Should emerging market investors diversify abroad despite superior domestic performance?

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Abstract

There is vast literature documenting benefits from international diversification for investors from developed countries. In this paper, we take an opposite view of a Russian investor who would like to diversify her local portfolio by investing abroad. We consider the period from 1999 to 2003 when Russian stock market experienced exceptional growth with an average return over 40% p.a., in contrast to poor performance of most of the foreign stock markets. Yet, despite the seeming unattractiveness of foreign markets, the benefits from international diversification for Russian investors were substantial. By investing about one third of the portfolio to the foreign equity indices, conservative Russian investors could have reduced the standard deviation by 2.5% to almost 11%, keeping constant the average return of 18% p.a. This result is apparently driven by low correlation between Russian and foreign assets and lack of diversification in the domestic stock market. The benefits remain significant even after accounting for the short-selling constraints, conditioning information, and transaction costs. Thus, international diversification benefits are robust and realized not only by developed countries' investors, but also by investors from the emerging markets, even in times of abnormally high domestic performance.

Keywords: emerging markets, international diversification, mean-variance spanning.

1. Introduction

There is vast literature investigating potential benefits from international diversification, i.e., from extending the portfolio of local assets to the securities in foreign countries. Most studies take the viewpoint of an investor from a developed country (typically, U.S.) analyzing potential benefits from new investment opportunities in other developed countries as well as in the emerging markets. They document the home bias puzzle, i.e., a tendency to hold much more domestic assets than in a diversified world market portfolio (see, e.g., French and Poterba, 1991). De Santis and Gerard (1997) estimate that the expected gain from international diversification to a U.S. investor is 2.11% p.a. A number of possible explanations have been offered, including transaction costs, asymmetric information, presence of the omitted asset, and statistical measurement problem; yet, it seems that no single explanation can fully account for the observed home asset bias (see, e.g., Lewis (1999), Glassman and Riddick (2001)). De Roon, Nijman, and Werker (2001) argue that the magnitude of the international diversification benefits crucially depends on such market frictions as short-sale constraints and transaction costs. Using mean-variance spanning methodology, they find that strong statistical evidence for diversification benefits from investing in emerging markets disappears after accounting for these frictions. However, Li, Sarkar, and Wang (2003) argue that the previous result may be due to the small power of the test and show using a Bayesian approach that the international diversification benefits remain substantial even when U.S. investors are prohibited from short-selling.

In the current paper, we take an opposite view to the studies mentioned above, considering a Russian investor who would like to diversify her local portfolio by investing in developed countries as well as in other emerging markets. We focus on the period from 1999 to 2003, which was characterized by a unique combination of risks and returns in Russia and abroad. The Russian stock market experienced spectacular growth during this time, as its capitalization increased more than ninefold (in dollar terms). In contrast, foreign stock markets realized low and in some cases even negative average returns during this five-year period. Yet, despite the seeming unattractiveness of foreign assets, the benefits from international diversification for Russian investors were substantial during this period. By investing about one third of the portfolio to the foreign equity indices, conservative Russian investors could have reduced the standard deviation by 2.5% to almost 11%, keeping constant the average return of 18% p.a. The gains from diversification remain significant both statistically and economically even after accounting for the short-selling constraints, conditioning information, and transaction costs. Moreover, most gains could be realized by investing in a single equity index of such countries as the U.S. or the U.K.

Our results are apparently driven by low correlation between local and foreign assets as well as lack of diversification in the domestic stock market. The Russian stock market is very concentrated, as most blue chips are from the oil&gas and energy industries. Moreover, the stock price dynamics of these companies is not very much related to the changes in prices of the underlying natural resources due to the importance of the corporate governance issues and non-economic (in particular, political) risks.[2]

An important practical implication of our results is that strict government regulation of foreign investments by Russian institutional investors, especially pension money managers, should be weakened. This is crucial for ensuring their long-run sustainability and success of the pension reform. Clearly, in the long run the benefits from international diversification will only increase, as the differential between returns of Russian and foreign stock markets goes down.

The structure of the remainder of the paper is as follows. Section 2 describes the regression-based methodology we use to test for mean-variance spanning and intersection. Section 3 provides the description of the data. In Section 4, we present our analysis of the benefits arising from extension of the local portfolio to foreign equity indices, controlling for such market frictions as short-sales constraints and transaction costs as well as for conditioning information. Section 5 concludes.

2. Measuring international diversification benefits

We measure the benefits from international diversification in the mean-variance framework.[3] In case of mean-variance spanning, i.e., when the mean-variance frontier based on local assets does not shift after adding foreign assets, there are no diversification benefits. In case of mean-variance intersection, i.e., when the local and the extended mean-variance frontiers have one point in common, some investors may profit from getting access to the foreign assets.

Let R and r denote the vectors of total returns of K local and N foreign assets, respectively. Under the law of one price, there exists a stochastic discount factor $m_R(v)_t$ with expectation v pricing the local assets:

$$E[m_R(v)_t R_t] = l_K, \tag{1}$$

[2] Black (2001) finds a strong positive relation between the corporate governance ratings of Russian companies and their market valuations in 1999. Based on a case study of Yukos, Lukoil, and Gazprom in 2002-2003, Goriaev and Sonin (2004) conclude that political risks in Russia are large and company-specific.

[3] See De Roon and Nijman (2001) for an excellent survey of the various approaches used for testing for mean-variance spanning and intersection.

where l_K is the K-dimensional vector of ones. Imposing the condition that such stochastic discount factor correctly prices foreign assets:

$$E[m_R(v)_t r_t] = l_N\,, \tag{2}$$

for one value of v or of for all values of v is equivalent to the hypotheses of mean-variance intersection and spanning, respectively, assuming the absence of market frictions such as short-selling constraints and transaction costs.

We test these hypotheses using the regression-based approach introduced by Huberman and Kandel (1987). We estimate the regression of the returns of foreign assets on the returns of the local assets:

$$r_t = \alpha + \beta R_t + \varepsilon_t\,, \tag{3}$$

with $E(\varepsilon_t) = 0$ and $E(\varepsilon_t R_t) = 0$ to obtain consistent estimates of α, an N-dimensional vector of intercepts, and β, an $N \times K$-dimensional matrix of slope coefficients. The restriction for intersection for a given value of v may be written as

$$\alpha v + (\beta l_K - l_N) = 0\,, \tag{4}$$

which implies that the local and the extended mean-variance frontiers intersect at a point corresponding to the portfolio with zero-beta return $1/v$. In case of spanning, (4) should be satisfied for any value of v, which is equivalent to the restrictions

$$\alpha = 0 \text{ and } l_N - \beta l_K = 0\,. \tag{5}$$

Intuitively, in this case the return of each foreign asset can be written as the return of a portfolio of local assets plus the return of an orthogonal error term with zero expectation. Obviously, such new assets can only add variance to the efficient portfolios of local assets with a given expected return. The linear restrictions (4) and (5) are tested using the standard Wald test.

When short-selling is not possible, the restricted mean-variance frontier based on local asset returns R_t consists of parts of the unrestricted mean-variance frontiers based on subsets of returns R_t^v (including only assets with long positions in the optimal portfolio) for different values of v. De Roon, Nijman, and Werker (2001) showed that the intersection test for a given value of v is equivalent to the restriction that in the regression of the foreign asset returns r_t on the corresponding subset of local asset returns R_t^v:

$$r_t = \alpha^v + \beta^v R_t^v + \varepsilon_t\,, \tag{6}$$

it holds true that

$$\alpha^{v} v + (\beta^{v} l_K - l_N) \leq 0 . \tag{7}$$

Under the null hypothesis and standard regularity conditions, the asymptotic distribution of the corresponding test statistic

$$\underset{\{\alpha^{v} \leq 0\}}{\xi(v)} = \min(\hat{\alpha}^{v} - \alpha^{v})' Var(\hat{\alpha}^{v})^{-1} (\hat{\alpha}^{v} - \alpha^{v}) \tag{8}$$

is a mixture of χ^2 distributions. We determine the corresponding *p*-values on the basis of numerical simulations using the covariance matrix $Var(\hat{\alpha}^{v})$ estimated by bootstrap.[4]

In case of mean-variance spanning, restriction (7) should be satisfied for all subsets R_t^v. De Roon, Nijman, and Werker (2001) showed that this condition will be met if there is intersection for the minimum and maximum values of v in a relevant range. Thus, testing for spanning is equivalent to a joint test of the inequality restrictions (7) for the minimum and maximum values of v. Similarly to the case of intersection, a Wald test statistic is asymptotically distributed as a mixture of χ^2 distributions.

One may extend the tests of mean-variance intersection and spanning considered above by taking into account transaction costs. The transaction costs τ imposed on foreign assets are assumed to be proportional and modeled in the following way. We suppose that return on the long assets is $r - \tau$, while investors taking short position face the return $r + \tau$. We double the number of foreign assets under consideration, imposing that investors can only take long positions in assets with return $r - \tau$ and that assets with return $r + \tau$ cannot have positive portfolio weights. Further analysis is analogous to the case of short-sales constraints.

Another extension of the tests of mean-variance intersection and spanning involves incorporating conditional information to reflect the possible predictability of asset returns. Following the approach suggested e.g. by Shanken (1990), we assume that regression coefficients α and β in (3) are linear in the instruments. The restrictions for intersection and spanning ((4) and (5), respectively) are modified accordingly.[5]

3. Description of the data

The sample period covers five calendar years after the August 1998 crisis, from January 1999 to December 2003. We concentrate on the post-crisis period because of the structural

[4] See De Roon, Nijman, and Werker (2001, pp. 726-728) for details.

[5] See section 4.3 in De Roon and Nijman (2001) for details.

differences between the market environment before and after the crisis. Since we use data at weekly frequency, this amounts to 260 observations. This is comparable with the typical number of observations in the studies of diversification benefits for U.S. investors (see, e.g., De Santis and Gerard (1997), De Roon, Nijman, and Werker (2001)), although the latter usually employ monthly data.

Our data set of local assets includes weekly dividend-adjusted dollar-denominated returns of 12 most liquid Russian stocks (Nornikel, Irkutskenergo, Lukoil, Mosenergo, RAO UES, RAO UES preferred, Rostelecom, Sberbank, Sberbank preferred, Surgutneftegaz, Surgutneftegaz preferred, and Tatneft). We limit our attention to the twelve blue chips, since other stocks were characterized by low liquidity (they were traded during less than 90% of the trading days during the sample period) and relatively high transaction costs.[6] Most of the stocks under consideration were traded on both of the two major Russian stock exchanges: RTS (Russian Trading System) Stock Exchange and MICEX (Moscow Interbank Currency Exchange). However, the trade intensity for each stock differed across the two exchanges. Therefore, we combined data on RTS and MICEX close prices, selecting the exchange by the number of trading days with the positive trading volume in a given year. Besides the twelve blue chips, we also included to the portfolio of local assets the 30-day Russian T-Bill dollar-denominated rate.[7]

MSCI (Morgan Stanley Capital International) free-float adjusted dollar-denominated stock indices are employed as foreign assets. MSCI indices are often used in the analysis of international portfolio diversification, since they are calculated on the basis of stocks available to foreign investors. In our basic analysis, we use two sets of foreign assets: (i) Developed and Emerging indices, and (ii) Europe, North America, Pacific, and Latin America indices. Subsequently, we also employ MSCI country equity indices.

We considered several macroeconomic variables including the oil price, ruble-dollar and ruble-Euro exchange rates, and EMBI+ spread on Russian government Eurobonds as instruments for the conditional analysis. In order to ensure the sufficient power of the tests, we left two most significant instruments: (changes in logs of) the oil price and the ruble-dollar exchange rate.

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[6] The results remain qualitatively the same when we apply a weaker selection criterion based on stock liquidity and include a larger number of Russian stocks to the set of local assets.

[7] We assume that in the beginning investors buy a T-bill with maturity closest to, but not lower than 30 days and hold it till expiration, when they replace it with another 30-day T-bill, and so on. Based on the interim T-bill prices and exchange rates, we compute weekly dollar returns of this strategy. The results do not materially change when we use the Russian government Eurobonds instead of the T-bills. During the sample period, investing in the Eurobonds implied slightly higher return, but much higher risks than investing in the T-bills.

Table 1 reports annualized summary statistics of the local and foreign assets based on dollar weekly returns in 1999-2003. During this period, the Russian stock market experienced spectacular growth with the average return of S&P-RUX index of 42% p.a. Year 2000 was the worst one with the average return of 1.3%. The average returns of 12 most liquid Russian stocks ranged from 28% for Irkutskenergo to astounding 70% for Nornikel. However, high returns were accompanied by high volatility. The standard deviation of S&P-RUX returns was around 42%, while for the individual stocks this number was even higher. For comparison, the 30-day Russian T-bill rate was on average 15.6% with standard deviation of 15%.

In contrast, foreign equity indices were characterized by much lower returns and risks. Their average returns were in the range from -0.5% to 12%, resulting from large negative returns in 2000-2002 and positive returns in 1999 and 2003. The standard deviations ranged from 17% for MSCI Developed to 26% for MSCI Latin America.

Table 2 documents cross-country correlations during the sample period. Across the MSCI regional indices, Pacific is the least correlated one. The highest cross-regional correlations are between North America and Europe (0.73) and between North America and Latin America (0.62). The correlation between MSCI Developed and Emerging indices is pretty high, in the order of 0.75. In contrast, the Russian stock market has very low correlations with the rest of the world, ranging from 0.22 for Pacific to 0.42 for Emerging. This provides preliminary evidence that the benefits from international diversification may be very high for Russian investors even despite abnormally high performance of local assets. The formal analysis of this claim is deferred till the next section.

4. Empirical results

As we will see, the shift of the local mean-variance frontier after adding foreign equity indices is most pronounced for low expected returns (see Figure 1). This is logical given that foreign equity indices are characterized by much lower risks and returns than Russian stocks. However, since it would be inappropriate to analyze the shift of the inefficient part of the local frontier, we consider as a benchmark the efficient local portfolios with moderate risk. The mean-variance intersection is tested at the point with the expected return equal to that of the global minimum-variance portfolio of local assets (GMV-L) plus 3%, which is about 20% p.a. We construct our test of mean-variance spanning as a joint intersection test at two points with the expected returns equal to that of GMV-L and to that of GMV-L plus 3%.

Besides statistical tests of mean-variance intersection and spanning, we also discuss economic significance of the benefits from international diversification. We use two measures of the diversification benefits: $\Delta\sigma$, the decrease in standard deviation, and ΔR, the increase in expected return, resulting from extension of the local portfolio to foreign assets. We compute these two measures for GMV-L, keeping constant the expected return and standard deviation, respectively. We focus on the first measure, since the principal gain from diversification for Russian investors should be from the reduction in high risks associated with local assets.

Adding international indices

We first consider the case when multiple MSCI international indices are added to the local portfolio of Russian T-bills and 12 most liquid stocks (see Table 3). Since short positions in local and foreign assets may be prohibited because of the regulation or excessive costs, we present estimation results of each specification both in the unconstrained case and in the case when no short sales are possible.

When MSCI Developed and Emerging equity indices are added to the local portfolio, the hypotheses of mean-variance spanning and intersection for the GMV-L mean return are both strongly rejected at any confidence level. The economic gains from international diversification appear to be substantial, as investors holding the GMV-L with mean return of 17.8% and standard deviation of 13.3% may increase the return by $\Delta R = 11.4\%$ or decrease standard deviation by $\Delta\sigma = 2.4\%$. The reduction in risks will be even larger if investors switch from the GMV-L to the global minimum-variance portfolio of local and foreign assets. Both MSCI indices have large positive weights in the optimal extended portfolio, which has the same mean return as GMV-L: 15% for the Developed and 21% for the Emerging. Among the local assets, T-bills have the highest weight of 60% in the optimal extended portfolio, which is not surprising given that they have much lower risk than Russian stocks. Among the blue chips, the top performer Nornikel has the highest portfolio weight.

In presence of short-sales constraints on all assets, both local and extended mean-variance frontiers shift to the right (see Figure 1). However, the results remain qualitatively similar. The statistical significance of spanning and intersection tests remains on a very high level, while economic significance of diversification benefits diminishes slightly. The gains in expected return and standard deviation are on the level of 7.4% and 2%, while the optimal portfolio weights of Developed and Emerging come down to 13% and 17%, respectively.

When we add MSCI Europe, North America, Pacific, and Latin America equity indices to the local portfolio, the results become stronger. Clearly, these four regional indices provide even more potential for diversification than Developed and Emerging indices. In particular, the reduction in risks, $\Delta\sigma$, is equal to 2.5% in the unconstrained case and 2.2% in presence of short-sales constraints. The gains from diversification are mostly driven by North America and Pacific indices that have weight of about 15% in the optimal extended portfolio. Europe does not enter in the optimal portfolio with positive weight, while Latin America's portfolio weight is around 5%.

Incorporation of conditioning information and transaction costs

In order to ensure the robustness of our main results, we investigate whether the diversification benefits found above are sensitive to the incorporation of the conditioning information and presence of the transaction costs (see Table 4).

In a highly dynamic environment of the Russian stock market, a conditional approach to the tests of mean-variance intersection and spanning may be more suitable. Indeed, we find using the oil price and ruble-dollar exchange rate as instruments a significant time variation in the portfolio weights of several Russian stocks. However, this does not affect our basic findings. As before, the hypotheses of mean-variance spanning and intersection are rejected with *p*-values far below 1% level. The reduction in risks, $\Delta\sigma$, remains practically the same as under the unconditional approach. At the same time, the total weight of the foreign indices in the optimal portfolio rises from 36% to 38-39%, mostly due to a higher impact of Pacific index.

It goes without saying that Russian investors aiming at foreign assets face non-negligible transaction costs. Even despite the relatively low level of development and, as a consequence, considerable trading costs at the local stock market, the transaction costs associated with investing abroad may exceed those due to a number of institutional and psychological factors. Russian investors may have limited knowledge of and bias against foreign assets and need to incur information gathering and processing costs. Perhaps, more importantly, the direct and indirect institutional constraints may impose considerable burden on Russian investors that would like to extend their portfolios to foreign assets. Until the beginning of 2004, the highly restrictive currency regulation required such investors obtain permit from the Central Bank of Russian Federation to acquire currency necessary for the purchase of foreign securities. Russian pension money managers who can currently invest up to 5% of the portfolio to foreign assets may do so only via index funds that impose an additional layer of expenses in comparison to

direct trading. To be on a conservative side, we impose transaction costs on foreign assets at the level of $\tau = 3\%$ p.a.[8] However, the statistical as well as economic significance of our results is only marginally affected. Apparently, the low correlation between Russian and foreign assets continues to outweigh the decrease in the expected returns of the latter. The reduction in standard deviation, $\Delta\sigma$, remains above 2%, and the total portfolio weight of the foreign indices stays at approximately the same level as before (34%). Even when we impose transaction costs in combination with the short-selling constraints, the hypotheses of mean-variance intersection and spanning are still rejected at a level far below 1%. The economic gains from diversification remain high, as $\Delta\sigma$ is on the level of 1.8-2% and the total contribution of the foreign indices is about 28-29%.

Adding individual country indices

So far, we have analyzed diversification benefits from adding combinations of regional indices to the local portfolio. However, we would also like to investigate the individual sources of these benefits. Therefore, we now consider MSCI equity indices of leading countries in each of the regions (namely, U.S., U.K., Germany, Japan, and Brazil) added to the local portfolio one at a time. In addition, we investigate the robustness of our findings in presence of the transaction costs on foreign assets. Since the results in presence of short-sales constraints are not materially different from those in the unconstrained case, we only report the latter (see Table 5). The findings in the constrained case are available from the authors upon the request.

We find that the strongest benefits from diversification both in terms of statistical and economic significance are realized for the U.S. and U.K. equity indices. Allocating around 30% of the portfolio to either of the two countries, Russian investors may reduce the standard deviation of their local portfolios by approximately 2%. The Japan and Germany indices offer somewhat lower, yet still highly significant diversification benefits for Russian investors. Investing 22% of the portfolio to Japan allows them to reduce risk by 1.4%, while allocating 17% of the portfolio in Germany helps to lower standard deviation by almost 1%. Finally, the addition of the Brazil index to the local portfolio brings statistically significant, yet marginal economic gains, with $\Delta\sigma = 0.5\%$.

When we impose the 3% transaction costs on foreign assets, the statistical significance of the intersection and spanning tests stays practically on the same level. Economic gains from

[8] As before, we assume zero transaction costs for local assets. Thus, we essentially assume that transaction costs associated with investing in foreign assets exceed those for local assets by 3%.

diversification measured by $\Delta\sigma$ decrease by not more than 0.1%, while the portfolio weight of the foreign country index does not lose more than 2%.

Thus, most of gains from international diversification can be realized by Russian investors even without choosing a broad portfolio of foreign indices. It is sufficient to invest in a single equity index of such countries as the U.S. or the U.K.

Additional robustness checks

One may criticize our choice of twelve blue chips as too restrictive and not fully representing the Russian stock market. Therefore, we repeated the analysis with an alternative set of local assets including eight AK&M Russian equity indices (composite, second-tier, ADR, oil & gas extraction, energy, telecommunication, chemistry & petrochemistry, and machinery) along with the 30-day Russian T-bill rate.[9] These indices represent a broader selection of Russian stocks, including not only securities investable during the whole sample period in the domestic market, but also stocks traded during part of the sample period (such as Yukos), less liquid stocks, and Russian stocks traded abroad as ADRs. This does not change our conclusions. As before, the hypotheses of mean-variance spanning and intersection are strongly rejected in all specifications. The economic gains from diversification become somewhat smaller. For example, the reduction in standard deviation, $\Delta\sigma$, is in the range from 1% to 1.6%, depending on the specification. The complete set of these results is available from the authors upon the request.

5. Conclusion

In this paper, we analyze the benefits from international diversification from the perspective of a Russian investor during the period from 1999 to 2003. We show that abnormally high performance of the Russian stock market during this period does not exclude the potential for international diversification. Addition of the international equity indices to the portfolio of local stocks and T-bills leads to a significant shift of the mean-variance frontier. As a result, the portfolio risks faced by Russian investors, especially conservative ones, could be substantially reduced. These findings are robust both from statistical and economical points of view to the introduction of short-selling constraints and transaction costs, as well as conditioning information. Moreover, Russian investors could achieve substantial gains simply by extending their local portfolio to a single equity index of such countries as the U.S. or U.K. Thus,

[9] AK&M Information Agency is one of the leading independent providers of news and data on Russian financial markets. See http://www.akm.ru/.

international diversification benefits are robust and realized not only by developed countries' investors, but also by investors from the emerging markets, even in times of unusually good domestic performance.

Our results have strong practical implications. In particular, the Russian government should weaken strict foreign investment restrictions imposed on local institutional investors, especially pension money managers interested in low-risk investments. These restrictions have been criticized by a number of Russian politicians and businessmen (see, e.g., Brusnikin and Abramov (2003)), but the government so far has not agreed to liberalize the regulations on the ground of the need to promote the domestic stock market. However, we believe that this goal may be better achieved by developing the institutional infrastructure and attracting foreign portfolio investors whose demand far exceeds that of Russian investors, whereas the lack of diversification due to the narrowness of the domestic stock market may seriously damage the prospects and reputation of Russian money managers. Similar argument for softening the pension fund limits on foreign assets may be made for the governments of other emerging markets (see, e.g., Reisen (1997), Davis (2002)).

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Table 1

Summary statistics

The table reports summary statistics for the weekly dollar returns of the selected MSCI indices, S&P-RUX index of the Russian stock market, 12 most liquid Russian stocks, and 30-day Russian T-bill rate for the sample period 1999-2003. All numbers are annualized.

	1999-2003		1999	2000	2001	2002	2003
	mean	st.dev.	mean	mean	mean	mean	mean
MSCI Developed	-0.39%	16.91%	23.91%	-15.31%	-16.53%	-21.44%	25.17%
MSCI Emerging	10.15%	20.33%	47.25%	-36.41%	2.20%	-2.97%	35.55%
MSCI Europe	-0.01%	18.69%	18.79%	-8.54%	-21.34%	-18.31%	29.35%
MSCI North America	-0.53%	19.87%	20.95%	-13.42%	-10.11%	-25.15%	22.67%
MSCI Pacific	3.61%	19.88%	46.55%	-32.61%	-29.50%	-9.11%	28.23%
MSCI Latin America	12.47%	26.07%	47.23%	-12.43%	3.09%	-24.96%	43.03%
S&P-RUX	42.18%	42.08%	73.50%	1.29%	53.77%	32.68%	41.48%
Nornikel	69.84%	59.61%	106.20%	43.00%	73.82%	27.06%	81.97%
Irkutskenergo	27.95%	52.91%	56.87%	6.87%	25.13%	5.12%	38.80%
Lukoil	35.04%	45.77%	64.15%	3.73%	38.71%	26.45%	39.61%
Mosenergo	34.63%	58.35%	61.77%	-15.96%	59.38%	-19.58%	62.14%
RAO UES	45.06%	63.89%	68.88%	20.88%	65.84%	-6.83%	64.12%
RAO UES pref	61.06%	68.93%	84.79%	14.82%	98.89%	3.87%	70.18%
Rostelecom	33.59%	65.78%	80.02%	-53.85%	25.16%	32.62%	47.18%
Sberbank	59.91%	64.69%	93.57%	-13.26%	83.19%	72.12%	30.09%
Sberbank pref	63.36%	67.70%	86.74%	4.66%	79.05%	76.94%	45.87%
Surgutneftegaz	45.90%	58.17%	97.42%	-7.29%	46.74%	11.05%	55.59%
Surgutneftegaz pref	59.55%	57.44%	111.67%	25.73%	67.22%	24.75%	50.99%
Tatneft	54.25%	61.83%	105.28%	27.00%	47.01%	39.30%	36.41%
30-day T-bill	15.62%	15.03%	22.62%	37.78%	4.66%	7.62%	9.58%

Table 2

Cross-country correlations

The table reports correlations between the selected MSCI stock indices and Russian S&P-RUX index based on weekly dollar returns in 1999-2003.

	Europe	North America	Pacific	Latin America	Developed	Emerging	S&P-RUX
Europe	1.00						
North America	0.73	1.00					
Pacific	0.41	0.39	1.00				
Latin America	0.54	0.62	0.44	1.00			
Developed	0.82	0.92	0.60	0.73	1.00		
Emerging	0.58	0.60	0.60	0.83	0.75	1.00	
S&P-RUX	0.32	0.27	0.22	0.31	0.29	0.42	1.00

Table 3

Adding international equity indices

The table presents the results of adding the MSCI international equity indices to the set of 12 most liquid Russian stocks and 30-day Russian T-bill rate in the unconstrained case (UC) and in the case when no short-sales are possible (NSS). The first four rows of the table report Wald statistics for tests of mean-variance intersection and spanning along with the corresponding *p*-values. The intersection test is for the mean return of the global minimum-variance portfolio of local assets (GMV-L). The next two rows present mean and standard deviation of GMV-L. ΔR denotes an increase in mean return when switching from GMV-L to the portfolio on the extended efficient frontier with the same standard deviation. Similarly, $\Delta\sigma$ denotes a decrease in standard deviation when switching from GMV-L to the portfolio on the extended efficient frontier with the same mean return. The last rows present weights of the latter portfolio (including foreign assets).

	UC	NSS	UC	NSS
Wald (intersection)	165.430	156.790	173.800	175.970
p-value	0.000	0.000	0.000	0.000
Wald (spanning)	173.010	164.870	182.240	184.560
p-value	0.000	0.000	0.000	0.000
GMV-L mean, %	17.810	16.941	17.810	16.941
GMV-L st. deviation, %	13.276	13.672	13.276	13.672
ΔR, %	11.388	7.384	11.908	8.372
$\Delta\sigma$, %	2.437	1.961	2.531	2.243
Portfolio weights:				
Nornikel	0.038	0.038	0.036	0.039
Irkutskenergo	0.033	0.000	0.028	0.000
Lukoil	0.038	0.000	0.029	0.000
Mosenergo	-0.060	0.000	-0.055	0.000
RAO UES	-0.032	0.000	-0.035	0.000
RAO UES pref	0.023	0.000	0.028	0.000
Rostelecom	-0.036	0.000	-0.024	0.000
Sberbank	0.002	0.000	0.016	0.007
Sberbank pref	0.036	0.025	0.024	0.023
Surgutneftegaz	-0.097	0.000	-0.094	0.000
Surgutneftegaz pref	0.060	0.003	0.065	0.007
Tatneft	0.032	0.004	0.024	0.000
30-day T-bill	0.606	0.625	0.600	0.602
EM	0.210	0.174		
DM	0.149	0.131		
Europe			-0.020	0.000
North America			0.165	0.115
Pacific			0.157	0.162
Latin America			0.057	0.045

Table 4

Adding international equity indices incorporating

conditioning information and transaction costs

The table presents the results of adding the MSCI international equity indices to the set of 12 most liquid Russian stocks and 30-day Russian T-bill rate using conditioning information (columns 2-3) and in presence of the transaction costs, assuming the absence or the presence of short-sales constraints (columns 4-5 and 6-7, respectively). In the conditional tests, we use two instruments (oil price and ruble-dollar exchange rate) and assume the absence of short-sales constraints. The transaction costs are assumed to be on the level of 3% p.a. The first four rows of the table report Wald statistics for tests of mean-variance intersection and spanning along with the corresponding *p*-values. The intersection test is for the mean return of the global minimum-variance portfolio of local assets (GMV-L). The next two rows present mean and standard deviation of GMV-L. ΔR denotes an increase in mean return when switching from GMV-L to the portfolio on the extended efficient frontier with the same standard deviation. Similarly, $\Delta\sigma$ denotes a decrease in standard deviation when switching from GMV-L to the portfolio on the extended efficient frontier with the same mean return. The last rows present weights of the foreign indices in the latter portfolio.

	Conditioning information		Transaction costs, UC		Transaction costs, NSS	
Wald (intersection)	69.450	69.790	76.360	98.210	7.500	11.330
p-value	0.000	0.000	0.000	0.000	0.010	0.010
Wald (spanning)	122.820	121.240	128.090	208.970	131.030	161.430
p-value	0.000	0.000	0.000	0.000	0.000	0.000
GMV-L mean,%	21.322	21.322	17.809	17.809	16.941	16.941
GMV-L st. deviation,%	12.555	12.555	13.276	13.276	13.672	13.672
ΔR,%	24.544	24.284	10.660	11.232	6.864	7.384
$\Delta\sigma$,%	2.502	2.596	2.279	2.380	1.781	2.005
Portfolio weights:						
EM	0.225		0.195		0.157	
DM	0.178		0.143		0.122	
Europe		0.003		0.000		0.000
North America		0.152		0.144		0.103
Pacific		0.190		0.143		0.150
Latin America		0.057		0.055		0.043

Table 5

Adding individual country equity indices

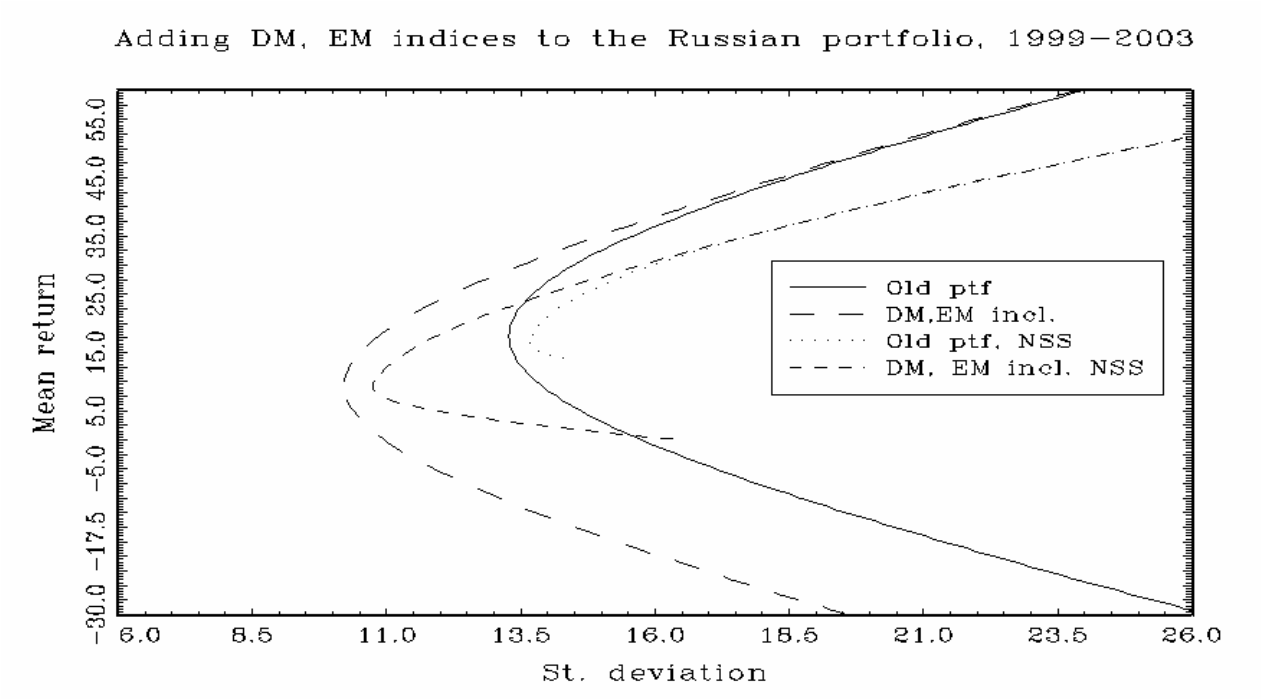
The table presents the results of adding the individual MSCI country equity indices of US, UK, Germany, Japan, and Brazil to the set of 12 most liquid Russian stocks and 30-day Russian T-bill rate, assuming the absence of short-sales constraints. The first four rows of the table report Wald statistics for tests of mean-variance intersection and spanning along with the corresponding *p*-values. The intersection test is for the mean return of the global minimum-variance portfolio of local assets (GMV-L). The next two rows present mean and standard deviation of GMV-L. ΔR denotes an increase in mean return when switching from GMV-L to the portfolio on the extended efficient frontier with the same standard deviation. Similarly, $\Delta\sigma$ denotes a decrease in standard deviation when switching from GMV-L to the portfolio on the extended efficient frontier with the same mean return. The last row presents weight of the foreign country index in the latter portfolio.

Panel A

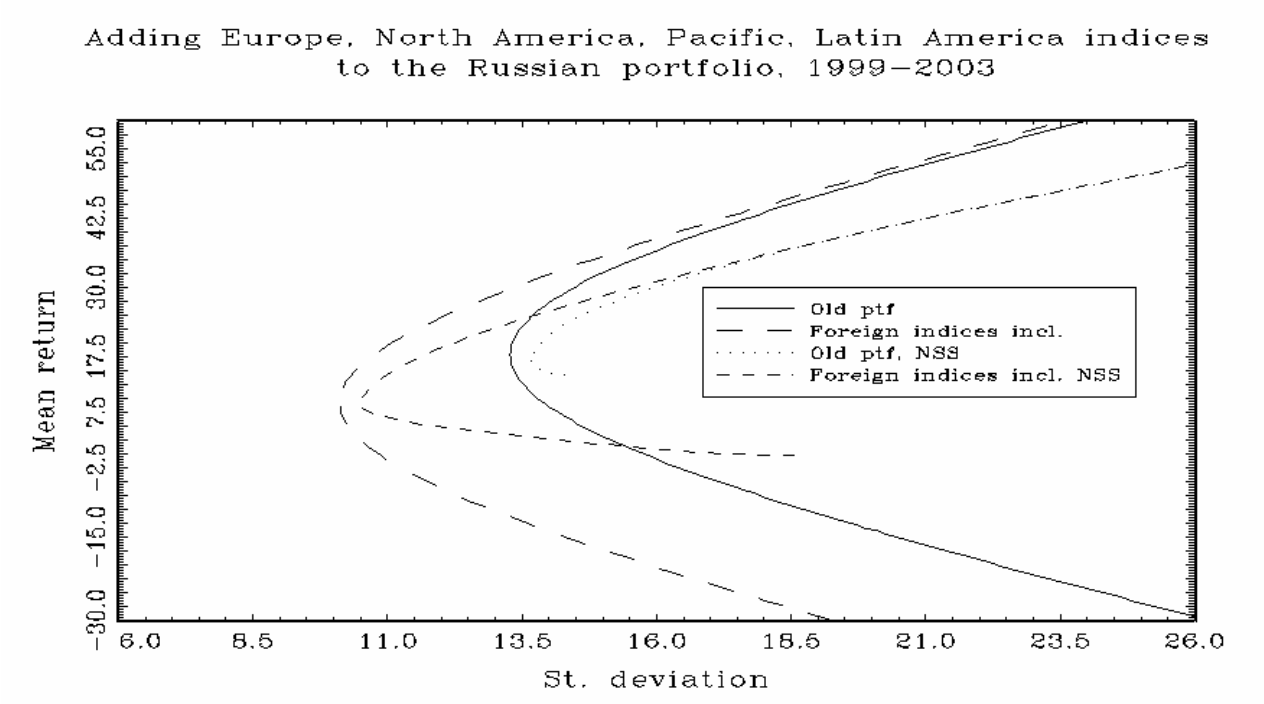
	US	UK	Germany	Japan	Brazil
Wald (intersection)	73.080	39.750	19.990	36.150	13.220
p-value	0.000	0.000	0.000	0.000	0.000
Wald (spanning)	102.670	53.770	24.310	45.960	20.100
p-value	0.000	0.000	0.000	0.000	0.000
GMV-L mean,%	17.201	17.201	17.201	17.201	17.201
GMV-L st. deviation,%	13.636	13.636	13.636	13.636	13.636
ΔR,%	10.660	9.984	7.228	8.788	6.708
$\Delta\sigma$,%	2.098	1.976	0.952	1.370	0.541
Portfolio weight of the foreign index	0.280	0.309	0.167	0.217	0.095

Panel B

	US	UK	Germany	Japan	Brazil
Wald (intersection)	68.790	38.110	19.020	34.430	13.080
p-value	0.000	0.000	0.000	0.000	0.000
Wald (spanning)	93.420	47.350	23.350	44.880	19.410
p-value	0.000	0.000	0.000	0.000	0.000
GMV-L mean,%	17.201	17.201	17.201	17.201	17.201
GMV-L st. deviation,%	13.636	13.636	13.636	13.636	13.636
ΔR,%	9.984	9.464	6.864	8.268	6.344
$\Delta\sigma$,%	1.990	1.853	0.909	1.305	0.534
Portfolio weight of the foreign index	0.267	0.291	0.159	0.207	0.094



Panel A



Panel B

Figure 1. Mean-variance frontiers for the local and foreign assets

The figure presents the frontier of local assets and the extended frontier of local and foreign assets in the unconstrained case and in the case when no short-sales are possible (NSS). The set of local assets includes 12 most liquid Russian stocks and 30-day Russian T-bill rate. The set of foreign assets consists of Emerging and Developed MSCI stock indices (Panel A) or Europe, North America, Pacific, and Latin America MSCI stock indices (Panel B).