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PAPER

Exchange Rate Risks of International Portfolio Investments: Comparative Analysis of Ukrainian and Other Frontier Markets

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Abstract The paper investigates the role of the exchange rate risk of investing in Ukrainian and other frontier equity markets during the period between 2006 and 2016. It argues that among frontier markets Ukraine has the largest relative exchange rate risk from euro and US dollar investors' perspective if measured by relative foreign exchange return differential. The market also shows the highest risks of USD, EUR and local currency returns.

Sharpe ratio for dollar, euro and local currency for all frontier markets is calculated. It also proves that the Ukrainian market does not provide relevant returns for high risks. The average Sharpe ratio for the period is -0.29 for USD and -0.40 for EUR making Ukraine the third least attractive market in the frontier group. Correlation matrix between Ukrainian total and equity international portfolio liabilities on the one hand and four groups of indicators associated with exchange rate risk (risk, return, Sharpe ratio and relative foreign exchange return differential – all for EUR, USD and local currencies) on the other is developed. Correlations are small and medium showing that these are not the only factors influencing portfolio inflows. It is detected that pairs with risk and relative foreign exchange return differentials have the strongest correlations while the latter affecting equity liabilities and almost not influencing total liabilities. It is proved that frontier markets group represents substantial exchange rate risk for foreign investors.

The relative differentials are -1.36 and -0.48 for USD and EUR investors respectively. Exchange rate risks from euro investors' perspective are much lower than from the perspective of an US dollar investor. The FM index has the lowest USD and EUR risks representing a more efficient investment when investors diversify.

Keywords International portfolio investments - exchange rate risk - frontier markets Ukraine - relative foreign exchange return differential - Sharpe ratio

JEL classification F21 - F31 - G11 - G15

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1. Introduction

Exchange rate risk is one of the most distinguishing features of international portfolio investments compared to domestic market investments. It is inevitable for investors who buy foreign securities either directly or indirectly. Direct purchases imply currency exchange to buy a security as well as to withdraw an investment back. Indirect investing like buying the shares of a country fund does not imply currency exchange but an investor is tied to it indirectly since the fund is engaged in this exchange. Eventually exchange rate risk generates certain portion of the total risk and is obviously a factor that affects investing decisions. In terms of investors' preferences it can be either acceptable or not. This actually depends on investors' risk tolerance, or risk aversion level. As behavioral idea implies, some investors just do not want to accept this type of risk and do not invest in foreign securities at all notwithstanding all existing advantages of such investments. This phenomenon became known as a home bias and is nowadays one of the most substantial barriers in the way of international portfolio investing. Sometimes this type of risk is really substantial and should be taken care of. In other cases it can be quite moderate and acceptable for most investors.

However, another important issue is to be considered. It is a return. Risk and return trade-off is the main determinant of international as well as domestic portfolio flows. High risks must be compensated by high returns or if one wants to get high returns high risks must be accepted. This relation is of an axiomatic character. It can also be used to deal with exchange rate risks. This risk brings about the increase in the total risk but gives an opportunity to get higher return. Thus if we agree that every investor has certain indifference level the question is not either to invest or not. The issue is what additional return would be sufficient for an exchange risk to become acceptable. Being an additional type of risk an exchange rate risk just requires additional premium. It thus can become rather an incentive than an obstacle for international portfolio investing. In many cases it's just a problem of an individual perception of investors and their basic financial education level.

Ukrainian equity market represents this group. It is a market with growing capitalization that offers investors high returns but encounters rather high risks. Among the most substantial risks of investing in Ukrainian market are exchange rate risk, political risk and the country risk, which actually includes the latter in terms of its constituting components. As to political and country risks, they are subjective substances and can be estimated rather than computed. Exchange rate risk is a purely financial issue that is related to unexpected changes in exchange rate between Ukrainian hryvna and an investor's currency. During the last couple of years, Ukrainian currency fell 3.5 times to USD and it is still depreciating. The question is whether or not this type of risk really turns international portfolio flows away from Ukrainian market or it provides additional opportunities for investors to earn higher returns. This is the question we are going to explore in our study particularly by the way of comparing investment characteristics of Ukrainian market and other frontier markets.

2. Literature review

The issues of international diversification of investment portfolios in general and of the exchange rate risk influence in particular have been widely studied in the literature. Solnik (1974-3) was one of the first who proved substantial benefits of international diversification compared to diversification in domestic markets. Internationally composed portfolio appeared to be the least risky among randomly composed portfolios of equities from seven European and the US market.

The basic concept of risk and reward was however introduced by Markowitz (1952). This concept implies among others that investors always select efficient portfolios i.e. such portfolios that have the highest return under a given risk or the lowest risk under a given return. This study became the basis for modern investment theory. Another most important implication of the latter is that portfolio risk depends significantly on the level of correlation between separate assets returns. The lower the correlation the lower the portfolio risk is. This is the idea that was developed by Solnik (1974-3) in international context. Solnik proved that correlation between different markets returns was much smaller than between separate securities in a domestic market and this allowed composing much more efficient portfolios internationally. Any investment decision actually depends on three factors: risk, return and risk aversion level. The latter is determined by the type of investor's indifference curve that is formalized by some utility function. One of the most widely used nowadays function was described by Levy and Markowitz (1979). Thereby, for any additional risk taken an investor requires additional premium but only to a certain extent which is defined by investor's limit of acceptable risk.

In terms of exchange rate risk the idea of additional reward for any additional risk was developed in international CAPM. Unlike traditional CAPM, international CAPM examines as many types of risks as many currencies are engaged in international investing process (Solnik, 1974-2). It was proved that an international equilibrium model was supposed to encompass exchange rate factor either in the form of exchange rate parity or exchange rate risk directly (Solnik, 1974-1). International CAPM stipulates that the total premium for a security should be estimated internationally considering the market portfolio of an international market. The premium itself consists of the world market risk (international systematic risk) premium and premiums for investing in different currencies – exchange risk premiums.

Roll & Solnik (1977) showed the significance of an exchange rate risk in asset pricing. International asset pricing model implies equilibrium among interest rates, exchange rates and inflation levels in different countries. According to their study, exchange rate risk is a result of taking a currency position that includes an interest for the currency and period considered and the expected exchange rate variation. The empirical part of the study included the plotting of a so-called exchange capital market line for six European and two North American markets. The result was not surprising from today's point of view – the weaker the currency, the higher the slope of the mentioned line. The similar idea was supported by Stulz (1984). He confirmed that in equilibrium the more risky the purchasing power of the domestic currency the larger the ratio of foreign money holdings to domestic money holdings. Thus, unlike traditional portfolio theory could assume, the share of foreign currency holdings does not depend on investors risk aversion level.

Black (1990) suggested a solution of one of the most substantial problems in the field of portfolio investing – determining risk tolerance that was basically considered unobservable. This was done in the context of international investing allowing for exchange rate risks. Assuming that a CAPM with many countries and many goods holds, investors in a country have identical utility functions and certainly defined future exchange rate. Black argued that if average risk tolerance is the same across countries all investors will bear identical market risks (world market portfolio) and exchange rate risks (foreign currencies portfolio). Investor's average risk tolerance equals to the relation of exchange rate risk to market risk. This relation is, on the other hand, the share of the market's exchange rate risk that is hedged by an investor. Black suggested a formula to compute the mentioned tolerance. It is a relation of the difference between the average world market risk premium and its variance to the difference between the

average world market risk premium and half of the average exchange rate variance.

Findings of Eun & Resnick (1994) testify the important meaning of exchange rate risks in international investment portfolios – the case was studied from the perspective of US and Japanese investors. In terms of our research goals, they showed that international portfolio risk and return incorporated exchange rate component. For instance, the dollar return of a security equals to the sum of local currency rate of return, the rate of appreciation of the local currency and the product of both. There is a respective share of risk for each of the mentioned components of return. The total risk equals to the sum of three mentioned components variance and their double covariance. They computed a share of exchange rate risk that is about 30 % of the total risk of dollar and yen stock portfolios. For bond portfolios, this figure equals about 77 % for dollar portfolio and about 65 % for yen portfolio. In case of mixed stock and bond portfolios, this share is about 59 % for dollar and 52 % for yen portfolio. Thus, the research showed that in international portfolios with exchange rate risks bonds that were riskless in domestic portfolios become risky while stocks that were risky in domestic portfolios then incorporated less exchange rate risks.

Evans & Lewis (1995) support the idea that foreign exchange returns can be hardly explained by traditional models of asset pricing. They argue that the shifts in exchange regimes (depreciating or appreciating) and the respective expectations can influence such returns. In periods of infrequent switches returns can be explained by small sample serial correlations. Another problem affecting foreign exchange returns is a so called 'peso problem' described generally by Milton Friedman and specified later by Rogoff (1980) and Fama (1984). This problem implies that premiums are affected by expectations of shifts in exchange rate regimes. The existence of the exchange rate risk was also supported by Dumas & Solnik (1995), who studied equity markets of Japan, the UK, the USA and Germany. They proved the significance of foreign exchange rate risk premiums in securities total risk and argued that respective estimations were better carried out by using international asset pricing models rather than domestic.

Important aspect of exchange rate risks in international portfolio investing is the one dealing with portfolio hedging. Research predominantly testifies that hedged international investment portfolios can result in even higher returns than unhedged. The general idea in these terms is that currencies should be treated as separate positions in a portfolio with respective strategies on them. For example, Jorion (1994) compared three methods of hedging international portfolios: separate optimization over the currencies, partial optimization and joint optimization over currencies and assets. He concluded that all mentioned methods produced more gains from international diversification than unhedged position, while the first method being the least superior and the last one being the most superior. Larsen and Resnick (2000) carry out some empirical tests on Jorion's result and conclude that under parameter uncertainty ex post and ex ante results of hedge ration determination can differ. They compare different techniques of controlling the parameter estimation risk and suggest the optimal combination of the latter and the hedging strategy.

International portfolio flows together with the exchange rate regime can accelerate international financial contagion. As Hsiao & Hsiao (2001) showed, while having almost equal macroeconomic fundamentals, Korea and Taiwan had different characteristics of external and financial sectors. Those differences did cause that Korea was much severely affected by the crisis compared to Taiwan. It goes mostly about three crucial figures: high relation of external debt (uppermost short-term debt) to foreign reserves, high ratio of foreign portfolio liabilities to international reserves that were much higher in Korea. The third issue is an exchange rate

regime. In Taiwan it was a completely free float. The majority of case studies covering the problems of interrelation between exchange rates and international portfolio investment also considered emerging markets, e.g. Longin & Solnik (2001), Phylaktis & Ravazzolo (2005), Saez, Fratzscher & Thimann (2007) and others. A combined research in terms of the market type was carried out by Fernández-Izquiedro & Lafuente (2004). They studied international transmission of shocks during Asian currency crisis using the data on developed, emerging and frontier markets. The study showed that in periods of increased exchange rate and asset prices volatility there was no constant risk aversion and benefits from international diversification were reduced.

Using the case of Thai baht in 2005 and 2006, Gyntelberg, Loretan, Subhanij & Chan (2009) proved that its exchange rate was driven partially by international portfolio flows in Thai equities. They also showed that if Stock Exchange of Thailand index return exceeded S&P 500 return then foreign investors should be net sellers of Thai equities. This in turn should bring about the depreciation of Thai baht since by selling Thai equities foreign investors also sell the baht. Analyzing portfolio equity flows between the USA and Euro area and dollar-euro exchange rate, Heimonen (2009) empirically showed that unlike traditional view implying that dollar appreciation was caused by equity flows from Euro Area to the USA, another point was to be considered. It's an idea of composing a minimum variance portfolio. Trying to resume the structure of the minimum variance portfolio investors decrease their holdings of foreign equities and thus the equity outflows cause foreign exchange outflow and the respective currency depreciates.

Diermeier & Solnik (2001) examined the relation between two types of exposures. He found that foreign stock market risk was higher than a foreign currency risk. Among eight developed markets in question only the USA had the reverse case. The highest difference was for Switzerland and Italy. Fidora, Fratzscher & Thimann (2007) showed that exchange rate uncertainty was an important factor of home bias in international investment portfolios. They proved that home bias in assets with relatively high local currency return volatility responded less to real exchange rate volatility than home bias with relatively low local currency return volatility. It means that under exchange rate volatility home bias is higher for assets with lower local currency return volatility. This can be explained by the fact that when the local currency risk is low real exchange rate risk makes more considerable contribution to the total real return risk of an asset.

This inference also implies that home bias should be higher for bonds than for equities since bonds' returns are usually less volatile than stocks' returns and bonds, thus have higher portion of an exchange rate risk. The acceptance of this conclusion like that one of Eun & Resnick (1994) is conditioned by an assumption that international portfolio investors measure their returns in their domestic currencies. This assumption is one of the most fundamental for international portfolio investments analysis otherwise the existence of an exchange rate risk would be hardly practically considerable.

3. Hypothesis, methodology and data

Notwithstanding the rich portion of literature devoted to various aspects of international portfolio investing and its interrelation with exchange rates and exchange rate risks, few studies explore frontier markets in general and Ukrainian market in part. This is quite clear considering the low level of these markets development and extremely little share of their global portfolio liabilities. Moreover, Ukrainian market is quite unstable, the currency is extremely volatile, general situation can be characterized as immensely risky

including respective military situation. However, Ukrainian market has substantial potential in attracting foreign portfolio investments. In our study we are going to explore the level of exchange rate risk of foreign portfolio investments into Ukrainian equity market and compare it with other frontier markets in order to find out practical implications for foreign holdings of frontier markets equities.

Methodologically we are to test three working hypotheses. First, there is a high exchange rate risk in Ukrainian equity market but the returns are not sufficient enough to compensate for substantial risk in terms of international portfolio investing. Second, the component of exchange rate risk in Ukrainian equity market is higher than in other frontier markets making it not attractive for foreign portfolio investors. Third, exchange rate risk factor does affect Ukrainian international portfolio liabilities but the level of this influence can be different depending on the indicator considered.

We are to test the mentioned hypothesis using the Morgan Stanley Capital International (MSCI) index data (MSCI, 2017). The basic issue of our analysis is the MSCI Frontier Market Index (FM) and its components. The FM includes the following frontier markets from five regions: Europe & CIS (Croatia, Estonia, Kazakhstan, Lithuania, Romania, Serbia, Slovenia, and Ukraine), Americas (Argentina), Africa (Kenya, Mauritius, Morocco, Nigeria, and Tunisia), Middle East (Bahrain, Kuwait, Oman, Saudi Arabia, Jordan, and Lebanon) and Asia (Bangladesh, Pakistan, Sri Lanka, and Vietnam). There are 24 markets in total. Besides the mentioned markets that participate in FM index calculation there are seven markets that are classified as frontier but are not included into the index (Bulgaria, Bosnia and Herzegovina, Botswana, Ghana, Jamaica, Trinidad and Tobago, and Zimbabwe). We are not going to analyze them. As a benchmark we shall use the FM index that reflects the frontier market group as a whole.

Using index values we calculate their monthly returns as a relation of the difference between the index value at the end of the current month and at the end of the previous month to the index value at the end of the previous month measured as a percentage. This is actually a standard methodology. The yearly returns are calculated by compounding the average of monthly returns for the respective year to the 12th degree. Standard deviations of monthly returns are converted into the yearly basis using a standard methodology. All indexes used are standard in terms of their market capitalization and include large, medium and small capitalization companies. Price index level is considered. Index returns are calculated using the respective values in USD, EUR and local currencies. Thus, comparisons of real returns for US & Euro area investors are relevant and appropriate.

As to the observation period, we would like it to be as long as possible but the data availability is different for different markets. So in fact, to make comparisons relevant we must select that period which will be the shortest available among markets in question. Ukraine is exactly such a market. The data is available since May 2006. Shorter periods are taken only for Bangladesh (since November 2009), Lithuania (since May 2008), Serbia (since May 2008) and Vietnam (November 2006). So we actually observe since May 2006 but the mentioned countries are excluded from earlier analysis. In order to carry out comparisons between Ukrainian and other frontier markets we use a well-known Sharpe ratio, computed using a well-known formula. In the present study, we are not going to examine the methodology of risk-free rate estimation but use a money market rate for a respective currency from the IMF International Financial Statistics database (IMF, 2017-1). However, the most typical version of a risk-free rate is the rate of government short-term securities like T-bills in the USA, not all frontier markets provide such data. Moreover,

in some frontier markets respective securities are not available as such. Money market rates are available for most markets and they typically represent the rates under the same risk category, which is one of the most important issues in this case. Technically the rates provided are the period (year) average values.

As to portfolio investments inflows to Ukraine we got this data from the IMF Coordinated Portfolio Investment Survey (IMF, 2017-2). We utilize the data on total portfolio liabilities, which is an investment position data which shows the total accumulated volume of inward international portfolio investments. Besides total portfolio liabilities, we also explore the data on liabilities in equity securities and fund shares.

4. Results

4.1. Analytical estimation of relative exchange rate risk

In order to estimate the level of an exchange rate risk we shall use some relative measure that can be a differential between foreign and local currency returns – a relative foreign exchange return differential. If this ratio is equal to zero then the relative exchange rate risk is formally absent. If the respective figure is not zero then relative foreign exchange rate risk does exist and its level can be described by respective difference. The exchange risk relative degree thereby can be characterized by the mentioned figure distance from zero. Actually, this is not the risk in a purely financial sense but a relative measure that characterizes the attractiveness of a market for a foreign investor ex post. Practically if this ratio is less than zero, then investing is not acceptable for a foreign investor.

The idea behind this is that the local currency is depreciating and is often followed by increase in local rates of return but the pace differs thus bringing about relative acceleration of local currency returns. Thereby, foreign investors get losses measured in foreign currencies and the respective market portfolio becomes less efficient. The key idea here lies in the mentioned pace. Under depreciation, investing can be profitable for foreign investors if the pace of rates of return growth is high enough to compensate depreciation. The opposite is true. Appreciation of the local currency usually makes local portfolios more efficient for foreign investors. Typically, their return in foreign currencies exceeds local currency returns and they get additional profits measured in a foreign currency. Consequently, the differential should exceed zero.

We must stress that the abovementioned method does not let us calculate the precise meaning of the exchange rate risk but allows estimating its relative value. The reason is that we consider the difference between foreign and local currency returns just like the differential between different countries interest rates. Moreover, such approach allows considering either negative or positive returns. If for example we utilized the dividing method and considered the relation of one return to another we would have hardly be able to deal with negative values. Such method would not be universal in these terms since we would have to make special estimations for negative values of the ratio. Technically, we would not be able to answer the question if the negative value resulted from negative values of foreign or local currency return.

Comparing this concept with a respective approach in traditional portfolio theory, we can match some points. For example dispersion and standard deviation as traditional risk measures can be decomposed into upside and downside dispersion (deviation) depending of the relation of observations to the average (see, for example, Markowitz, 1959, p. 188). In our case we can introduce a provisional term ‘upside relative foreign exchange return differential’ for values above the zero and ‘downside relative foreign exchange return differential’ for values below the unity. What is a real risk for foreign

investors is the downside risk since only in this case they have losses relative to the local currency return.

While examining differential zero values we should obviously consider values approaching zero since they imply small exchange rate risks. The matter is how to determine the tolerance level of these values. Actually, it can be set depending on the research goals and specific situations. Let us take it as 1 % of the whole range of differential values. The range for USD varies between 1.58 and -11.18 and for EUR it is between 3.76 and -10.55 (table 1). The value of 1 % is 0.1276 and 0.1432 respectively.

Table 1 Grading of markets according to the relative differential value

Panel A (USD)

#	Market	Value	#	Market	Value	#	Market	Value
1	Mauritius	1.58	10	Croatia	-0.28	19	Vietnam	-2.59
2	Slovenia	0.31	11	Bangladesh	-0.70	20	Serbia	-3.91
3	Kuwait	0.02	12	Estonia	-0.71	21	Pakistan	-4.25
4	Jordan	0.02	13	Morocco	-0.75	22	Kazakhstan	-4.32
5	Lebanon	0.00	14	FM	-1.36	23	Nigeria	-4.40
6	Oman	0.00	15	Argentina	-1.62	24	Tunisia	-4.91
7	Saudi Ar.	0.00	16	Kenya	-1.88	25	Ukraine	-11.18
8	Bahrain	-0.03	17	Lithuania	-2.12			
9	Romania	-0.11	18	Sri Lanka	-2.49			

Panel B (EUR)

#	Market	Value	#	Market	Value	#	Market	Value
1	Oman	3.76	10	Slovenia	0.02	19	Sri Lanka	-1.31
2	Bangladesh	3.52	11	Lithuania	-0.01	20	Pakistan	-3.09
3	Lebanon	1.65	12	Estonia	-0.01	21	Tunisia	-3.15
4	Jordan	1.65	13	Croatia	-0.24	22	Serbia	-3.16
5	Saudi Ar.	1.22	14	Argentina	-0.41	23	Nigeria	-4.53
6	Kuwait	1.20	15	FM	-0.48	24	Kazakhstan	-4.56
7	Mauritius	1.09	16	Kenya	-0.59	25	Ukraine	-10.55
8	Bahrain	0.82	17	Romania	-1.07			
9	Morocco	0.35	18	Vietnam	-1.13			

Notes:
1. Calculated and composed by the authors using (MSCI, 2017) data.
2. Markets with zero or close to zero differential values, Ukrainian market and the FM index are marked with grey filling.
3. Rounding is up to the second decimal order.

As we can see from table 1, Ukraine has the weakest position among all frontier markets for USD as well as for EUR investors. Its relative differential value is the smallest and deeply negative in both cases. It equals -11.18 from USD and -10.55 from EUR investor perspective. Furthermore, the second smallest value for Tunisia and Kazakhstan respectively are more than twice higher that underlines substantial exchange rate risk of Ukrainian market for foreign investors.
The general conclusion for frontier markets is that they imply substantial exchange rate risks for foreign investors. The value of the differential for the index is -1.36 and -0.48 for USD and EUR investors respectively. For USD investors only two markets have positive differential values: Mauritius (1.58) and Slovenia (0.31). Seven markets have zero or close to zero level of relative differential thus implying the absence of exchange rate risks. In some cases the precise zero values can be explained by the monetary policy regimes. Some countries anchor their local currencies to world currencies like USD or EUR thus having no exchange rate risks by definition. Certain countries have lately entered the Euro zone and their EUR differential is close to zero (Estonia in 2014 and Lithuania in 2015). Other 15 markets have negative relative differential values and have substantial exchange rate risks for USD investors.

The case is a bit different for EUR investors. Nine markets have positive return differentials and are therefore attractive for euro investors. Three markets are neutral in terms of euro foreign exchange rate risk. Other 11 markets and the FM index have high downside exchange rate risk and are not attractive for foreign euro investors. Frontier markets as a group is not attractive for USD and EUR investors considering their exchange rate risks, but the relative attractiveness level is much higher for EUR investors – respective differential values are -1.36 and -0.48 that makes almost three times difference. Euro highest differential value (3.76 for Oman) is more than twice larger than its highest dollar value (1.58 for Mauritius).

4.2. Risks and risk-adjusted returns

Apart from more general analytical framework there are some objective statistical measures used to estimate the level of risk and return of an investment. We shall consider two of them in our study. The first one is the general risk measured as a standard deviation of returns. The second one is a more conventional measure – the mentioned Sharpe ratio that is a purely financial index to measure an investment's return adjusted for risk. Risk and Sharpe ratio calculations are presented in table 2.

Table 2 Sharpe ratios and standard deviations of frontier markets

Market	USD		EUR		Local Currency	
	Sharpe Ratio	σ	Sharpe Ratio	σ	Sharpe Ratio	σ
Mauritius	1.17	17.17	1.67	14.99	0.94	13.88
Kenya	1.05	21.47	1.71	20.77	1.58	18.70
Pakistan	0.69	23.40	0.79	23.79	0.44	22.48
Nigeria	0.54	28.85	0.69	28.78	0.37	26.38
Argentina	0.51	33.63	0.65	31.22	0.13	32.86
Saudi Ar.	0.43	23.24	0.49	23.85	0.58	23.24
Bangladesh	0.41	14.18	0.65	16.49	0.01	13.95

Market	USD		EUR		Local Currency	
	Sharpe Ratio	σ	Sharpe Ratio	σ	Sharpe Ratio	σ
Oman	0.26	16.72	0.24	15.04	0.61	16.02
Sri Lanka	0.24	24.78	0.69	24.08	-0.05	23.21
Slovenia	0.21	21.25	0.14	16.98	0.04	16.98
Estonia	0.18	27.95	0.09	25.25	0.25	25.25
FM	0.15	14.50	0.27	13.06	0.08	13.45
Croatia	0.06	21.60	-0.06	17.11	-0.03	16.83
Vietnam	0.01	27.75	0.17	27.62	-0.11	26.97
Kazakhstan	-0.01	27.74	0.04	26.03		27.76
Lithuania	-0.06	18.11	0.18	14.75	0.09	14.75
Kuwait	-0.16	18.48	-0.02	18.15	-0.22	17.89
Tunisia	-0.17	16.21	-0.02	15.92	-0.09	14.68
Serbia	-0.21	29.73	-0.13	25.24	-0.56	23.81
Lebanon	-0.27	18.69	-0.20	20.19	-0.58	18.69
Ukraine	-0.29	36.23	-0.40	34.78	-0.35	33.99
Jordan	-0.58	17.28	-0.60	17.99	-0.75	17.25
Bahrain	-0.79	19.88	-0.77	20.66	-0.59	19.85

Notes:
1. Calculated and composed by the authors using the (MSCI, 2017) and (IMF, 2017-1) data.
2. Ukrainian market and the FM index are marked with grey filling.
3. Markets in the table are graded by their USD Sharpe ratio (first column).
4. Sharpe ratio is an average of respective ratios for 11 years.

As we can see from table 2, according to the USD Sharpe ratio Ukraine is the third worst market for investing. It is -0.29 while being -0.40 for EUR (3rd worst market again) and -0.35 for the local currency (5th worst market). In terms of our hypothesis it means that high risks are not compensated by high returns. Furthermore, the latter are often negative. Moreover, if we consider the frontier market group as a whole it has positive Sharpe ratios for all three currencies considered. Thus, Ukraine is doing much worse than the group as a whole. Unlike the case with relative differential, the Sharpe ratio shows that Ukrainian market is more attractive for USD than for EUR investors. The fact that local currency Sharpe ratio is lower than the USD Sharpe ratio proves that the market is rather risky even without an exchange rate risk. This is also true for the majority of other frontier markets.

Another issue that should be considered is the risk of the markets. Ukrainian market is the most risky among all markets considered either in terms of USD standard deviation as well as EUR and local currency risks. This also supports the idea that the market is rather risky even if exchange rate risk is ignored though the latter is rather high in Ukraine.
The least USD and EUR standard deviation accounts for FM index, while in terms of local currency index is the second least. This is important since even considering high total risks and high exchange rate risks it is better to diversify frontier markets portfolios for USD as

well as for EUR and local currency investors. In this sense, we also provide a statistical support of the concept of diversification that is proved on the example of international diversification in frontier markets.

In terms of frontier markets attractiveness for USD and EUR investors, they are much more efficient from euro investor perspective. Euro Sharpe ratio (0.27) is almost twice larger than USD ratio (0.15) for the whole group. Euro return standard deviation is also lower. It equals to 13.06 compared to 14.50 dollar risk.

4.3. Sensitivity of Ukrainian international portfolio liabilities

We have studied some prerequisites associated with exchange rate risks that promote or impede international portfolio inflows to Ukrainian and other frontier markets. However, we have not examined the issue of their real impact on international portfolio inflows to Ukrainian market. A conventional way to do this is to calculate the correlation ratio between indicators under question (table 3). In our case, we shall calculate correlations in pairs of total and equity investments on the one hand and other indicators on the other. Thus, we shall get 22 correlations – 11 for total and 11 for equity liabilities (table 4).

Table 3 Selected indicators of Ukrainian market

Indicator	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Investments – T	10.2	12.4	5.6	6.0	9.5	9.3	15.2	19.0	12.8	13.5	
Investments – E	0.6	2.0	0.7	0.5	1.1	1.0	1.1	1.8	0.6	0.5	
Local risk	14.9	24.9	37.9	47.5	45.0	43.9	28.6	30.8	-9.6	33.2	17.8
USD risk	15.2	25.0	43.9	57.0	45.5	44.0	29.2	30.5	47.7	37.8	22.7
EUR risk	15.5	26.5	37.5	50.3	44.4	41.0	26.9	33.4	47.8	39.4	19.9
Local return	-2.5	11.5	-73.1	48.8	64.4	-39.3	-46.3	-9.6	74.5	-9.6	20.4
USD return	-3.2	11.7	-81.5	49.3	65.6	-39.5	-46.5	-11.8	-7.7	-37.7	17.5
EUR return	-5.6	1.1	-81.3	40.1	75.1	-38.7	-47.8	-14.9	5.0	-30.3	20.4
USD differential	-0.7	0.2	-8.4	0.5	1.2	-0.2	-0.2	-2.2	-82.2	-28.1	-2.9
EUR differential	-3.1	-10.4	-8.2	-8.7	10.7	0.6	-1.5	-5.3	-69.5	-20.7	0
Local Sharpe ratio	-0.41	0.37	-2.29	0.76	1.36	-1.06	-2.04	-0.46	1.25	-0.95	
USD Sharpe ratio	-0.54	0.27	-1.90	0.86	1.44	-0.90	-1.60	-0.39	-0.16	-1.00	0.75
EUR Sharpe ratio	-0.56	-0.11	-2.27	0.78	1.68	-0.96	-1.78	-0.45	0.10		

Notes:
1. Calculated and composed by the authors using the (MSCI, 2017) and table 2 data.
2. 'Investments' is Ukrainian international portfolio liabilities derived from (IMF, 2017) investment position data. 'T' – total liabilities, 'E' – liabilities in equity in billion USD. The figures are as of the year-end.

Table 4 Correlation matrix for selected indicators of Ukrainian market

Indicator	Investments – T	Investments – E
Local risk	-0.37	0.07
USD risk	-0.49	-0.42
EUR risk	-0.32	-0.34
Local return	-0.02	-0.09
Indicator	**Investments – T**	**Investments – E**
USD return	-0.11	0.12
EUR return	-0.09	0.05
USD differential	-0.16	0.37
EUR differential	-0.16	0.30
Local Sharpe ratio	-0.04	0.06
USD Sharpe ratio	-0.13	0.16
EUR Sharpe ratio	-0.07	0.03

Notes:
1. Calculated and composed by the authors using table 3 data.
2. Different groups of indicators are marked with grey filling for visual convenience.

As we can see from table 4, there are no strong correlations. The largest ratios can be treated as low or medium. This can be quite clear since these factors are not the only affecting foreign portfolio investments inflows. In our study we do not actually analyze other factors but the exchange rate risk, although such important determinants as political risks, regulatory environment, military tension, macroeconomic situation undoubtedly exert their substantial influence. However, such values as -0.49 for example (the pair of total investments and dollar risk) is almost a half and can be considered as medium level correlation, but under the set of other factors can be regarded as substantial.

The strongest correlations are observed for risk and differential indicators groups. All others equal risks affect portfolio inflows adversely. Thus, the negative value of respective correlations looks natural. The only case in this group where the correlation is positive is the pair of local risk and equity investments though the ratio of 0.07 signifies almost absent correlation rather than its positive direction. These figures mean that with the increase in USD and EUR risks foreign portfolio inflows decrease while USD risks influence either total or equity inflows more than EUR risks. The differential group looks informationally attractive. Correlations with total investments are little and negative, while correlations with equity investments are relatively large (compared to group's risks) and positive. It means that relative foreign exchange differentials do affect the equity portfolio liabilities and do not almost influence the total liabilities. As it was discussed earlier positive differentials promote foreign portfolio investing, thus relatively high positive correlations are appropriate. Using the opposite sign of correlations in differential group, we can even assume that positive differential promotes foreign portfolio investments in equities and deters portfolio inflows in debt securities. This conclusion obviously needs additional discussion and testing but its

general idea keeps with that of Eun & Resnick (1994), who came up with relatively large portion of an exchange rate risk for bonds than for stocks.
Return and Sharpe ration groups show little correlations. Considering their signs, we can conclude that returns and Sharpe ratios can be used to explain equity rather than total investments. That is actually what we began with. Equity investments correlations are positive and it means that the higher the return (premium) the higher the liabilities figure. However, the values are extremely small to confirm substantial relationship. Sharpe ratio to the point is not the actual factor driving portfolio flows but an analytical investment analysis ratio that is used to characterize some investment quality and in taking investment decisions.

5. Conclusions

We have proved and quantitatively identified our three hypotheses. Ukraine has the largest relative foreign exchange rate risk among frontier markets in terms of foreign portfolio investing from euro as well as from American dollar perspective. The estimation of relative exchange rate risk was carried out using a relative foreign exchange return differential that is difference between foreign and local currency returns. For Ukrainian market it is deeply negative and equals -11.18 from USD and -10.55 from EUR investor perspective while the second smallest values are twice higher. The risk measured as a standard deviation is also the highest among all markets either considering local, EUR or USD currency returns.

Ukrainian market is not attractive for foreign investors in terms of a more conventional Sharpe ratio that reflects a risk-adjusted return of an investment. Ukraine has the third lowest USD Sharpe ratio (-0.29) and the third lowest EUR ratio (-0.40). This confirms that our first hypothesis is true: returns are not enough to compensate for high foreign exchange rate risks. Ukrainian Sharpe ratios are lower than those of the frontier markets group in general. Low average local currency Sharpe ratios show that Ukrainian market is risky even for local investors, i.e. not considering exchange rate risks. Unlike relative differential Sharpe ratio shows that Ukrainian market is relatively more attractive for USD than for EUR investors.
Small and medium correlations between Ukrainian international total and equity liabilities on the one hand and risks, returns, Sharpe ratios and relative differentials (all measured in USD, EUR and local currencies) on the other can be explained by the fact that other factors also influence the inflows of portfolio investments to Ukrainian market. The highest correlations for standard deviations and relative differentials prove that these factors have the largest impact on Ukrainian international portfolio liabilities. Relative differentials have positive influence on equity liabilities while having almost no impact on total liabilities. Risks have an adverse effect, while USD risks influence more than EUR risks. Sharpe ratios and returns have little influence. These results show that the suggested relative differential measure can be used to estimate the relative foreign exchange rate risk of an investment.

In terms of our study results, it becomes evident that in order to attract foreign portfolio investments Ukraine needs to stabilize its currency and introduce relevant monetary policy. Its positions are weak considering either other frontier markets or solely the domestic market. High exchange rate risks must be eliminated since they negatively impact risk-return trade-off.
Frontier markets as a group also enclose considerable exchange rate risk for foreign investors. The relative differential values are -1.36 and -0.48 for USD and EUR investors respectively. However, exchange rate risks from euro investors' perspective are much lower than from the perspective of an American dollar investor. The FM index has the lowest USD and EUR risks thus supporting the concept of diversification. Investors should diversify using the whole market group rather than individual markets, while such an investment being much

more efficient for euro than for dollar investors. That is supported either by Sharpe ratios or by absolute risk figures.

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