Foreign exchange markets' seasonal effects in the newly integrated EU countries: what can they tell us?

Carlos Vieira and Isabel Vieira*

Departamento de Economia, Universidade de Évora, Portugal

CEG-IST, Instituto Superior Técnico, Lisboa

(This version: February/06)

Abstract:

Evidence of seasonal and other regularities in financial markets challenges traditional theories on how markets price securities, and suggests some predictability which could be used to obtain abnormal profits. The empirical studies have largely focused on stock markets, although the methodology may be extended to other markets also important in portfolio investment choices. This paper focuses on the foreign exchange markets of the new European Union members, and searches for some of the usual calendar effects. Broadly considered as tests of financial markets' efficiency, they may shed some light on the current financial maturity of the new members, and provide useful information in terms of the timing for euro adoption.

JEL Classification: F31, F36, G14, G15

Key words: Foreign exchange markets, Calendar effects, Seasonal effects, Financial integration, Financial efficiency.

* Corresponding author: Departamento de Economia, Universidade de Évora, Largo dos Colegiais, 7000-803 ÉVORA - PORTUGAL. impvv@uevora.pt

1 - Introduction

Economic and monetary integration greatly restricts the ability of individual countries to react to specific shocks. This is the more important the lesser the degree of economic homogeneity among the countries in the integrated area. Perhaps having this in mind, no pressure has been exerted upon the newly integrated members of the European Union (EU) in terms of timing for their adoption of the common currency. They have not the choice of opting out of full monetary integration (as others did before) and have to comply with the so called Maastricht criteria before adopting the euro, but it is on their hands to decide when they intend to do so. Self imposed deadlines have nevertheless been announced, ranging from 2006 to 2010 (European Central Bank, 2004). Bearing in mind that these are relatively tight deadlines in view of the foreseen time needed for their convergence to EU economic standards, these countries' decisions raise a number of academic and political questions.[1]

A much discussed issue concerning monetary integration is the availability of alternative adjustment mechanisms capable of replacing foreign exchange and monetary policies in short term reaction to an asymmetric shock. In the case of the EU, the options are limited. There is no significant common budget, capable of automatic stabilisation following a shock, domestic fiscal autonomy is severely restricted by the stability and growth pact, labour force is relatively immobile and prices and wages are sluggish. In these conditions, financial markets are of uttermost importance because they are theoretically capable of providing the smoothing of consumption in the aftermath of a negative specific disturbance, so long as they are efficient and integrated.[2]

The empirical assessment of the level of efficiency and integration already attained by the newly acceded countries' financial markets is therefore one way of adding value to the discussion evolving around the subject of their adoption of the common currency. Some attempts to evaluate financial integration in the Central and Eastern European countries have already been done.[3] However, to the best of our knowledge, one aspect that remains untouched is the assessment of the level of information efficiency of these countries' foreign exchange markets. Having in mind the rationale developed so far, such an analysis may be valid for a number of reasons. Foreign exchange markets are usually the first segment of financial markets to be

[1] Assuming a 1.5% annual growth for the EU15 GDP and growth rates for the new EU members that double those registered in 2002, Bolle (2004) shows that the Czech Republic, Hungary and Poland would achieve 80% convergence to EU15 GDP in 2014, 2011 and 2048, respectively.
[2] The role that may be played by flows of capital in the process of economic adjustment and stabilisation has been highlighted by many authors. See, *inter alia*, Ingram (1969), Bisignano (1994) or Allsopp and Vines (1998).
[3] See, for instance, Mansori (2003).

relieved from controls and regulations and, consequently, the first to become efficient and integrated. If evidence of segmentation is uncovered in foreign exchange markets, it is most certainly present in other smaller, less liquid and less cost efficient segments of the financial markets.

An additional appeal of this investigation is the fact that, although the efficiency of financial markets has been the object of countless published and unpublished analyses, the vast majority concentrate on stock markets. In comparative terms, the body of research on the information efficiency of foreign exchange markets is relatively thin, in spite of the fact that they are the largest markets in terms of daily traded values. Besides, no conclusive explanations of these calendar effects has been proposed so far, which suggests that further research is needed to improve our understanding of the phenomena.

The remainder of the paper is organised as follows: section 2 deals with the issue of financial efficiency and surveys the relevant empirical literature on the information efficiency of foreign exchange markets. Section 3 displays our own empirical assessment of efficiency (more specifically, the weak form information efficiency) with the objective of testing for the existence of calendar effects on the foreign exchange markets of the three countries that have adopted the most flexible foreign exchange regime: the Czech Republic, Hungary and Poland.[4] Section 4 concludes with the implications of our empirical findings for the discussion on the timing of these countries' euro adoption.

2 - Foreign exchange markets' efficiency in theory and in practice

Financial markets' efficiency may be related to information processing, agents' rationality or functional aspects. Information efficiency is by far the most popular concept, and the Efficient Markets Hypothesis states that financial markets' agents are efficient processors of information, and price assets according to their true or 'just' value. Fama (1970) defined three levels of information efficiency – weak, semi-strong and strong - differing in terms of the information sets taken into account by agents when forming expectations.

In the weak form efficiency, the information set contains past assets' prices, only. Current prices should therefore reflect all information contained on their past history, thus making it impossible to earn abnormal profits on the basis of chartist analyses. A time series of prices determined in a weak form efficient market would follow a random walk. The semi-strong and the strong efficiency forms rely on sets of,

[4] Dean (2004) classifies the ten new EU members in terms of their foreign exchange regimes as large floaters (the Czech Republic, Hungary and Poland) and small peggers.

respectively, all publicly available information and all information available, including that which is confidential. According to the former, only agents possessing inside information would be able to beat the market, whereas according to the latter this would be impossible even for them.

The information efficiency of financial markets has been subject to intense empirical investigation. Stock markets have largely been the most assessed, especially their weak form efficiency, by nature the less demanding test in terms of data requirements. Among these tests, some concentrate on seasonal or calendar effects, such as the day of the week effect, the month of the year effect, or the turn of month effect, and many display evidence of regularities that, although not always long lived, identify periods of financial markets' inefficiency.[5]

Although the number of studies investigating what has been termed financial anomalies in stock markets is outstanding, much less attention has been directed towards foreign exchange markets.[6] Such asymmetry of interest may not be justified in terms of scarcity of available data, investors' interest or lack of theoretical ground. In fact, high frequency foreign exchange quotes for the most traded currencies are readily available, from multiple credible sources. Furthermore, foreign exchange aspects have to be taken into account by international portfolio investors, because they are a source of potential gains and losses. And finally, the financial assets' market approach to foreign exchange rate determination view exchange rates as one of many prices of assets (currencies) traded in world-wide markets, thus justifying the testing of efficiency using foreign exchange quotes.

Empirical studies on foreign exchange markets' weak form information efficiency have mostly concentrate on calendar effects. In spite of being closer than any other to the theoretical definition of a perfect market, empirical studies on these markets have uncovered a number of apparent inefficiencies. One of the first published papers was produced by McFarland et al. (1982). Employing daily data collected from January 1975 to June 1979, the authors analysed eleven major and minor foreign exchange markets, concentrating on the statistical distribution properties of the data. They found different probability distributions for different trading intervals and obtained results suggestive of inefficiency. According to their results, from the point of view of an American investor, returns on most of the assessed foreign currencies appear to be consistently higher on Mondays and Wednesdays and lower on Thursdays and Fridays.

So (1987) investigated whether the day of the week effect uncovered by McFarland et al. (1982) was biased by their assumption of a symmetric distribution of foreign exchange returns. In accordance with the previous study, So found evidence of

[5] A good survey may be found in Keim and Ziemba (2000).
[6] The term *anomalies* used in this context, although largely employed, is not without controversy. On this discussion see, for instance, Frankfurther and McGoun (2001).

higher returns on Wednesdays and lower returns on Thursdays and Fridays, but obtained a contradictory result for Mondays. The author concluded that the weekday effect is reduced when the symmetric distribution assumption is relaxed and suggested that his finding of significant skewness within each day of the week is less "disturbing" for the notion of perfect markets than evidence of the same effect displayed by the returns' mean (as produced by McFarland et al. (1982)).

Yamori and Mourdoukoutas (2003), and Yamori and Kurihara (2004) recently add to this literature by showing that, for the most liquid currencies, calendar effects, (and among these, especially the day of the week effect), were visible in the 80s but are practically absent in the 90s. These results are related to foreign exchange markets deregulation and international integration, an intuition supported by analyses such as that of Aydoğan and Booth (1999), who find evidence of day of the week and of week of the month effects also in the first half of the 90s, for the less developed foreign exchange market of the Turkish lira.

The fact that calendar effects are more abundant in periods of foreign exchange markets' segmentation and tend to disappear, or become scarcer, following deregulation and abolishment of capital controls and of other barriers to capital mobility is already documented for stock markets.[7] This suggests that maturity and efficiency come hand in hand with the development and sophistication of financial markets and, in accordance with economic theory, both characteristics appear to be enhanced by international integration. In what follows, we extend the empirical literature on this subject by assessing the existence of calendar effects in the foreign exchange markets of three transition countries that have recently entered the EU. Having started a process of transition towards market economies in the 90s, it is interesting to evaluate if such an effort is already visible in tests of information efficiency in foreign exchange markets.

3. Empirical Analysis

The empirical analysis in this section is performed with daily exchange rates against the US dollar of the currencies of the three largest new EU economies, the Czech Republic (koruna), Hungary (forint) and Poland (zloty). The sample covers the period from January 1993 to March 2005, for a total of around 3100 observations, slightly varying with the number of national holidays. The data has been obtained from these countries' central bank databases. Using data from different sources, and different markets, implies that the comparability of the results may be affected by potentially different transaction or clearing systems in each country. However, tests performed with a shorter common

[7] See, for instance, Dubois and Louvet (1996).

database, from an international financial institution, do not qualitatively affect the results for the common period.[8]

This sample will also be divided into two sub-samples, to assess the dynamics in market efficiency as these countries' financial markets develop and integrate into global markets. Given the relatively short period for which data is available, some caution is necessary when interpreting the results for the sub-samples.

Table 1 displays summary statistics of the exchange rate returns for the whole sample and the two sub-periods. All countries show positive mean returns until March 1998 and negative mean returns afterwards. Volatility increases in the second half of the sample. All series are positively skewed and thick-tailed, compared to a normal distribution, a problem more significant in the first half of the sample. The *ADF stat.* represents the Augmented Dickey-Fuller test statistic for the null hypothesis of a unit root, strongly rejected for all cases.

Table 1: Summary statistics of the exchange rate returns

	Obs.	Mean	Std. Dev.	Skewness	Kurtosis	ADF stat.
Czech Republic						
Jan.93-Mar.05	3100	-.00722	.67120	.59016	11.74663	-55.415
Jan.93-Mar.98	1331	.01154	.55980	2.44026	38.74844	-37.917
Apr.98-Mar.05	1769	-.02135	.74394	.00242	4.21954	-41.113
Hungary						
Jan.93-Mar.05	3073	.02671	.66848	1.69110	25.10522	-29.815
Jan.93-Mar.98	1323	.06994	.54968	6.536340	99.84515	-18.352
Apr.98-Mar.05	1750	-.00597	.74433	.22214	5.80897	-19.112
Poland						
Jan.93-Mar.05	3090	.02239	.62545	.74449	14.53998	-32.754
Jan.93-Mar.98	1316	.05906	.45967	3.61571	60.04110	-38.271
Apr.98-Mar.05	1774	-.00480	.72324	.21773	6.78585	-25.180

ADF stat. represents the Augmented Dickey-Fuller test statistic for the null hypothesis of a unit root.

As usual in this literature, the following equation is estimated to investigate the existence of the day-of-the-week (DOW) effect:

$$(1) \qquad R_t = a_1 Dmon_t + a_2 Dtue_t + a_3 Dwed_t + a_4 Dthu_t + a_5 Dfri_t + \varepsilon_t ,$$

[8] For the sake of brevity, these tests are not shown, but are available upon request.

where $R_t = log\ (S_t/S_{t-1})$ are rates of return for holding USD for one trading day, with S_t representing the national currency spot price of one US dollar at time t, and each dummy variable $D._t$ takes the value one for the respective day of the week and zero otherwise. A positive return rate indicates a depreciation of the national currency against the USD and therefore the R_t are returns to national investors in USD. Table 2 presents the estimates from the regressions for the three countries and the tests for the joint significance and for the equality of the coefficients. The Ljung-Box Q statistic for autocorrelation indicates the presence of serial correlation in the Polish series so that the Newey and West (1987) autocorrelation consistent covariance matrices are employed in this case to analyse the significance of the estimated coefficients. This correction does not, however, qualitatively change the results had the autocorrelation problem been overlooked.

In the period under analysis, these countries have undergone profound fundamental changes, with a rapid transition process towards a market economy and the integration in the EU. It is therefore expectable that the seasonal patterns of currency returns may have changed over time. To evaluate this hypothesis, the sample was divided approximately in half, with two sub-samples for the periods from January 1993 to March 1998 and from April 1998 to March 2005. The partition coincides exactly with the date when the formal EU accession process began for these countries. Table 2 also displays the results obtained when applying the same previous methodology to both sub-samples.

Table 2: The day-of-the-week effect

	Monday	Tuesday	Wednesday	Thursday	Friday	*F*-test [p-value]	Wald test *[p-value]*
Czech Republic							
Jan.93-Mar.05	-.02748	-.00238	.02677	-.01637	-.01718	0.56 *[.7317]*	0.61 *[.6563]*
Jan.93-Mar.98	-.00044	.01809	-.00065	.02364	.01678	0.20 *[.9630]*	0.11 *[.9800]*
Apr.98-Mar.05	-.04795	-.01779	.04720	-.04635	-.04291	1.13 *[.3435]*	1.05 *[.3824]*
Hungary							
Jan.93-Mar.05	-.00176	.01469	.02103	.06504**	.0333	1.67 *[.1394]*	0.86 *[.4898]*
Jan.93-Mar.98	.07121**	.04665	.08093**	.07963**	.07145**	4.41***[.0006]*	0.17 *[.9547]*
Apr.98-Mar.05	-.05753	-.00923	-.02384	.05406	.00405	0.86 *[.5068]*	1.05 *[.3811]*
Poland							
Jan.93-Mar.05	-.04055	.02853	.01260	.07222***	.03812	2.81** *[.0154]*	2.42** *[.0466]*
Jan.93-Mar.98	.06127**	.05126*	.02321	.09614***	.06450**	5.06*** *[.0001]*	0.86 *[.4893]*
Apr.98-Mar.05	-.11465***	.01167	.00465	.05439	.01847	2.23** *[.0492]*	2.76** *[.0262]*

Standard errors in parenthesis below the dummies' coefficients (Newey and West autocorrelation consistent standard errors in Poland, with the number of lags chosen by their rule 4(N/100)^(2/9)). The asterisks ***, ** and * denote significance at the 1, 5 and 10 per cent levels, respectively.

The results of the Wald test of equal coefficients for all days of the week suggest that only Poland displays a day-of-the-week effect, but not in the first sub-period. This is somewhat against previous evidence for other countries showing that the effects tend to disappear as financial markets become more integrated and efficient.

Some other interesting information can be observed in the table. The lowest mean returns in all countries occur on Mondays, both for the whole sample and for the second sub-period. The highest mean returns occur on Wednesdays in the Czech Republic and on Thursdays in Hungary and Poland. In fact, the coefficients on the Thursday dummy in Hungary and Poland appear to be statistically significant and positive, possibly reflecting some common phenomena in both countries. No significant coefficient was found for the Czech Republic, probably suggesting a more efficient currency market.

Although done in some previous papers, it does not seem totally correct to look at the statistical significance of the day dummies in order to identify the specific days of the week in which the effect occurs. The coefficient of a particular day may be statistically different from zero but not statistically different from that of the rest of the week, and consequently no DOW effect would exist. Therefore, *t*-tests have been performed on the hypothesis that the mean return on each weekday is equal to the mean return on the rest of the week, assuming unequal variances. Table 3 displays the results, showing only the p-values of the test to allow an easier comparison of results.

Table 3: Tests of equal means and variances, day versus rest of the week (*p*-values)

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
			Czech Republic		
Ho: day = rest of week (mean)	0.4135	0.8450	0.1996	0.6808	0.6521
Jan.93-Mar.05	0.6915	0.8428	0.7375	0.6395	0.8467
Jan.93-Mar.98	0.4727	0.9205	0.0678	0.4581	0.5124
Apr.98-Mar.05					
Ho: day=rest of week (variance)	0.4718	0.0992	**0.0000**	**0.0000**	**0.0000**
Jan.93-Mar.05	0.3589	**0.0086**	**0.0000**	**0.0000**	**0.0000**
Jan.93-Mar.98	0.2254	0.6519	**0.0111**	0.0598	**0.0051**
Apr.98-Mar.05					
			Hungary		
Ho: day = rest of week (mean)	0.3097	0.5762	0.7997	0.0909	0.8004
Jan.93-Mar.05	0.9741	0.3198	0.6564	0.6845	0.9677
Jan.93-Mar.98	0.1894	0.9218	0.6030	0.0904	0.7808
Apr.98-Mar.05					
Ho: day=rest of week (variance)	**0.0000**	**0.0000**	**0.0003**	**0.0036**	**0.0001**
Jan.93-Mar.05	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Jan.93-Mar.98	**0.0081**	**0.0267**	0.2885	0.8779	0.8446
Apr.98-Mar.05					
			Poland		
Ho: day = rest of week (mean)	**0.0090**	0.7745	0.6549	**0.0235**	0.4963
Jan.93-Mar.05	0.9276	0.7744	0.0966	0.0848	0.8595
Jan.93-Mar.98	**0.0033**	0.5997	0.7858	0.0897	0.4836
Apr.98-Mar.05					
Ho: day=rest of week (variance)	**0.0084**	**0.0306**	0.3169	0.1070	0.0959
Jan.93-Mar.05	**0.0344**	**0.0066**	**0.0000**	**0.0000**	**0.0000**
Jan.93-Mar.98	**0.0041**	**0.0011**	0.4832	0.8234	0.2255

The means test is a two -sample t test with unequal variances

Again, only Poland seems to display a significant day of the week effect. At the usual five per cent significance level, the only significantly different mean returns occur on Mondays and Thursdays in the complete sample and on Mondays in the second sub-period. This, more recent, strongly negative effect on Mondays, in Poland, is consistent with previous findings for currency markets in MacFarland et al. (1982) and So (1987), for example. The same consistency also occurs with the Thursday effect uncovered for the whole sample, but not statistically significant in the sub-periods.

This may indicate that the Polish foreign exchange market is not becoming more efficient, but suggests it may be becoming more integrated in the global markets, following the global seasonal effects found elsewhere. The evidence for the other two countries suggests more efficient markets. However, this mean returns analysis must be complemented with a volatility analysis, to examine whether the expected relationship between returns and risk breaks up. Accordingly, Table 3 also displays the results of tests on the equality of variances between each weekday and the rest of the week. The results show a pattern of quite diverse risk behaviour in the different days of the week, apparently not connected with the mean returns' pattern. This occurs especially in the first sub-period, suggesting that forex markets are becoming less inefficient in this respect.

Furthermore, since daily financial data traditionally presents evidence of significant kurtosis and skewness (see Table 1), indicating a deviation from a normal distribution, some authors have noted the importance of also testing these seasonal effects on higher moments of the currency returns. Differences in higher moments might explain the seasonal effects found in the mean currency returns. Following Tang (1998), Table 4 presents the results of two-sample Kolmogorov-Smirnov non-parametric tests of equality of distributions, to determine whether any differences emerge in the distribution of the currency returns. In order to test only for differences in the higher moments, the currency returns obtained above are standardized for each day by subtracting their means and dividing by the standard deviation. This transformation does not affect skewness and kurtosis but imposes the same mean (zero) and standard deviation (one) on each distribution. The tests have been performed both for the difference between each weekday and all the others, and also for the difference between every pair of weekdays.

Table 4: Two-sample Kolmogorov-Smirnov test for equality of distribution functions (Jan.1993-Mar.2005)

	Czech Republic	Hungary	Poland		Czech Republic	Hungary	Poland
Monday	.0324	.0340	.0407	Mo-Tu	.0398	.0440	.0501
	[.685]	*[.639]*	*[.397]*		*[.715]*	*[.598]*	*[.422]*
Tuesday	.0437	.0412	.0336	Mo-We	.0540]	.0291	.0446
	[.297]	*[.365]*	*[.625]*		*[.332]*	*[.960]*	*[.575]*
Wednesday	.0436	.0271	.0363	Mo-Th	.0315	.0456	.0639
	[.301]	*[.859]*	*[.525]*		*[.920]*	*[.554]*	*[.167]*
Thursday	.0344	.0276	.0283	Mo-Fr	.0355	.0469	.0697
	[.600]	*[.845]*	*[.829]*		*[.832]*	*[.524]*	*[.102]*
Friday	.0243	.0310	.0396	Tu-We	.0637	.0440	.0456
	[.930]	*[.732]*	*[.416]*		*[.159]*	*[.583]*	*[.532]*
				Tu-Th	.0385	.0610	.0464
					[.746]	*[.195]*	*[.518]*
				Tu-Fr	.0417	.0582	.0571
					[.651]	*[.244]*	*[.259]*
				We-Th	.0700*	.0325	.0622
					[.095]	*[.898]*	*[.183]*
				We-Fr	.0443	.0416	.0506
					[.572]	*[.660]*	*[.402]*
				Th-Fr	.0447	.0345	.0364
					[.562]	*[.857]*	*[.809]*

The first columns present the results of tests on the null hypothesis that the day distribution is equal to the rest of the week distribution, while the last columns presents the results of testing the same hypothesis for all pairs of weekdays (p-values in parenthesis).

As shown in Table 4, the null hypothesis of equal higher moments cannot be rejected in any situation, except for the pair Wednesdays-Thursdays in the Czech

Republic, and only at the ten per cent level. Therefore, it may be confidently concluded that no evidence emerges of this calendar effect on higher moments.

6. Concluding Remarks

Our empirical analysis assessed the existence of seasonal effects in the foreign exchange markets of three recently acceded EU countries. To the best of our knowledge, such tests were not previously done, but our results comply with the existing empirical literature for other countries in that clear evidence of day of the week is uncovered. According to what was also previously established, some of these effects loose their strength in recent years, reflecting the liberalisation and integration efforts.

The overall results suggest some form of currency markets' inefficiency exist in the three countries, either in means or in variances. Considering only the more often studied effect on mean returns, the evidence suggests that, of the three studied countries, and in general terms, Poland displays the stronger signs of inefficiency. If it was reasonable to expect that the less efficient countries would intend to adopt the euro after the more efficient did so, these results are clearly at odds with the self declared intentions of these countries. According to the European Central Bank (2004), the Czech Republic would adopt the euro around 2009/10, Hungary in January 2008 and Poland around 2008 or 2009. The differences in terms of time are not substantial, but may all be too premature, especially in the case of Poland.

References:

Allsopp, Christopher and Vines, David (1998): The assessment: macroeconomic policy after EMU, in: Oxford Review of Economic Policy, Volume 14, Number 3, pp. 1-23.

Aydoğan, Kürşat and Booth, Geoffrey (1999): Calendar anomalies in the Turkish foreign exchange markets, available at:
http://www.bilkent.edu.tr/~aydogan/calendar.pdf.

Bisignano, Joseph (1994): The internationalisation of financial markets: measurement, benefits and unexpected interdependences, Banque de France Cahiers Économiques et Monetaires, 43.

Bolle, Michael (2004): The enlargement of the European Union – will it all work? (Mimeo).

Dean, James (2004): Adopting the Euro: tradeoffs and challenges facing the new EU-ten, in: Journal of Policy Modeling, Volume 26, Number 7, pp. 759-767.

Dubois, Michel and Louvet, Pascal (1996): The day-of-the-week effect: the international evidence, in: Journal of Banking and Finance, Volume 20, Number 9, pp. 1463-1484.

European Central Bank (2004): The acceding countries' strategies towards ERM II and the adoption of the euro: An analytical review, Occasional Paper Series, 10, available at: http://www.ecb.int/.

Fama, Eugene (1970): Efficient capital markets: a review of theory and empirical work, in: The Journal of Finance, Volume 25, Number 2, pp. 383-417.

Frankfurter, George and McGoun, Elton (2001): Anomalies in finance - What are they and what are they good for?, in: International Review of Financial Analysis, Volume 10, Number 4, pp. 407-429.

Ingram, James (1969): Comment: the currency area problem, in: Robert Mundell and Alexander Swoboda (eds.) Monetary Problems of the International Economy, The University of Chicago Press.

Keim, Donald and Ziemba, William (2000): Security market imperfections: an overview, in: Donald Keim and William Ziemba (eds.) Security Market Imperfections in World Wide Equity Markets, Cambridge University Press.

Mansori, Kashif (2003): Following in their footsteps: comparing interest parity conditions in Central European countries to the Euro countries, CESifo Working Paper Number 1020.

McFarland, James, Pettit, Richardson and Sung, Sam (1982): The distribution of foreign exchange price changes: trading day effects and risk measurement, in: The Journal of Finance, Volume 37, Number 3, pp. 693-715.

Newey, Whitney and West, Kenneth (1987): A simple positive-definite heteroskedasticity and autocorrelation consistent covariance matrix, in: Econometrica, Volume 55, Number 3, pp. 703-708.

So, Jacky (1987): The distribution of foreign exchange price changes: trading day effects and risk measurement - A comment, in: The Journal of Finance, Volume 42, Number 1, pp. 181-188.

Tang, Gordon (1998): Weekly pattern of exchange rate risks: evidence from ten Asian-Pacific currencies, in: Asia-Pacific Financial Markets, Volume 5, Number 3, pp. 261-274.

Yamori, Nobuyoshi and Kurihara, Yutaka (2004): The day-of-the-week effect in foreign exchange markets: multi-currency evidence, in: Research in International Business and Finance, Volume 18, Number 1, pp. 51-57.

Yamori, Nobuyoshi and Mourdoukoutas, Panos (2003): Does the day-of-the-week effect in foreign currency markets disappear? Evidence from the yen/dollar market, in: International Finance Review, Number 4, 443-459.