results suggest that market participants in Russia pay attention to developments in U.S. markets.

Dynamic effects of news on stock market

As in the case of bond markets, we analyze the dynamic structure of information arrival, using a plus/minus one day window around the announcement day (see Table 4). As in Table 3, war news does not show a significant impact. For good energy news, there is no significant effect on any one of the three days. In the case of bad energy news, however, we find that on the day before the announcement, the market shows returns that are negative but statistically indistinguishable from the average. On the news day, the market shows a (further) decline, which is only significant at a 10% level. Finally, on the day after the event, the market becomes bullish, showing a significant and above average performance. Hence, although effects are less significant in general, we find a similar dynamic structure for the impact of bad news on stock markets than on bond markets.

Stability of estimated model over time

Figure 2 displays the out-of-sample performance of the equation. It is apparent from the graph that no violation of the hypothesis of stable parameters occurs. Note, however, that the confidence band is much wider compared to the one of the bonds equation in Figure 1.

Next, we study in-sample stability and changes in correlations over time. As in the case of bond markets, we test the influence of yearly dummies. We find that 1998 is characterized by a low daily rate of return on stocks, significant at the 5% level. However, testing all yearly dummies jointly, we cannot reject that they are equal to zero ($Chi^2(7)$ = 10.1). Thus, the time effects are not very strong.

Focusing on the international integration of Russian stock markets, we investigate the impact of the U.S. stock market. As before, we interact the S&P index with the yearly dummies and include these, instead of the original S&P variable, in the model shown in Table 3. Opposite to the bond market results, we cannot reject that in every year the U.S. influence was the same at a 5% level ($Chi^2(6)$ = 10.5). We hence conclude that, while 1998 was a bad year for Russian stock markets too, this did not significantly affect the coefficient of the S&P variable.

Considering the Russian financial crisis again, we include a step dummy from September 1998 onwards. This variable and the interaction variable based on this dummy and the S&P index are not found statistically significant at a 5% level.

Applying the EBRD indicator for financial liberalization (see Table 5) again, we find that it is insignificant when included alone in the model of Table 3. However, when it is interacted with the S&P variable, it shows a positive and significant coefficient at a 5% level. The original S&P index is no longer significant. In addition, we cannot reject that the coefficients for the financial liberalization index itself and the original S&P index returns are equal to zero ($Chi^2(2)$ = 0.34). When we include the interacted S&P index alone, it displays a coefficient of 0.27 and a t-value of 7.44. We thus conclude that the degree of financial liberalization determines the extent to which the U.S. stock markets influence Russian stock markets.

As in the case of bond markets, we decompose the impact of financial liberalization (see Table 5). When we include the two financial liberalization sub-indices in the model as well as their interaction terms with the S&P index, we discover that the interaction with banking reform is significant at the 5% level. The original S&P variable is no longer significant. A test of exclusions for both financial liberalization sub-indices, the S&P variable interacted with the non-banking index, and the original S&P variable is not rejected at the 5% level ($Chi^2(4) = 5.1$). Including the S&P variable as an interacted term with the banking reform sub-index alone in the model yields a coefficient of 0.29 and a t-value of 7.43. Hence, compared to the results for bond markets, we find that it is the degree of banking reform and interest rate liberalization that affects the impact of international stock markets on Russian stock markets.

It should be further noted that interacting any of the other variables in our model in Table 3 does not yield any interesting conclusions.

Further robustness checks

As for bond markets, we check the hypothesis that oil price volatility may influence stock market returns. Again, none of our indicators for oil price volatility shows a significant influence on returns.

It is interesting to look at the impact of the trading volume on stock markets, as order flows have been discovered as being an important information element in explaining movements in financial markets (see O' Hara, 1995 and Lyons, 2001). We cannot use the trading volume variable in levels, because the volume data in levels is not stationary.[18] Therefore, we use the growth rate of the volume of trading. First, putting this variable into the

[18] To economize with respect to space, we do not include the full output in the paper. Full estimation results are available upon request.

returns equation does not yield any statistically significant results (robust t-value = 1.44). There is one big outlier; trade on 28 December 1995 was unusually low, resulting in a growth rate of 3200%. We neutralize the impact of this observation by using a dummy for this date and find that now growth in trading volume now has a significantly positive impact on stock returns (robust t-value = 4.21**). The size of the estimated coefficient implies that an increase in trading volume by one percentage point raises stock returns by 0.006%. Given an average of about 17% for trade growth, this indicates an increase in stock returns by 0.10 percentage points.[19]

Note, however, that causality may also run from volume to prices. To circumvent this problem, as well as the potential endogeneity bias, we include the lagged value of the trading volume in estimations, instead of the current one. This leads to a less significant estimate (robust t-value = 2.15*) and a lower coefficient (0.001). Overall, we interpret the findings as supporting the view that trading volume contains valuable information for stock markets, supporting the implications of the microstructure models. A thorough analysis of these effects requires a higher frequency data analysis, which is beyond the scope of this paper.

Second, when the trading volume variable is included in the variance equation, we find that a higher growth in trading volume leads to a highly significant increase in the volatility of stock returns (robust t-value = 5.33**). This result is not sensitive to including the dummy variable for 28 December 1995 as discussed above. This implies that the estimated conditional variance will be smaller on average when the trading volume variable is included. In contrast to our analysis of trade volume on returns, the lagged value of the trade volume growth is not significant in the variance equation (robust t-value = 1.74)

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[19] Using squared values of the trading volume growth rate in the variance equation does not lead to converging estimates.

VII. Conclusions

This paper analyzes Russian financial markets using daily returns on stock and bond markets over the period September 1995 to November 2001. In both markets, movements in the U.S. stock market index Granger-cause Russian returns. This finding indicates that Russian markets have become dependent on developments in global financial markets. However, there was a decline in the degree of globalization of Russian markets after the 1998 crisis. A more detailed analysis reveals that the international influence on Russian financial markets depends upon the degree of financial liberalization. We find that a higher degree of financial liberalization is associated with a stronger impact of U.S. stock returns on Russian financial markets. We also decompose the impact of financial liberalization. While banking reform and interest rate liberalization efforts seem to be more important for the globalization of Russian stock markets, it is the progress in liberalizing securities markets and non-bank financial institutions that matters more for the globalization of Russian bond markets. However, a more detailed examination of these issues is beyond the scope of this study.

Our finding that the Russian stock market is sensitive to oil price suggests that oil price movements may significantly destabilize Russian markets. International investors may diversify such risks by investing in other emerging markets that are not as dependent on rich energy resources as Russia. Regarding the effect of information arrival on financial market returns, there is considerable evidence for energy news playing an important role on bond markets. We do not find, however, a statistically significant impact of news from the war in Chechnya on financial markets. Thus, financial markets clearly differentiate between different types of news. Although energy news are priced in the markets, an event as widely publicized in the international press as the Chechnya war does not seem to have much of an influence on both bond and stock markets. It is also of interest to note that news does not appear to influence the volatility on financial markets. We also find evidence that order flows help to explain Russian financial market returns as well as, though less robustly, volatility. This is in line with a strongly developing literature pointing towards the microstructure of markets as an important determinant in the development of financial market series. However, for a more precise analysis of the issue, intraday data would be needed.

Our results indicate that further liberalization and deepening of Russian markets will likely result in increased financial market co-movements between Russian and global markets. However, the decrease in financial liberalization that occurred in Russia after 1998 implies that at least for the moment it can still serve as a market that allows U.S. investors to reduce portfolio risk through diversification. However, over time, other transition economies, such as those in the central and eastern Europe, may provide a better alternative for diversification. The correlations of the latter markets with the U.S. is expected to be relatively low, as the latter are the candidate countries for the European Union and, thus, may be more influenced by financial markets in the Euro area than by U.S. markets.[20]

[20] Gilmore and McManus (2002) examine the correlations between the U.S. stock and central European markets. They find no significant long run relationship. Their evidence also indicates that the U.S. market does not Granger-cause any of the European markets.

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Table 1: Defining news categories

Category	Definition	No. of cases
Energy:		
Energy good news	Announcements, actions, or events with positive implications for the energy sector	7
Energy neutral news	Announcements, actions, or events relating to energy with neither obvious good or bad implications	14
Energy bad news	Announcements, actions, or events with negative implications for the energy sector	5
Chechnya:		
War good news	Announcements, actions, or events that imply either Russian gains or an ending of the conflict	17
War neutral news	Announcements of Russian or Chechen military actions	28
War bad news	Announcements, actions, or events that imply either Russian losses or a continuation of the conflict	17

Table 2: Descriptive Statistics of daily returns (growth rates in %)

	Mean	St.Dev.	Min	Max	Skewness	Excess kurtosis
Russian bonds	0.08	2.64	-25.78	23.33	-0.32	2.64
Russian stocks	0.06	3.45	-19.03	16.83	-0.07	3.49
U.S. bonds	-0.03	0.10	-4.75	4.84	0.19	2.03
U.S. stocks	0.05	1.17	-6.87	5.12	-0.07	2.63
Oil price	0.01	2.51	-20.04	17.65	-0.06	5.86

Notes: The sample period is 1 September 1995 to 30 November 2001, with a total of 1388 consistent observations.

Table 3: Explaining returns using a GARCH (1,1) model with t-distributed errors

	Bond returns		Stock returns	
	Coeff.	SE	Coeff.	SE
α_0	0.02**	0.01	0.55**	0.21
α_1	0.07**	0.02	0.24**	0.06
β_1	0.90**	0.02	0.73**	0.06
Student-t degrees of freedom (ν)	5.1		6.8	
Threshold	0.08*	0.03		
Constant	0.12**	0.03		
Dummy 10/23/1997	-3.13**	0.03	-4.20**	0.12
Bond return$_{t-1}$	0.09**	0.03	0.12*	0.05
Stock return$_{t-1}$			0.11**	0.03
Stock return$_{t-6}$			0.05	0.03
S&P return$_{t-1}$	0.20**	0.03	0.52**	0.08
Oil price growth rate$_{t-1}$			0.08**	0.03
Energy neutral news	0.23	0.31	-0.08	0.86
Energy good news	1.04**	0.23	-0.71	0.50
Energy bad news	-1.00**	0.26	-1.12	0.74
War neutral news	0.31	0.27	0.36	0.49
War good news	-0.28	0.21	-0.49	0.49
War bad news	-0.04	0.28	0.13	0.56
Number of observations	1347		1347	
Log-likelihood	-2535.5		-3337.2	
Normality test	$Chi^2(2) = 2574$**		$Chi^2(2) = 69.5$**	
ARCH 1-2 test	$F(2, 1328) = 0.03$		$F(2, 1327) = 2.36$	
Portmanteau test	$Chi^2(25) = 17.7$		$Chi^2(25) = 35.8$	

Notes: * (**) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent.

Table 4: Explaining returns using a plus/minus one day news window

	Bond returns		Stock returns	
	Coeff.	SE	Coeff.	SE
α_0	0.02	0.01	0.54*	0.23
α_1	0.07**	0.02	0.25**	0.07
β_1	0.90**	0.02	0.73**	0.07
Student-t degrees of freedom (ν)	5.1		6.7	
Threshold	0.08*	0.04		
Constant	0.12**	0.03		
Dummy 10/23/1997	-3.12**	0.04	-4.19	0.16
Bond return$_{t-1}$	0.09**	0.03	0.11*	0.06
Stock return$_{t-1}$			0.11**	0.03
Stock return$_{t-6}$			0.05	0.03
S&P return$_{t-1}$	0.20**	0.03	0.53**	0.08
S&P return$_{t-2}$				
Oil price growth rate$_{t-1}$			0.08**	0.03
Energy neutral news$_{t-1}$	0.03	0.43	0.23	0.58
Energy neutral news$_{t}$	0.24	0.31	0.05	0.82
Energy neutral news$_{t+1}$	-0.10	0.40	0.55	0.58
Energy good news$_{t-1}$	0.01	0.19	-0.43	1.20
Energy good news$_{t}$	1.04**	0.21	-0.74	0.53
Energy good news$_{t+1}$	-0.41*	0.17	-1.16	0.74
Energy bad news$_{t-1}$	-0.54**	0.11	-1.33	0.84
Energy bad news$_{t}$	-0.99**	0.21	-1.21	0.66
Energy bad news$_{t+1}$	0.72**	0.13	0.73*	0.29

Continues on next page

Table 4 continued

War neutral $news_{t-1}$	0.03	0.21	0.07	0.46
War neutral $news_t$	0.24	0.28	0.34	0.53
War neutral $news_{t+1}$	0.21	0.23	0.18	0.51
War good $news_{t-1}$	0.11	0.17	-0.41	0.50
War good $news_t$	-0.29	0.19	-0.61	0.57
War good $news_{t+1}$	0.33	0.23	1.05	0.67
War bad $news_{t-1}$	0.33	0.29	-0.09	0.46
War bad $news_t$	-0.02	0.28	0.26	0.59
War bad $news_{t+1}$	0.25	0.33	0.45	0.62
Number of observations	1351		1346	
Log-likelihood	-2537.5		-3330.2	
Normality test	$Chi^2(2) = 2579$**		$Chi^2(2) = 69.2$**	
ARCH 1-2 test	F(2, 1320) = 0.02		F(2, 1314) = 2.46	
Portmanteau test	$Chi^2(25) = 16.8$		$Chi^2(25) = 34.6$	

Notes: * (**) indicates significance at a 5% (1%) level. Standard errors are heteroscedasticity-consistent.

Table 5: EBRD Financial liberalization index

	1995	1996	1997	1998	1999	2000	2001
Financial liberalization	2.00	2.50	2.67	1.84	1.67	1.67	1.67
Banking reform and interest rate liberalization	2.00	2.00	2.33	2.00	1.67	1.67	1.67
Securities markets and non-bank financial institutions	2.00	3.00	3.00	1.67	1.67	1.67	1.67

Fig. 1: Out-of-sample performance of daily bond returns equation with 95 %-intervals

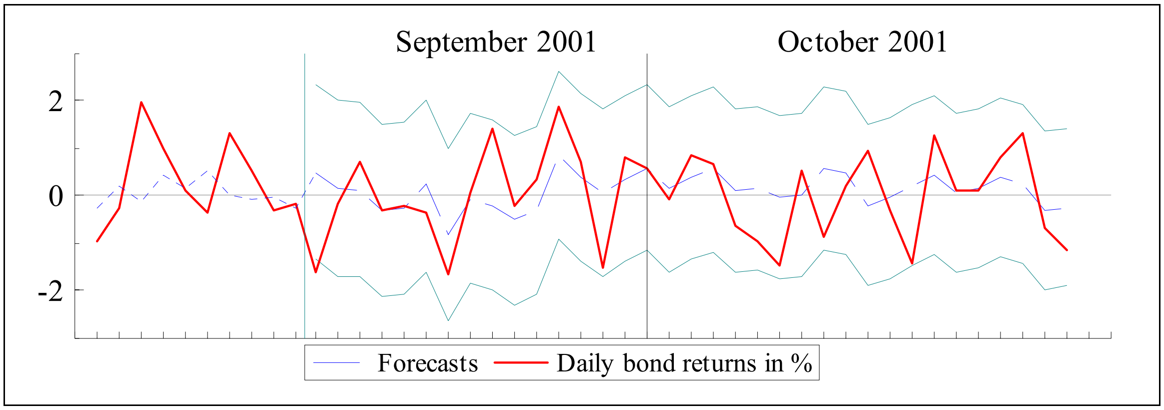
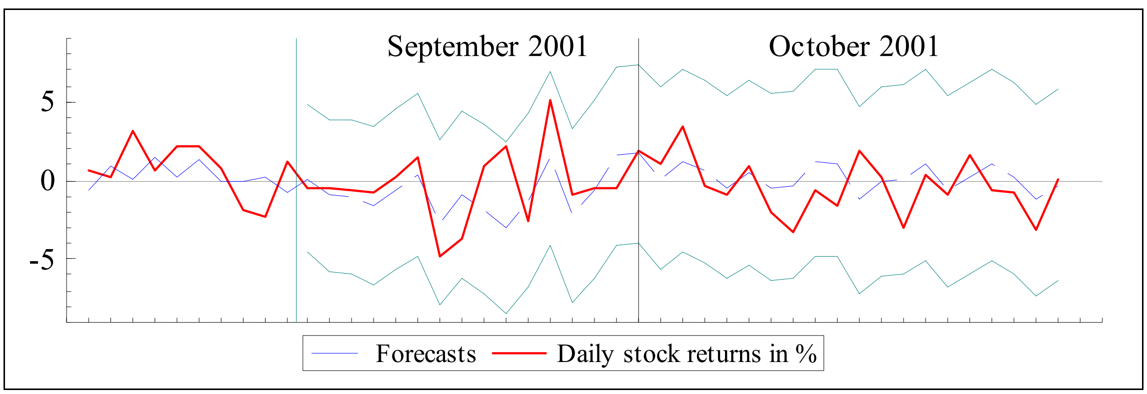


Fig. 2: Out-of-sample performance of daily stock returns equation with 95 %-intervals



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