ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume LX 54 Number 2, 2012

EXCHANGE RATE EUR/USD RISK IN INVESTMENTS DENOMINATED IN USD IN THE PERIOD OF THE FINANCIAL AND ECONOMIC CRISIS

O. Šoba

Received: November 30, 2011

Abstract

ŠOBA, O.: *Exchange rate EUR/USD risk in investments denominated in USD in the period of the financial and economic crisis.* Acta univ. agric. et silvic. Mendel. Brun., 2012, LX, No. 2, pp. 409–420

The paper discusses the evaluation of the influence of the EUR/USD exchange rate on the yield-rate of dollar share investments from the viewpoint of the Euro investor in varying investment periods with emphasis on the period of the financial and subsequent economic crisis targeted mainly in the period 2008–2010.
The outputs of the paper are realized for the following investment periods: one-year, three-year, five-year, seven-year, ten-year and fifteen-year. The supplementary investment period is the twenty-year period, which due to the small number of observations is characterized by low informative value. The share investments denominated in USD are represented by investments in the S&P 500 Total Net Return that also considers reinvestment in the period 1988–2010.
The basic methodical tool of the paper is quantification of the factors that influence the yield-rate of the foreign currency investments in the reference currency of the investor. Quantification mainly attaches to the ratio of the influence of the EUR/USD exchange rate on the yield-rate of the dollar share investments from the viewpoint of the euro investor.

exchange risk, investment, exchange rate, return on investment, financial and economic crisis, Standard&Poor's 500

A foreign exchange investment can be understood as an investment into foreign exchange assets denominated in a foreign currency, different from the reference currency of an investor. The currency in which the investor uses revenue from the investment is considered to be the reference currency.

Exchange rate risk is then in the context of a foreign currency investment seen as the impact of an unexpected change of the relevant exchange rate in the period of the given investment, which is in particular to the profitability of the foreign currency investment, if it is calculated from values in the reference currency of the investor. The relevant exchange rate is the reference currency of the investor/ denomination currency of the foreign currency investment.

Many various authors dealt on the topic of the exchange rate risk in foreign currency investments in the past. The topic of the importance of the exchange rate for the international investment decisions is discussed for example by Froot (1993), who claims that the exchange rate risk can evaporate in the very long investment horizons, which refer to horizons in decades. Solnik and McLeavy (2004) state similar knowledge as well, who claim that an investor should be aware of the exchange rate risk and that he should secure against it in particular in short-term investment periods.

In publications, two types of recommendations for investors undergoing an exchange rate risk in terms of foreign currency investments can be found. According to work of Arikawa and Muralidhar (2006), on one side there are Perold

and Shulman (1988) who always recommend to be fully secured in foreign currency investments, since the exchange rate risk is not properly "paid" in the foreign currency investments. On the other side, there is Froot (1993), who represents also the basis for the works of Solnik and McLeavey (2004) who claim there is no need to be secured in long-term investment horizons. The same declaration can be found also at Siegel (2007).

The trendy decrease in the importance of the exchange rate in foreign currency investments with a growing length of the investment horizon is primarily dependent on the fact that in the long-term horizon the exchange rates tend to have a weak trend component of their developing. This can be very clearly demonstrated on Fig. 1 showing the developing of the EUR/USD exchange rate in the period 1988–2010. In the chart a very weak long-term trend component of this exchange rate developing can be observed.

A weak trend component of the long-term developing is given especially by the character of the exchange rate, which is, even if sometimes counted among financial assets, not a financial asset. It represents the price of one currency expressed in another currency. If we focus on financial assets in their factual form, their value in the long-term horizon usually shows a trend growth. This happens due to the fact that these are real assets which bring certain forms of revenue in the future. However, the exchange rate is not an asset whose value would grow in the long-term trend, but it is the price – conversion coefficient – which is given by the interaction between supply and demand for foreign currency. Furthermore, it should be noted that the supply and demand for foreign currency is a derived supply and demand, mainly for goods or instruments whose price is expressed in foreign currency (Pilbeam, 2005).

Arikawa and Muralidhar (2006) add to the character of the exchange rate in comparison to financial assets (stocks and bonds), that there is an important precondition existing at the financial markets which is the fact that the value of securities or an asset in general is equal to the present value of all future cash flows coming from this asset. Even though the exchange rate could be classified as daily traded securities, it does not, in fact, generate any interest revenue as a bond, any dividends as shares and does not have any expected future cash flows or a value in the real meaning as each typical financial asset. Currencies are, however, referred to as a medium of an exchange and, even if they are traded in the same way as securities, they are not financial assets in the real meaning.

The more the economies whose currencies create the given exchange rate equal economically and the lower inflation differential is between them, the weaker is a long-term trend component of an exchange rate developing. For example Baye and Jansen (1995) state namely that in the long-term horizon the exchange rates are determined especially by an inflation differential and by the developing of the real income in economies, while in the short-term horizon mainly the interest rate differential plays its role.

The calculation of the rate of return on foreign currency asset investment is according to Solnik and McLeavey (2004) going out of the equation:

$$R = R^{FC} + s + (s \times R^{FC}), \quad (1)$$

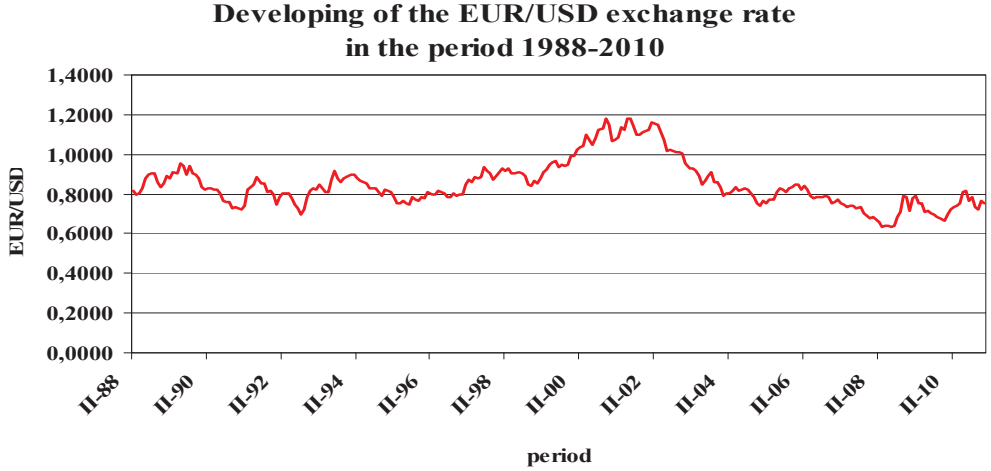
where:

R ..... rate of return on foreign currency investment from the period 0 to period 1

R^{FC} ... performance of investment in its denomination currency from the period 0 to period 1

s ..... change of the spot exchange rate within the period of the investment, which is from the period 0 to period 1.

Solnik and McLeavey (2004) point out that the last component in the formula 1 is generally of



1: *Developing of the EUR/USD exchange rate in the period 1988–2010*
Source: Federal Reserve Statistical Release (2011)

a low importance and is considered to be too small for short-term periods to be able to influence the total calculation in a more significant way. The rate of return on foreign investment is therefore primarily given by the equation. Should, however, the calculation be as accurate as possible, also the mentioned last component of the equation, which is mainly in longer investment horizons, must be considered.

Following conclusions can be then logically applied to the formula 1:

1. A depreciation of a reference currency (considering the direct quotation of the exchange rate) in the period of the foreign currency investment will result into an increase of its rate of return quantified from the values in the reference currency of the investor and vice versa.
2. The impact of the exchange rate on the rate of return of a foreign currency investment can be described as $R - R^{FC}$. This difference shows, among other things, by how many percentage points the rate of return quantified in the reference currency of the investor is for the same investment higher (R) and in comparison to its rate of return quantified in its denomination currency (R^{FC}). This difference further shows that the impact of exchange rate developing is:

$$R - R^{FC} = R^{FC} + s + s \times R^{FC} - R^{FC} = s + s \times R^{FC}.$$

In other words, if it is true that $|R^{FC}| > |s + s \times R^{FC}|$, then value will be more impacted by the performance of investment in its denomination currency and the impact of a change in the relevant exchange rate will be smaller and vice versa.

Therefore, two factors impact the rate of return on foreign currency investment in the reference currency of the investor directly: (1) *performance of an investment in its denomination currency* (R^{FC}) and (2) *the change of the relevant exchange rate* ($s + s \times R^{FC}$).

The analysis of a change of an exchange rate on the performance of the foreign currency investment can be done for differently long investment horizons based on the value comparison of both mentioned basic factors. This means to analyze the impact of investment performance in its denomination currency (R^{FC}) and the impact of change of the relevant exchange rate ($s + s \times R^{FC}$). The factor whose absolute value for the given period is higher impacts the final performance of the foreign currency investment more. Both factors must be considered in their absolute forms ($|R^{FC}|$ and $|s + s \times R^{FC}|$) and they are calculated as follows[1]:

$$R^{FC} \vee s = \frac{V_1}{V_0} - 1, \tag{2}$$

where:

V_0... is the value of an investment in its denomination currency, or of the relevant exchange rate in the period 0

V_1... is the value of an investment in its denomination currency, or of the relevant exchange rate in the period 1.

The resultant impact of a change of an exchange rate on the performance of a foreign currency investment can thereinafter be quantified according to the quotient:

$$|s + s \times R^{FC}| \,/\, (|R^{FC}| \text{ and } |s + s \times R^{FC}|. \tag{3}$$

According to the value of this quotient (formula 3), relevancy of the impact of an exchange rate change on the rate of return on a foreign currency investment can be derived. If the percentage value of this quotient is equal 50%, both factors should impact the mentioned rate of return in the same way. If the quotient value is higher than 50%, the exchange rate change had a bigger impact than the investment performance in its denomination currency, and in case the indicator value is lower than 50%, it is vice versa. If the quotient value decreases from value of 50% to zero, the exchange rate loses its impact more and more.

Implying from formula 3, also the performance of an investment in its denomination currency is, in terms of both impacting factors, considered for a calculation of the impact of the exchange rate change on the rate of return on a foreign currency investment. The period of the past financial and following economic crisis was accompanied by the significant price fluctuations on financial market, which is mainly on the stock markets, which impacted the partial performances of the share investments very much.

Thus, there is a question in which way these fluctuations could have impacted the importance of the exchange rate risk in foreign currency investments finished in this crisis period, which is also in the context of conclusions of above mentioned authors dealing on this topic. This article thus implements the relevant quantification of the impact of an exchange rate change in conducting foreign currency stock investments more closely targeted mainly at these investments finished in the years 2008–2010, representing the mentioned crisis period. The biggest stock market, it is the stock market of the USA (according to the market capitalization), and the most important world currency pair (according to trading volumes on foreign exchange markets) were chosen in this connection to represent it. Therefore, the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor is quantified here.

1 The calculated indicator can of course be multiplied by one hundred to get its percentage form.

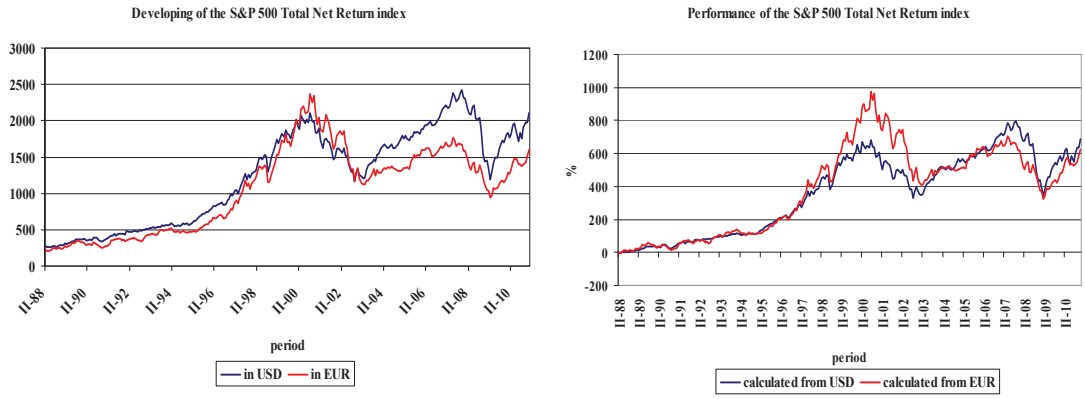
The target of this article is to analyze the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investment in the viewpoint of a euro investor in differently long investment horizons targeted at these investments finished in the time of the financial and economic crisis. This period is set between the years 2008–2010.

METHODS AND RESOURCES

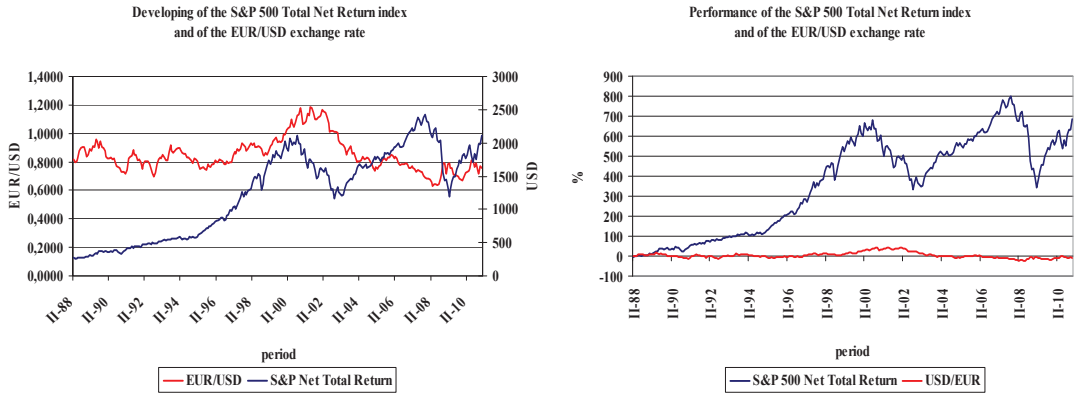
We got the outputs for the following investment horizons: one-year, three-year, five-year, seven-year, ten-year and fifteen-year. The supplementary horizon is the twenty-year one, where the received results have a lower evidence potential due to a lower number of observations. Share investments denominated in USD are represented by investments in the S&P 500 Total Net Return share index considering also the dividend reinvestments, which is in the years 1988–2010. The developing of the values of this index was, based on our request, sent directly from the company Standard & Poor's in an electronic form, and a relevant electronic source for these data cannot therefore be given, as it is in the case of the developing of the EUR/USD exchange rate. As for the data basis for the EUR/USD exchange rate, its time series for the years 1988–2010 was gained from official sources of the Federal Reserve System of the United States of America, while for the period 1988–1998 the conversion to ECU was accepted.

The developing of the value and the performance of the S&P 500 Total Net Return index from February 1988 to December 2010 are shown on Fig. 2. A similar trend developing for the value and the performance of the index in both currencies in the years 1988–2010 can be seen in this picture. However, there still remains a question, what was the impact of the change of the EUR/USD exchange rate on the rate of return on the investments done on this market by a euro investor within individual investment horizons.

In the Fig. 2, the developing of value and performance of the S&P 500 Total Net Return in USD and of the exchange rate from February 1988 to December 2010 are shown, from which a strong trend component of the developing of the index value and in contrary a very weak trend component of the developing of the EUR/USD exchange rate value can be deduced.



2: *Developing of the value and performance of the S&P 500 Total Net Return index*
Source: Standard & Poor's, Federal Reserve Statistical Release (2011); calculations by author.



3: *Developing of the value and performance of the S&P 500 Total Net Return index and of the EUR/USD exchange rate*
Source: Standard & Poor's, Federal Reserve Statistical Release (2011); calculations by author

I: *Number of foreign currency share investments for individual investment horizons*

Length of the horizon	1 year	3 years	5 years	7 years	10 years	15 years	20 years
Number of investments	263	239	215	191	155	95	35

Source: calculations by author

To quantify and analyze the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor, monthly closing values of the EUR/USD exchange rate and values of the S&P 500 Total Net Return index in the period 1988–2010, which is a 23-year period, were taken as basic information. The official monthly closing values of the EUR/USD exchange rate for the given period were received from the *Federal Reserve System*.

The number of input values (observations) of both of these variables for individual investment horizons (or better the number of simulated foreign currency investments for individual investment horizons) is given in Tab. I. The number always describes the maximum number of foreign currency investments for the given horizon in the monitored period (on the assumption of monthly data).

We analyzed the factors impacting the rate of return on dollar bond investment in the viewpoint of a euro investor to get an empiric analysis of the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor (see Formula 3 in the methodology of this article). $|s + s \times R^{FC}|/(|R^{FC}|$ and $|s + s \times R^{FC}|$

RESULTS AND DISCUSSION

The reached results for individual chosen investment horizons are, according to the methodology of this article, presented on individual pairs of charts (see Fig. 4 to Fig. 10). The first chart of the given pair compares the performances of partial share investments in USD ($|R^{FC}|$) for the given investment horizon with the impact of a change of the EUR/USD exchange rate ($| s + s \times R^{FC}|$), see methodology of the paper. If $|R^{FC}| < |s + s \times R^{FC}|$, influence of exchange rate on rate of return on the foreign currency was bigger than influence of the performance of the investment in currency of its denomination and vice versa. Concrete value of exchange rate importance (influence) is calculated by the quotient in the second chart in the pair.

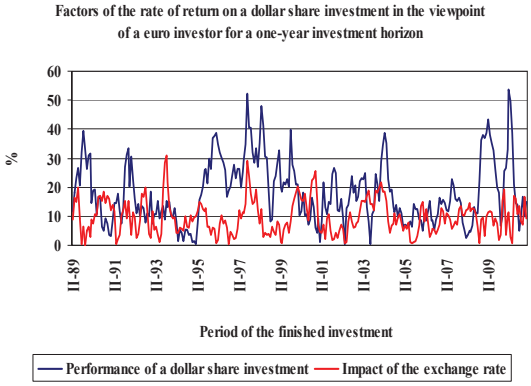
The second of the chart pairs shows the values of quotient of a change of the EUR/USD exchange rate on the rate of return on individual dollar share investments in the viewpoint of a euro investor for the given investment horizon (see formula 3 in metodology of the paper:

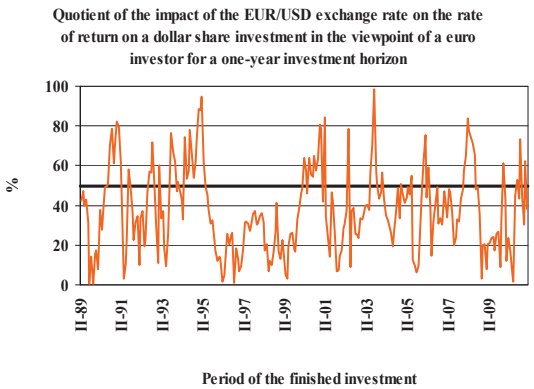
$$(|s + s \times R^{FC}| / |s + s \times R^{FC}| + |R^{FC}|).$$

If the quotient is equal 50% both factors had the same influence on rate of return on the dollar investments in the viewpoint of a euro investor ($|R^{FC}| = |s + s \times R^{FC}|$). If the quotient is over 50% influence of exchange rate was more important than influence of dollar investment performance ($|R^{FC}| < |s + s \times R^{FC}|$) and if the quotient is bellow 50% influence of exchange rate was less important than influence of dollar investment performance ($|R^{FC}| > |s + s \times R^{FC}|$). Stability of the impact for concrete investment horizon can be calculated by the standard deviation or coefficient of variation.

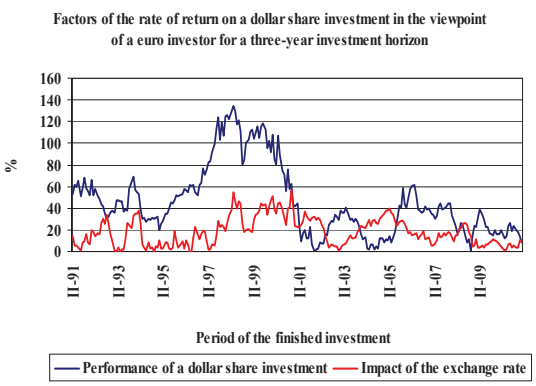
If also the twenty-year horizon was analyzed, where, however, the analysis would be done on 35 input values and that is why it is not included among the basic investment horizons for share investments, outcomes stated in Fig. 10 would be the results.

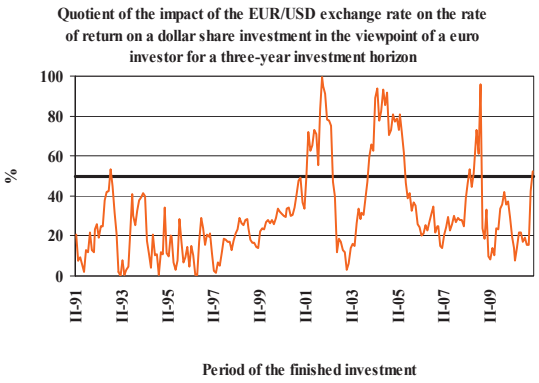
Fig. 11 demonstrates a developing of the average quotient value of the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor depending on the length of the investment horizon. A trend decrease in this impact depending



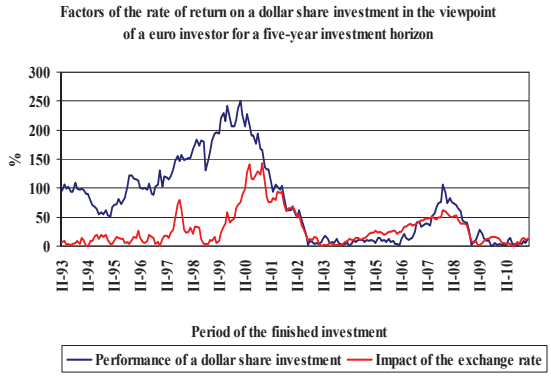


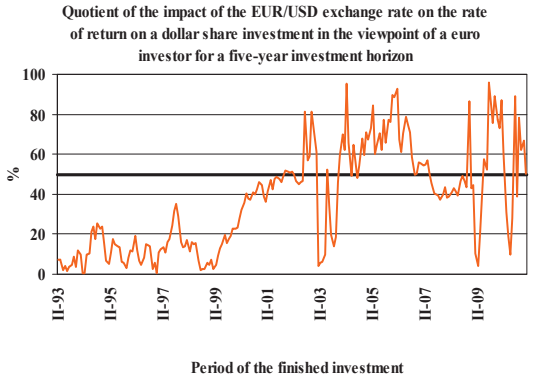
4: *One-year horizon*
Source: calculations by author



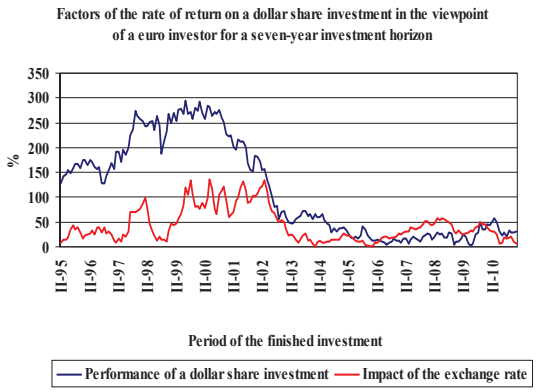


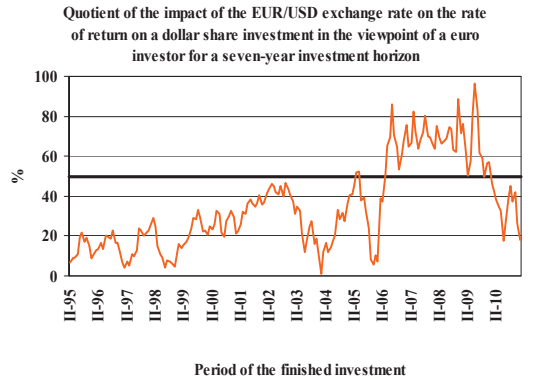
5: *Three-year horizon*
Source: calculations by author





6: *Five-year horizon*
Source: calculations by author



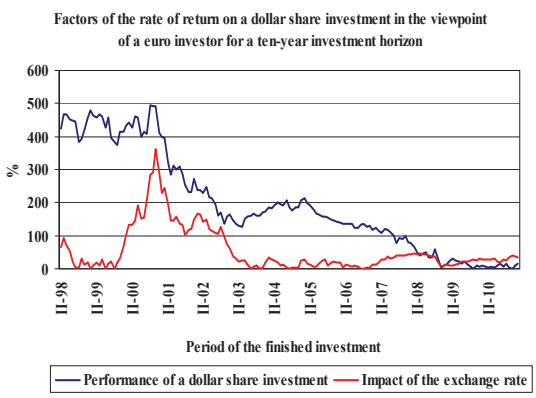


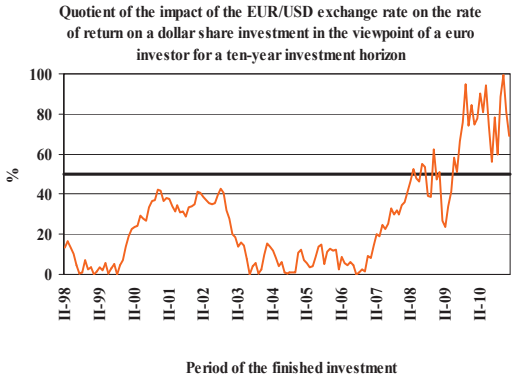
7: *Seven-year horizon*
Source: calculations by author

on the increasing length of an investment horizon can be observed here, which corresponds with the conclusions of authors mentioned at the beginning of this article saying that the impact of an exchange rate change on the rate of return on foreign currency investment goes down in longer investment horizons.

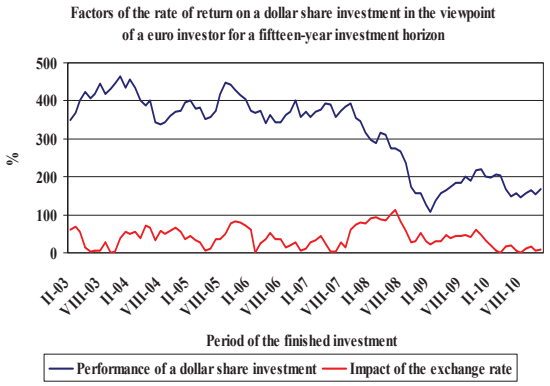
However, if the investments finished in the years 1988–2010 are divided into investments finished in the time before crisis (1988–2007) and in the crisis period (2008–2010), the average values of the given quotient for individual investment horizons will be as follows (see Fig. 12).

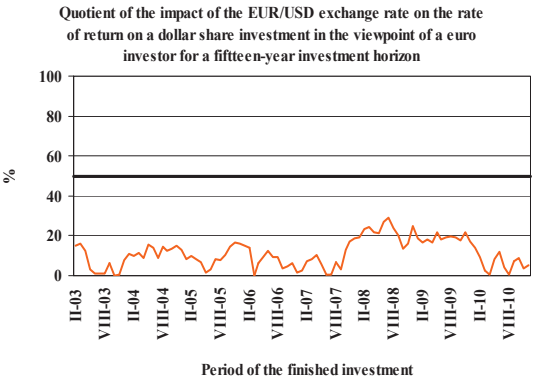
Fig. 13 demonstrates variability of the quetient value measured by coefficient of variation. Period 1988–2010 is dividend into two parts again. First part represents period 1988–2007 and the second period 2008–2010. Impact of exchange rate was more stable



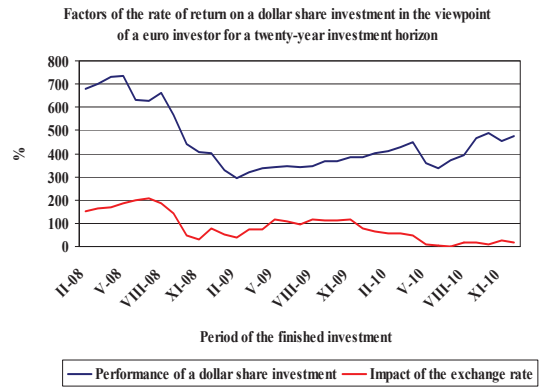


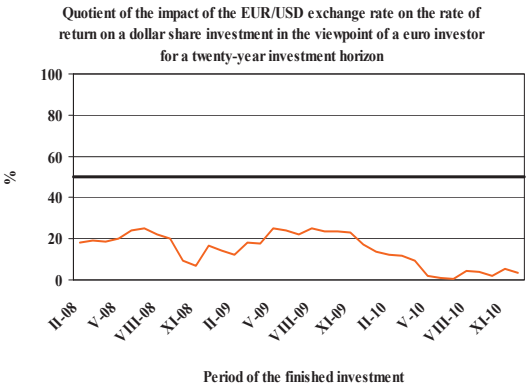
8: *Ten-year horizon*
Source: calculations by author





9: *Fifteen-year horizon*
Source: calculations by author



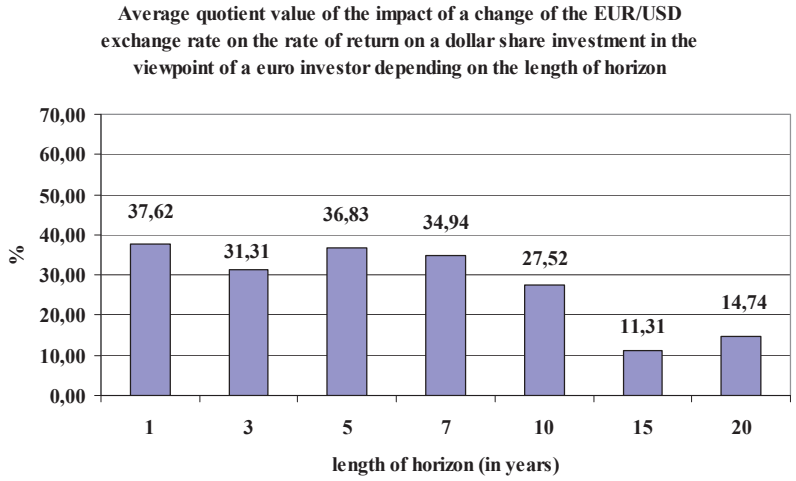


10: *Twenty-year horizon*
Source: calculations by author

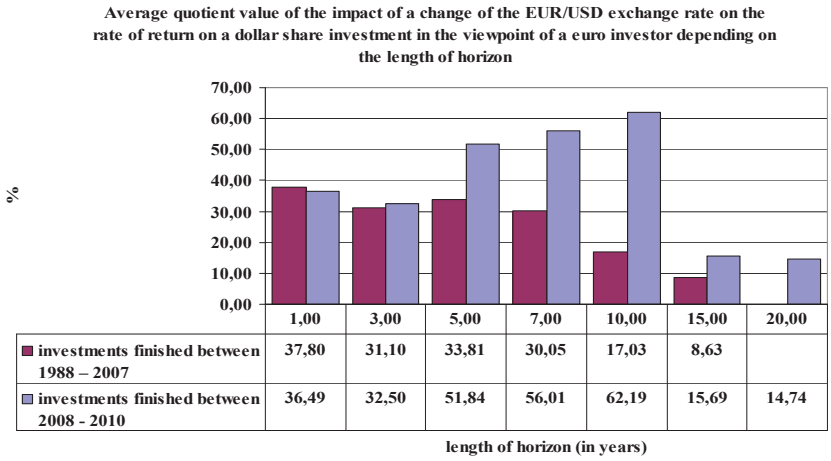
especially in five to ten-years investment horizons in period 2008–2010 (financial and economic crisis) than in period (1988–2007).

In Fig. 12, an increase in the average impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor in period 2008 and 2011 is evident. Increasing of stability of the impact in this period in middle-term investment horizons (5 to 10 years) is evident too (see Fig. 13).

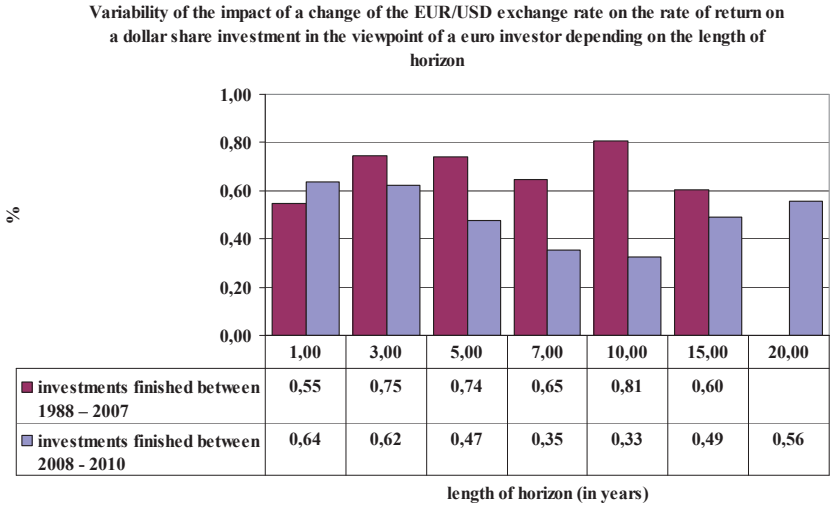
In the case of short investment horizons (1 to 3 years) average impact of the exchange rate (see Fig. 12) was relatively insignificant in comparison to medium-term investment horizons (5 to 10 years), when the developing of a change of the EUR/USD exchange rate had in average a bigger



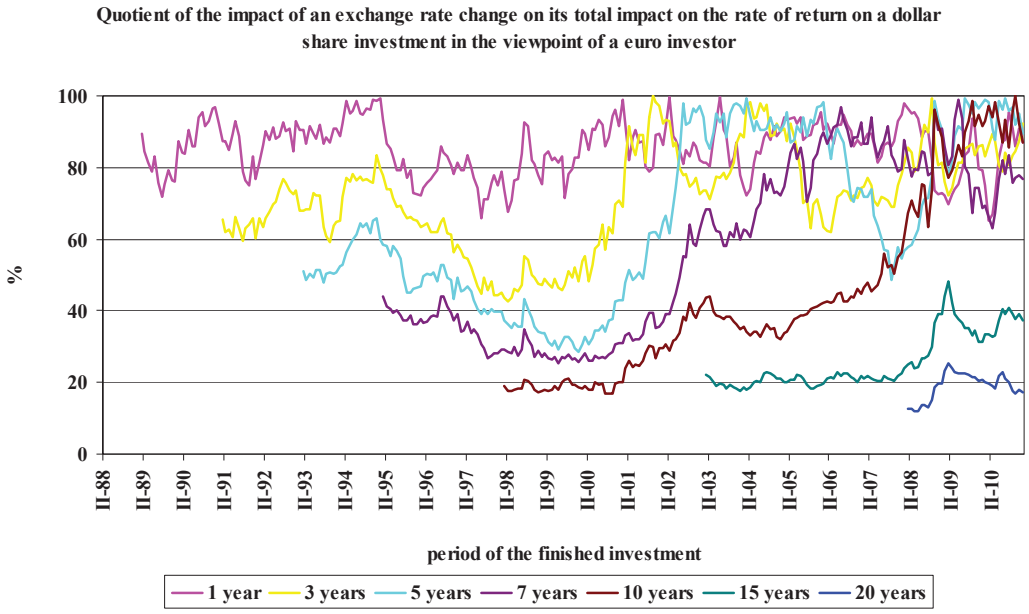
11: *Average quotient value of the impact of an exchange rate by the length of horizon*
Source: calculations by author



12: *Average quotient value of the impact of an exchange rate change (investments finished in the years 1988–2007 and 2008–2010)*
Source: calculations by author



13: *Variability of the impact of an exchange rate change (investments finished in the years 1988–2007 and 2008–2010)*
Source: calculations by author



14: *Developing of the impact of an exchange rate change in individual investment horizons*
Source: calculations by author

impact on the rate of return on dollar share investments in the viewpoint of a euro investor than the performance of share investments in USD themselves. These conclusions are thus inconsistent with the statements of authors Solnik and McLeavey (2004), Froot (1993) or Siegel (2007), who claim the necessity of securing foreign currency investments against the exchange rate risk in the case of short-term horizons. Implying from the above mentioned calculations, this risk played an important role also for medium-term and long-term horizons represented for example by a ten-year investment horizon.

A considerable growth of the average impact of an exchange rate change was noticed also in the case of a fifteen-year investment horizon (higher stability of the impact too). In the case of the supplementary twenty-year horizon, no investment, in terms of the monitored period 1988–2010, was finished before 2008, therefore no comparison of results in this investment horizon could have been done. But also a ten-year and a fifteen-year investment horizon are in the case of share investments long and representative enough as investment horizons.

A value slump in the American stock market is the reason for an increase in the impact of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor finished in the times of economic and financial crisis (2008–2010), which means a decrease in the performance of dollar investments in USD finished in this period or in other words the decrease of values. Since no decrease in value (s) meaning a change of the EUR/USD[2] exchange rate appeared in a similar way in the period of the given investment, it is logical that the impact of the EUR exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor finished in this period increased and the impact of performance of these investments in USD decreased.

However, a question, whether this fact is valid just for the investments finished in the years 2008–2010, remains open. When the quotient value developing of the impact of a change of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor for individual investment horizons (always the second chart from the Fig. 4 to Fig. 10) is displayed in one chart only (see Fig. 14), it is obvious that the impact of a change of the EUR/USD exchange rate had a growing trend for the horizons lasting 3 to 10 years already approximately from the years 2000 to 2001, which were connected with the so called dotcom speculative bubble, which represented the beginning of a relatively turbulent period on this market in the past 10 years (see Fig. 2 and Fig. 3). This period is connected with several important drops on this market which were increasing the impact of an exchange rate change on the rate of return on foreign currency investments done on this market. The most important increase of the impact of an exchange rate change appeared

2 Looking at the Fig. 3, an independent trend developing of the value of the EUR/USD exchange rate and of the American share in the years 1988 to 2010 is obvious. A rational economic explanation for a partial correlation between these variables exists, but both variables are influenced by many other factor which cannot be omitted.

for the investments finished in the years 2008–2010, which is in the times of the financial and following economic crisis. The crises increased influence of exchange rate on rate of return on foreign exchange investments in middle-term investments horizons because of deep stock market decreasing and stability of the influence was increasing in these horizons too. It means, financial and economic crisis increased importance of exchange risk in the case of foreign exchange investments in the market in middle-term horizons.

CONCLUSION

The importance of an exchange rate risk connected with globalization of the world financial system and of the much larger investment opportunities for investors also by foreign currency investments is, in case of investments not secured against this risk, growing.

The article discussed investments on the most important world stock market (according to the market capitalization), which is the stock market of the USA, when an exchange rate risk given by the impact of a change of the most important world currency pair EUR/USD (according to trading volumes on foreign exchange markets) was undergone.

Going out of an empiric analysis, the article proved a significant growth of the impact of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor in period of financial and economic crisis (2008–2010), especially in middle-term horizons, and higher stability of the impact in these horizons too, which appeared because of higher turbulences on this market connected with its deeper drops, which were not accompanied by an adequate change of the EUR/USD exchange rate. This was valid also for medium-term and long-term investment horizons (a ten-year to a fifteen-year horizon), which is for such lengths of the investment horizon, in which other authors consider the exchange rate risk and its impact on the rate of return on foreign currency investments to be relatively insignificant.

A globalization of the world financial system, however, does not mean only new investment opportunities; it means also closer and closer connection of individual partial markets connected with a very similar course of events on these markets. This includes common appearance of turbulences connected with deeper drops of values of these markets. Because of this reason, a similar growth of the impact of an exchange rate in foreign currency investments can be expected also when done on other markets (with deeper drops of values of these markets), which is even in the following periods, and the exchange rate risk must not be omitted in the foreign currency investments, even not in longer investment horizons.

SUMMARY

The paper discusses the evaluation of the influence of the EUR/USD exchange rate on the yield-rate of dollar share investments from the viewpoint of the Euro investor in varying investment periods with emphasis on the period of the financial and subsequent economic crisis targeted mainly in the period 2008–2010.

The outputs of the paper are realized for the following investment periods: one-year, three-year, five-year, seven-year, ten-year and fifteen-year. The supplementary investment period is the twenty-year period, which due to the small number of observations is characterized by low informative value. The share investments denominated in USD are represented by investments in the S&P 500 Total Net Return that also considers reinvestment in the period 1988–2010.

The basic methodical tool of the paper is quantification of the factors that influence the yield-rate of the foreign currency investments in the reference currency of the investor. Quantification mainly attaches to the ratio of the influence of the EUR/USD exchange rate on the yield-rate of the dollar share investments from the viewpoint of the euro investor.

The article proved a significant growth of the impact of the EUR/USD exchange rate on the rate of return on dollar share investments in the viewpoint of a euro investor in period of financial and economic crisis (2008–2010), especially in middle-term horizons, and higher stability of the impact in these horizons too, which appeared because of higher turbulences on this market connected with its deeper drops, which were not accompanied by an adequate change of the EUR/USD exchange rate. This was valid also for medium-term and long-term investment horizons (a ten-year to a fifteen-year horizon), which is for such lengths of the investment horizon, in which other authors consider the exchange rate risk and its impact on the rate of return on foreign currency investments to be relatively insignificant.

Acknowledgement

This article was prepared within the scope of problem-solving to the Thematic orientation 02 of the Scientific research of FBE MUB MSM 6215648904 Czech economy in processes of integration and globalization and developing of the agricultural sector and sector of services in the new conditions of an integrated European market.

REFERENCES

ARIKAWA, M., MURALIDHAR, A., 2006: *Hedging Currency Risk In International Investment and Trade* [online]. Tokyo: Center For Advanced Research in Finance, 2006: [cit. 2008-07-05]. Cited from: http://www.carf.e.utokyo.ac.jp/pdf/workingpaper/fseries/91.pdf >.

BAY, M. R., JANSEN, D. W, 1995: *Money, Banking, and Financial Markets: An Economics Approach*. 1st ed. Boston: Houghton Mifflin, 779 pp. ISBN 0-395-64395-3.

FEDERAL RESERVE STATISTICAL RELEASE [online]; 2011: [cit. 2011-01-10]. Cited from: <http://www.federalreserve.gov/releases/h10/Hist/>.

FROOT, K. A., 1993: *Currency Hedging over Long Horizon*. NBER Working Paper No. 4355, Issued in May 1993.

PEROLD, A., SHULMAN, E. C., 1998: The Free Lunch. In: Currency Hedging: Implications For Investment Policy And Performance Standards", *Financial Analysts Journal*, May/June 1988, Vol. 44, No. 3: 45–52.

PILBEAM, K., 2005: *Finance and Financial Markets*. 2nd ed. New York: PALGRAVE MACMILLAN, 479 pp. ISBN-13: 978-1-4039-4835-9.

SIEGEL, J., 2007: *Stocks for the Long Run: The Definitive Guide to Financial Market Returns & Long Term Investment Strategy*. 4th ed. McGraw-Hill, 436 pp. ISBN 978-0071494700.

SOLNIK, B., McLEAVEY, D., 2004: *International Investments*. 5th ed. Boston: Pearson Addison Wesley, 760 pp. ISBN 0-201-78568-4.

Address

Ing. Oldřich Šoba, Ph.D., Ústav financí, Mendelova univerzita v Brně, Zemědělská 1, 613 00, Brno, Česká republika, e-mail: oldrich.soba@mendelu.cz