CREATES
Center for Research in Econometric Analysis of Time Series

CREATES Research Paper 2007-34

Extreme Coexceedances in New EU Member States' Stock Markets

Charlotte Christiansen and Angelo Ranaldo

School of Economics and Management
University of Aarhus
Building 1322, DK-8000 Aarhus C
Denmark

Aarhus School of Business
University of Aarhus
Handelshøjskolen
Aarhus Universitet

UNIVERSITY OF COPENHAGEN

Extreme Coexceedances in New EU Member States' Stock Markets*

Charlotte Christiansen†
University of Aarhus & *CREATES*

Angelo Ranaldo‡
Swiss National Bank

November 7, 2007

*The views expressed herein are those of the authors and not necessarily those of the Swiss National Bank, which does not accept any responsibility for the contents and opinions expressed in this paper. Christiansen acknowledges support from *CREATES* funded by the Danish National Research Foundation. The authors gratefully acknowledge helpful comments and suggestions from Susanne Bonomo, Michael Rockinger, and Sébastien Wälti, as well as from seminar participants at the *CREATES* Opening Conference, and at the SNB.

†School of Economics and Management, University of Aarhus, Building 1322, Universitetsparken, 8000 Aarhus C, Denmark. Phone: +45 8942 5477. Email: CChristiansen@econ.au.dk.

‡Research Department, Swiss National Bank, Switzerland. Email: Angelo.Ranaldo@snb.ch.

Extreme Coexceedances in New EU Member States' Stock Markets

Abstract: We analyze the financial integration of the new EU member states' stock markets using the coexceedance variable that counts the number of large negative returns on a given day across the countries. We use a multinomial logit model to investigate which factors influence the coexceedance variable; separately for geographical effects, asset class effects, volatility effects, and persistence effects. The effects differ for negative (large negative returns) and positive (large positive returns) coexceedance variables. The coexceedance variables for the old and the new EU countries are influenced differently. The effects on the new EU coexceedance variables change after the EU enlargement in 2004.

Keywords: Emerging markets; EU enlargement; EU Member States; Extreme returns; Financial integration; New EU Member States; Stock Markets

JEL Classifications: C25; F36; G15

1 Introduction

How do extreme price jumps propagate across countries? How are the relations of forces between developed and emerging markets in these circumstances? Do price disruptions in one region lead or lag extreme price movements in anther one? Do extreme price movements spill over across asset classes? In which market conditions is it more likely to observe contagion? Does the prospect of adopting a common currency have any bearing on the contagion phenomenon? This paper attempts to shed some light on these and related important questions.

In times of financial crisis investors and policy makers have a very strong interest in whether the crisis propagates to other countries; this is known as contagion effects. The past has for instance seen the "Asian flu" that started in Thailand in 1997 and propagated around the world. The way international markets reacted to recent events such as 9/11, the Second Gulf War, and hurricanes Rita and Katrina suggests that contagion is increasingly a global phenomenon. In this paper we investigate the interaction and contagion effects in the emerging and developed European stock markets. This provides valuable information about the typical market conditions and dynamics leading to joint price falls or rises in European countries. We analyze three main aspects of the contagion phenomenon between established and emerging European stock markets: geographical aspects, asset classes' interdependence, and dominant market conditions such as risk perception and propagation timing. These research questions should highlight the anatomy of contagion, the transmission mechanism within and between regions and any asymmetry between positive and negative spillover effects.

The European Union (EU) enlargement in 2004 might be considered a natural experiment to observe the effects of the plan of adopting a common currency on financial markets. For the new EU member states that are developing countries, this event represents a unique case to examine the effects of such policy decision on emerging stock markets. However, one can argue that the enlargement mechanism is more about adopting the EU legislation rather than the effects of a common currency and, in addition, that it is unfair to generalize this issue since each country distinguishes itself by its own unique socioeconomic characteristics. In his seminal work, Mundell (1961) pointed out the main trade-off for adopting a common currency. On the one hand, a common currency represents a reduction of transaction costs. On the other hand, it implies the loss of the natural "shock absorbers" represented by flexible exchange rates and independent monetary policies. The specific questions we address in

this study is whether and to what extent the contagion phenomenon within new member states has changed after their adhesion to the EU.

In the literature, there is yet little convergence of definitions and terminology. A number of authors call for discrimination between the terms "pure contagion", "interdependence", "shock propagation", "transmission effects", "spillovers" and so on (see, e.g., Forbes and Rigobon (2002)). Previously, contagion was mainly measured by the correlation between the returns at different financial markets. Among other disadvantages, correlation may be biased by conditional heteroskedasticity (see Boyer, Gibson and Loretan (1999) and Forbes and Rigobon (2002)).

Bae, Karolyi and Stulz (2003) suggest measuring contagion by how often extreme returns on different markets occur simultaneous. Extreme returns are large positive and large negative returns. Bae et al. (2003) count the number of coexistence of extreme returns (positive and negative separately) in different emerging stock markets in the same region. In this way, their definition of contagion is implicitly alike to correlation but yet it overcomes the problems mentioned above of the definition of contagion as well as the problems of using correlation to measure contagion. They use the multinomial logit model to explain the number of coexistence of extreme returns in Asia and Latin America. They find that contagion depends on interest rates, exchange rate changes and conditional stock return volatility. In this paper we apply a similar method to investigate the factors that explain the comovement between the stock markets in the new EU member states from the previous Communist states of Central and Eastern Europe. The lessons from the euro adoption indicate that EU membership might have strong implications for the integration of the individual financial markets. Also, the new EU member states aim at adopting the euro, and in fact some did so at the beginning of 2007, so they have strong interests in their markets becoming more integrated with the markets of old European member states and we pay special attention to effects stemming from their entry to the EU.

Methodologically we mainly lean on Bae et al. (2003), however other papers use related methods to investigate contagion effects. Cumperayot, Keijzer and Kouwenberg (2006) use a bivariate probit model for the extreme currency event and the extreme stock event as the explanatory variables. The model is estimated separately for 26 countries. Extreme stock market events are found to increase the likelihood of extreme currency events. Fazio (forthcoming) looks at bivariate probit models for crisis variables for a pair of countries. Contagion emerges if the error terms are correlated. The crisis variable is a measure of

speculative pressure depending on the exchange rate and level of international reserves. Hartmann, Straetmans and de Vries (2004) use extreme value theory to model the expected number of market crashes given that at least one market has already crashed. Their empirical analysis covers the five largest industrialized countries. Chan-Lau, Methieson and Yao (2004) also apply extreme value theory to analyze contagion in Latin America and Asia.

In general, the new EU member states' asset markets are becoming more integrated with the old EU member states' asset markets. Cappiello, Gérard, Kadareja and Manganelli (2006) consider the integration of seven new EU countries' stock markets using quantile regressions to make so-called comovement plots. They find that the integration within the new EU countries and with the old EU countries increases over time, and that it is mainly due to the three largest markets, (the Czech Republic, Hungary, and Poland). Moore and Wang (2007) consider the volatility of five new EU member states' stock markets. They show that the stock volatility decreases when the state enters the EU, i.e. the stock markets tend to be in the low volatility states. They use a regime switching model so that they do not have to use the exact entry date to investigate the effect of EU entry. Dovak and Podpiera (2006) investigate the stock returns in the new EU member states after the announcement of the enlargement of the EU. They use firm-specific data to calculate betas. They find that part of the stock price increase is connected to differences between local and world betas. Dovak (2007) shows that the new EU member states' bond yields (government and corporate) have moved towards the levels in the old EU countries.

Using the coexceedance methodology of Bae et al. (2003) we investigate the contagion between the stock markets in the 10 new EU member states from the former Communist countries in Eastern and Central Europe. The negative coexceedance variable for the new EU countries counts the number of extreme returns (below 5 percentile) across the new EU countries on a given day. The positive coexceedance variable for the new EU (above 95 percentile) and the negative and positive coexceedance variables for the new EU are constructed analogously. Using the multivariate logit model, we investigate which factors influence the coexceedance variables. We distinguish between four hypotheses that are investigated separately, namely geographical effects, asset class effects, volatility effects, and persistence effects. The effects from the explanatory variables are of the expected signs. We find that negative coexceedances in the new EU stock markets are significantly influenced by US stock return, old EU stock return, new EU stock return, old EU stock volatility, interest rate volatility,

lagged negative coexceedance for new EU, and negative coexceedance for old EU. Moreover we find that the factors that influence the coexceedance variables differ for the old and new EU stock markets. More specifically, we find that coexceedances among old EU states appear more connected to US stock markets and to extreme price movements into other asset classes. The coexceedance factors also differ for the positive and negative coexceedance variables. In particular, negative coexceedances for new EU stock markets show up when turmoil is a common factor across world regions and asset classes. Finally, we find that the new EU markets appear more dependent on old EU countries after the EU enlargement in May 2004.

The structure of the remaining part of the paper is as follows: In Section 2 we present the data and in Section 3 we explain the empirical set-up. Section 4 contains the empirical results and Section 5 concludes.

2 Data Description

Here we describe the data: first the coexceedance variables that we use as explained variables in the regressions to come, and second, the explanatory variables that enter those regressions.

We consider the following ten new EU member states: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. Notice that we focus on the new EU member states from the former Communist Central and Eastern European countries, i.e. we exclude two new EU member states, Cyprus and Malta, which are small population-wise and Mediterranean. Bulgaria and Romania joined the EU on January 1, 2007, the other countries on May 1, 2004.[1] We consider the joining countries as one group irrespective of whether they joined the EU in 2004 or in 2007.

The group of old EU countries consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the UK.

We apply daily data for the stock markets for various European countries. When available we use the DataStream stock index. In a few cases we instead use the relevant index from the local stock market because the DataStream index is not available. This applies to Estonia, Latvia, Lithuania, Slovakia, and Slovenia.

We use daily log returns from the total return indexes for the stock markets

[1] We excluded Luxemburg for obvious reasons of data availability (e.g. no stock market index exists).

measured in local currency.[2] The data cover the period from October 2, 2000 to April 20, 2007 which gives us a total of 1710 observations. This can be viewed as a representative sample period including both bull and bear phases, high and low volatility environments and different market conditions.[3][4]

2.1 Coexceedance Variables

It is from the log returns that we define the extreme returns. We follow Bae et al. (2003) and use the 5% and 95% percentiles to define the negative and positive extreme returns, respectively.[5] We treat large positive and negative returns separately.

We treat the new and old EU member states separately. We construct a variable that counts the number of extreme positive returns for the new EU countries on a given day. The variable can take on integer values between 0 and 10. We collect observations of 4 and above into one group, so the variable is truncated to take on values between 0 and 4. We denote this variable the positive coexceedance variable for the new EU countries. A similar positive coexceedance variable is constructed for the old EU countries. The negative coexceedance variable for the new EU countries is constructed by counting the number of negative extreme returns on the new EU stock markets on a given day. Finally, we construct the negative coexceedance variable for the old EU countries. We use the following notation for the coexceedance variables.

- XN_t^{new}: negative coexceedance for new EU countries on day t
- XN_t^{old}: negative coexceedance for old EU countries on day t
- XP_t^{new}: positive coexceedance for new EU countries on day t
- XP_t^{old}: positive coexceedance for old EU countries on day t

Summary statistics for the coexceedance variables are given in Table 1. Most of the days, there are no instances of extreme returns. 64% and 76% of the days there are no extreme negative returns in the new EU countries and the old

[2] Local currency returns are equivalent to currency hedged returns. Using common currency returns would bias the results and confound the genuine stock performance with that of the exchange rates.

[3] October 2, 2000 is the earliest date with daily stock market data for all the countries under investigation.

[4] We do the same analysis using a shorter sample period, namely beginning in August 2002. We performed this additional analysis in order to compare two well-defined bull periods, i.e. from August 2002 to April 2004 and after May 2004. This allows us to see whether the bull markets may bias our results. The results are very similar.

[5] The 5% and 95% percentiles are supposed to be the best compromise to capture the farthest portions of the distribution tails and to get representative samples of extreme returns.

EU countries, respectively. The figures are slightly higher for extreme positive returns (66% and 77%). For positive extreme returns, 11% of the days have more than one new EU member states with a positive extreme return. This applies to 12% of the old EU states. There are slightly more days with more than one extreme negative return in the new EU countries (namely 12% of the days). This also applies to the old EU countries where this happens 13% of the days. IT is the days with more than one extreme return that we are trying to explain by various factors in the empirical analysis to come.

Figure 1 shows the time series plot of the four coexceedance variables. We see that the instances of several coexceedances are spread out during the sample period and are not confined to a limited period of time.

2.2 Explanatory Variables

In the empirical analysis, in addition to the coexceedance variables we also make use of the variables below that are used as explanatory variables in various logit models. We have a sample of daily observations for which the sample period matches that for the coexceedance variables.

- S_t^{US} : Concurrent return from the US stock market (DataStream index)
- S_t^{old} : Concurrent return for European stock market (DataStream index for Western Europe)
- S_t^{new}: Concurrent return for new EU stock market (log-returns from equally weighted index constructed for the Czech Republic, Hungary, and Poland)
- σ_t^{old}: Concurrent volatility for old European stock return (square root of variance from AR(1)-GARCH(1,1) model for S_t^{US})
- C_t: Concurrent currency log return (exchange rate of GDM/euro per USD)
- σ_t^C: Concurrent volatility for currency return (square root of variance from AR(1)-GARCH(1,1) model for C_t)
- R_t: Concurrent interest rate (first differences of 1-month EURIBOR (Euro Interbank Offered Rate), first differences because unit root cannot be rejected)[6]
- σ_t^R: Concurrent interest rate volatility (square root of variance from AR(1)-GARCH(1,1) of first differences of R_t)

[6]It does not seem to be of importance whether we use a US or a European interest rate.

3 Empirical Set-Up

In first part of this section, we present the econometric technique. The second part describes the hypotheses to test.

3.1 Multinomial Logit Model for Coexceedances

We conduct univariate analysis and model one coexceedance variable at the time. The coexceedance variables are discrete choice variables, which can be modelled using a multinomial discrete choice model, such as the logit model we apply here. By considering only five categories (0, 1, 2, 3, and 4 and above) we reduce the number of parameters and make the results easier to understand.

In the multinomial logit model the probability of (say) XN_t^{new} being in category i where $i = 0, 1, 2, 3, 4$ the distribution is given by

$$P_i = \frac{\exp\left(\beta_i^{'} x\right)}{1 + \sum_{j=1, j\neq i}^{4} \exp\left(\beta_j^{'} x\right)}$$

where x is the vector of explanatory variables (including a constant) and β_i is the vector of coefficients. There is one coefficient for each covariate for each of the categories. In this way we can test whether the number of coexceedances is explained significantly by a given variable. For simplicity below, we state that the probability of being in category i is given as a function of the explanatory variables: $P_i = function(\beta_i' x)$ where $i = 1, 2, 3, 4$.

We estimate the multinomial logit model using different sets of explanatory variables, more hereon follows below.

We access the goodness of fit of the various models by using a χ^2 test for the significance of all the explanatory variables, i.e. where we compare the estimated model with the base line model that only has the constant term as explanatory variable. We also use the base line model to calculate a pseudo R^2 which is not adjusted for the number of parameters. We use a χ^2 test to access the significance of a given explanatory variable, i.e. whether all the coefficients to all the categories are insignificant simultaneously.

The multinomial logit model is estimated using PCGive in OxMetrics. Unless otherwise noted we apply a 5% level of significance.

3.2 Testable Hypotheses

We investigate four main hypotheses (H1-H4) that relate to which factors influence the likelihood of the coexceedance variables taking on large values, i.e. showing contagion. The hypotheses relate to geographical effects, asset class effects, volatility effects, and persistence effects. For each hypothesis we use a separate logit model for the four coexceedance variables. By using separate models for each of the four hypothesis we avoid any problems of multicolinearity. Also, it makes the results easier to interpret. However, we might incur problems of omitted variables. We find the latter argument to of less importance.[7]

The fifth hypothesis (H5) relates to asymmetry effects between positive and negative extreme returns. In each case we also investigate whether the influence of the variables upon the coexceedance variables for the new EU states change when the first group of the former Eastern Block countries joined the EU in May 2004 (H6). The hypotheses that we investigate are described in detail below.

3.2.1 H1: Geographical Effects

In correspondence with the gravity law in physics, Rose (2000) proposes to explain the flow of international trade between a pair of countries as being proportional to their economic "mass" (read "income") and inversely proportional to the distance between them. By analogy, the main reasons behind financial crisis transmission from one country to another can be the size of the international capital markets and their geographical location. Geographical proximity and larger market capitalization should increase the likelihood of transmission. From this perspective, one would expect that sharp market movements tend to move from old to new EU member states because of the geographical closeness and economic partnership. However, the US equity market is the largest market worldwide, one can also expect that contagion effects come from the US market. It is worth asking whether these forces have changed after the EU enlargement. One could expect that the link between new and old EU member states has become stronger and that after the financial market integration of new EU member states within the EU zone, new EU members are more responsive to international shocks.

[7] We performed several regressions accommodating all explanatory variables or different combinations of them. This additional analysis essentially suggests that the bias of omitted variables does not hold.

3.2.2 H2: Asset Class Effects

One important reason behind financial crisis transmission across asset classes is an abrupt portfolio re-allocation in times of flight-to-quality (e.g. Caballero and Krishnamurthy (2007)), and these effects can be reinforced by liquidity spirals (Brunnermeier and Pedersen (2007)). These arguments suggest a substitution effect between equities and safer assets such as bonds or money market instruments. Extreme price interdependence between short-term bonds, equities and currencies can arise at unanticipated news announcements and monetary policy decisions. Other sources of transmission especially relevant for emerging markets are currency attacks (Morris and Shin (1998) and Obstfeld (1986)) and unwinding carry trade (Bank for International Settlements (1999)). According to these arguments, we expect that coexceedances in equity markets be connected with large price movements in bond and currency markets.

Additionally, the EU membership may have (1) decreased the currency risk premium and (2) increased the degree of equity return correlation within new member states and between them and old member states. As pointed out by Adjaouté and Danthine (2003), these effects may be intensified by a higher integration of capital markets and a reduction of "home bias".

3.2.3 H3: Volatility Effects

The likelihood of observing a propagation of severe price movements across countries depends on market conditions and investors' portfolio characteristics. Propagation is more likely in a highly volatile environment overriding all asset classes. Unhedged or leveraged international allocations may also increase contagion. Schinasi and Smith (2001) show that even in an efficient and frictionless setting, spillover effects can emerge on the basis of optimal portfolio decisions taken by leveraged investors as a simple rebalancing response. The hypothesis to test is whether coexceedances are more likely to occur when volatility is pervasively high in all financial markets. The volatility on EURIBOR interest rates deserves an aside consideration. It is the rate at which euro interbank term deposits within the euro zone are offered by one prime bank to another prime bank and it is highly influenced by the ongoing monetary policy stance. In times of a well-defined phase of monetary stance, either accommodating or restrictive, the absolute value of the first difference of EURIBOR rates should be larger. This would imply a negative relation between volatility in EURIBOR rate changes and uncertainty on monetary policy, and possibly a lower degree of coexceedances.

Increased trade is one of the few undisputed gains from a currency union.

Substituting a single currency for several national currencies eliminates exchange rate volatility and reduces the transactions costs of trade within that group of countries. The Maastricht criteria imply the convergence of macroeconomic fundamentals which, in turn, should harmonize national asset market behavior.[8] In that sense, we expect that coexceedances in new EU member states are more connected with equity market volatility in the old EU member states after formal EU membership.

3.2.4 H4: Persistence Effects

The mechanism of how coexceedances materialize is uncertain. On the one hand, the overreaction hypothesis in behavioral finance (DeBond and Thaler (1985)) suggests that extreme movements in stock prices are followed by movements in the opposite direction to correct the initial overreaction and that the greater the magnitude of initial price change, the more extreme the offsetting reaction. On the other hand, some empirical studies find that the bid-ask bounce and the degree of market liquidity explain overreaction and short-term price reversals (Cox and Peterson (1994)). Here, we test whether coexceedances follow reversal or continuation patterns. We also test whether coexceedances within new EU countries are more likely to occur at the same time as coexceedances in old EU member states, and whether this link has changed after the EU enlargement.

3.2.5 H5: Asymmetry Effects

Abundant empirical evidence shows that correlation between assets is different in upward and downward markets. Bertero and Mayer (1990) and King and Wadhwani (1990) find evidence of an increase in the correlation of stock returns at the time of the 1987 crash. Also, Calvo, Leiderman and Reinhart (1996) report correlation shifts during the Mexican crisis. Baig and Goldfajn (1999) find significant increases in correlation for several East Asian markets and currencies during the East Asian crisis. Samitas, Kenourgios and Paltalidis (2007) show that during periods of large negative returns, equity market volatilities share stronger linkages. In the same line of reasoning, we expect that there is asymmetry between positive and negative coexceedances. We test the four hypotheses stated above for positive and negative coexceedances separately in order to assess any dissimilarity.

[8] There are four main aspects in the Maastricht Convergence Criteria: inflation, fiscal, interest rates and exchange rates. The inflation and interest rate criteria state that the macroeconomic variables of a country should remain within a given range defined by "the three best performing states". Adjaouté and Danthine (2004) provide empirical evidence on increased synchronization of macroeconomic activities across the euro area.

3.2.6 H6: Changes after Joining the EU

For each hypothesis we test whether the effects for the new EU coexceedance variables have changed after May 1, 2004, the time of the first round of the recent EU enlargement. Notice that we investigate the differences to all the new EU countries irrespective of whether they joined in 2004 or in 2007. Underlying this is the implicit assumption that the changes brought about by the EU membership also incurred in May 2004 for Bulgaria and Romania although they did not join until $2\frac{1}{2}$ years later. When more time has elapsed since January 2007 it will be possible to investigate any differences between the first and second round EU memberships.

4 Empirical Findings

4.1 H1: Geographical Effects

The first analysis asks whether coexceedances are transmitted across geographical areas. The explanatory variables are the US stock return (S_t^{US}), the old European stock return (S_t^{old}), and the new EU stock return (S_t^{new}).[9] For XN_t^{new} the probability of having i negative coexceedances is:

$$P_i = function\left(\beta_{i0} + \beta_{i1} S_t^{new} + \beta_{i2} S_t^{old} + \beta_{i3} S_t^{US}\right) \text{ where } i = 1, 2, 3, 4.$$

The results from the multinomial logit regressions with those three covariates (plus constant) are shown in Table 2. The left-most part of the table concerns the situation where the negative coexceedance variable for the new EU is the explained variable, in the second part the positive coexceedance variable for the new EU is the explained variable, and in the third and fourth parts the negative and positive coexceedances for old EU are the explained variables. The structure within each part of the table is identical. The first two columns show the parameter estimates and their standard deviations in parentheses. In the third column */**/*** indicate the significance of the parameter at a 10%/5%/1% level of significance. In the fourth column, it is marked by &/&&/&&& when the explanatory variable is overall significant at the 10%/5%/1% level of significance. We investigate whether the dependence structure of the coexceedance variables for the new EU member states has changed after May 2004. We include an intercept dummy as well as interaction dummies for all three variables, where the dummy equals unity after May 1, 2004 and zero before. The estimates are not tabulated, but the significance level (10%/5%/1%) of the dummy

[9] We also considered the Japan market as an additional region in the gravity framework. Its relevance is barely discernable.

variables is indicated by #/##/### in the right-most column in the first two parts of the table, i.e. in the regressions concerning the new EU.

For the negative coexceedances both for the new and old EU (XN_t^{new} and XN_t^{old}) we find that stock returns from all three regions are significant in explaining the number of negative coexceedances, that is from western Europe, eastern Europe, and the US. The positive coexceedances for the new EU (XP_t^{new}) is only influenced by its own stock market (S_t^{new}). The positive coexceedance for the old EU (XP_t^{old}) is influenced by both its own stock return and the US stock return supporting the "gravity" hypothesis, cf. Rose (2000). In general, for the negative coexceedance variables the influence from the stock returns is negative, so that when stock returns are small, negative coexceedance is more probable. The opposite applies for the positive coexceedance case.

For the negative coexceedance variable for the new EU member states only the level has changed whereas the dependence of neither of the explained variables has changed (neither individually nor jointly). The probability of coexceedance has decreased after May 2004. Exactly the same applies to the positive coexceedance variable for the new EU member states. The result is somewhat surprising as we would have expected increased dependence on the western European stock markets and higher synchronism among new member states. However, it is arguable whether the prospect of a common currency is synonymous with financial market integration and how long time is needed to achieve it. Interestingly, Rogers (2007) shows that most of the substantial reduction in the dispersion of traded-goods prices across European cities occurred between 1990 and 1994, i.e. the period of the "single market" initiative, rather than after the introduction of euro. In the same line of reasoning, it is possible that interdependence between new and old member states was in progress long before the formal enlargement in 2004 and that the convergence to the Maastricht criteria had some effects before the formal adhesion date.

4.2 H2: Asset Class Effects

Now we ask whether coexceedances spill over across different assets types. The explanatory variables are currency return (C_t), interest rate (R_t), and the old European stock return (S_t^{old}). For XN_t^{new} the probability of having i negative coexceedances is:

$P_i = function\left(\beta_{i0} + \beta_{i1}C_t + \beta_{i2}R_t + \beta_{i3}S_t^{old}\right)$ where $i = 1, 2, 3, 4$.

The results are given in Table 3. The table is structured as Table 2.[10]

[10] We are aware that some new EU members have relatively developed bond markets, e.g. Poland and Czech Republic. However, the limited number of these countries and their short

The results are robust to using the yield to maturity of the German 10-year government bond index in place of the EURIBOR interest rates (results not tabulated). So the results do not depend on whether we use a short term interest rate or a long term interest rate.

For the negative coexceedance variable for the new EU member states only the stock market has significant influence. The effect is negative as also found when investigating the geographical effects. For the positive coexceedance variable for the new EU member states both the currency return and the stock return have a significant and positive influence. For the stock market this result is in accordance with the findings regarding geographical effects. In neither case for the new EU is the interest rate of importance.

For the old EU member states the negative coexceedance variable is influenced by the currency return and the stock return, in both cases a negative influence. For the positive coexceedance variable for the old EU all three variables are significant, a negative influence from the interest rate and a positive influence from the currency return and the stock return. The signs of the interest rate coefficients are in line with the discounted value approach, that is an equity asset value decreases as its discounted factor increases. The relation between coexceedance and currency movements can be interpreted in the light of the standard models involving a central bank reaction function having a preference for low inflation. In this view, a more tightening monetary policy is the response to some inflation concern that, in turn, appreciates the euro and it overall dampens equity prices.

The fact that asset classes appear more highly interconnected in old than new EU member states can be explained by a stronger market integration in developed markets or, conversely, some market segmentation among investment categories in new EU member states.

For the negative coexceedance variable for the new EU the influence of the currency return changed after May 2004, when the influence became stronger (more negative). The same applies to the stock return. Also the level decreased after May 2004. For the positive coexceedance variable for the new EU only the level changed after May 2004, when it decreased. At least for negative coexceedances, this could be interpreted as an effect of the inclusion in the EU. If the euro appreciates in response to a tighter monetary policy, this would increase the likelihood of equity price falls in new EU member states after 2004 being all simultaneously affected by the euro's fortune. This reaction would be even more intense because of the Balassa-Samuelson effect, where inflation

lifetime do not allow a comprehensive analysis.

risk is higher for new EU states. On the other hand, it is worth emphasizing that in the euro-zone there were two distinct monetary policy phases before and after 2004. The former (latter) period was characterized by an expansionary (restrictive) stance. In that sense, it is more likely to observe equity price drops as euro appreciates after 2004.

4.3 H3: Volatility Effects

We investigate whether volatility factors can explain the occurrence of simultaneous very large or very small returns. We apply both currency, interest rate, and stock market volatility as explanatory variables: σ_t^C, σ_t^R, and σ_t^{old}. For XN_t^{new} the probability of having i negative coexceedances is:

$P_i = function\left(\beta_{i0} + \beta_{i1}\sigma_t^C + \beta_{i2}\sigma_t^R + \beta_{i3}\sigma_t^{old}\right)$ where $i = 1, 2, 3, 4$.

The results are given in Table 4. The table is structured as Table 2.

We also investigate this hypothesis using the volatility from the yield from the German 10-year government index calculated as for the EURIBOR volatility (results not tabulated). The results are consistent with what we find using the ERIBOR volatility.

For the negative coexceedance variable for the new EU member states we find that the stock market volatility acts as expected, i.e. the likelihood of coexceedance increases in highly volatile environments, whereas the currency volatility is insignificant. For the positive coexceedance variable for the new EU member states we find that all three volatility factors are of significance. The influence from stock volatility and currency volatility is mainly positive as expected. The new EU coexceedances (both positive and negative) depend negatively on the interest rate volatility, so that the more volatile the short rate is, the less likely is the occurrence of coexceedances. This result supports the idea that a larger change in EURIBOR rates is a sign of well-defined phase of monetary stance and, in turn, it stands for less uncertainty coming from monetary policy.

For the old EU member states the results are identical to those of the new EU countries except that the positive coexceedance variable does not depend on the currency volatility.

For the negative coexceedance variable for the new EU the probabilities have changed after May 2004. The level has become smaller, such that negative coexceedances have become less likely. Also, the dependence on the stock volatility has increased. In contrast, for the positive coexceedance variable for the new EU member states, the dependence structure on the volatilities has not changed after May 2004. These findings can partially be explained by the equity bull

phase coupled with low volatility in recent years. An additional explanation is that the new EU countries' equity markets have become more connected with old EU equity markets.

4.4 H4: Persistence Effects

We test whether the coexceedances are influenced by coexceedances of the same type in the other European markets and whether the coexceedances are autoregressive. So for the negative coexceedance variable for the new EU member states (XN_t^{new}) the explanatory variables are XN_{t-1}^{new} and XN_t^{old}. For XN_t^{new} the probability of having i negative coexceedances is:

$P_i = function\left(\beta_{i0} + \beta_{i1} XN_{t-1}^{new} + \beta_{i2} XN_t^{old}\right)$ where $i = 1, 2, 3, 4$.

For all four regressions both explanatory variables are significant and the influence is positive. So, the more extreme negative returns we have on the old EU markets, the more likely it is to have many extreme negative returns on the new EU markets. Moreover, the number of extreme negative returns today is positively dependent on the number of extreme negative returns yesterday supporting the "continuation" rather than the "reversal" hypothesis. A similar interpretation applies to the other markets. The results are given in Table 5. The table is structured as Table 2.

For the negative coexceedance variable for the new EU, the dependence on the old EU has become stronger after May 2004. It appears that nothing happens to the positive coexceedance variable for the new EU.[11]

We also considered other possible combinations such as adding positive coexceedances for the old EU markets (XP_t^{old}) to the equation for XN_t^{new}. This opposite market movements would be reasonable in the light of flight to quality effects when investors flee away from emerging markets to safer and more liquid markets in times of stress. The results do not support this idea, in that XP_t^{old} is insignificant whereas XN_t^{old} remains significant.

4.5 H5: Asymmetry Effects

The separate analysis of joint price drops and price jumps suggests that there are significant differences between negative and positive coexceedances. In general, negative coexceedances appear to be more dependent on the international dynamics of stock markets. In contrast, positive coexceedances appear to be more responsive to other asset classes, in particular with respect to the currency movements both in terms of returns and volatility. Instead, the way positive and

[11] We do not include the term XP_t^{old} multiplied by the May 2004 dummy, since we then get a singular matrix.

negative coexceedances materialize in terms of persistence and interconnection between old and new EU member states is similar.

4.6 H6: Changes after Joining the EU

While discussing the results for H1-H4 we have also discussed the last hypothesis that states that there were changes after the first set of countries formally joined the EU in May 2004.[12] We have found that many significant changes take place after May 2004. To sum up, coexceedances in new EU markets increased after May 2004 and negative coexceedances appear more connected to euro fluctuations and to stock market movements in the old EU zone.

5 Conclusion

We use the coexceedance methodology of Bae et al. (2003) to investigate the contagion between the stock markets in the 10 new EU member states from the former Communist countries in Eastern and Central Europe. The negative coexceedance variable for the new EU counts the number of extreme returns (below 5 percentile) across the new EU countries on a given day. The positive coexceedance variable for the new EU (above 95 percentile) and the negative and positive coexceedance variables for the new EU are constructed analogously. Using the multivariate logit model, we investigate which factors influence the coexceedance variables. We investigate four hypotheses separately, namely regarding geographical effects, asset class effects, volatility effects, and persistence effects. The factors differ for the positive and negative coexceedance variables.

For the new EU member states we find that there are significant global linkages, especially for negative coexceedances. As for asset classes, the stock coexceedances hold main dependence on stock market. We find volatility effects. The new EU show asymmetry effects in that the influential factors differ across negative and positive coexceedance variables. The coexceedance variables for the new EU are persistent and they cross depend on the relevant coexceedance variable for the old EU. The influence of many of the factors changed after the EU enlargement in May 2004.

The factors that influence the coexceedance variables differ for the old and new EU stock markets. For the old EU member states we find that there is a stronger interdependence among asset classes which might indicate that the

[12] In the same way as for the new EU countries, we applied the dummy variables to old EU countries in order to capture if there is a significant difference before and after May 2004. The main findings show that despite a slight change in levels, all the interaction dummies are not significant.

capital markets in the old EU are more integrated than in the new EU. We find that the coexceedance variables for the old EU is persistent and that it cross depends on the relevant coexceedance variable for the new EU. So the cross dependence structure goes both ways, i.e. from old to new EU and from new to old EU.

In future research it would be interesting to extend this method to analyze coexceedance in other asset classes such as bonds, individual stocks, and hedge funds, as well as in times of crucial changes of market conditions or monetary regimes.

References

Adjaouté, K. and Danthine, J.-P.: 2003, European Financial Integration and Equity Returns: A Theory-Based Assessment, *in* V. Gaspar, P. Hartmann and O. Sleijpen (eds), *The Transformation of the European Financial System*, European Central Bank, Frankfurt, Germany, pp. 185–245.

Adjaouté, K. and Danthine, J.-P.: 2004, Equity Returns and Integration: Is Europe Changing?, *Oxford Review of Economic Policy* **20**(4), 555–570.

Bae, K.-H., Karolyi, G. A. and Stulz, R. M.: 2003, A New Approach to Measuring Financial Contagion, *Review of Financial Studies* **16**(3), 717–763.

Baig, T. and Goldfajn, I.: 1999, Financial Market Contagion in the Asian Crisis, *IMF Staff Papers* **46**(2).

Bank for International Settlements: 1999, *International Banking and Financial Market Developments*, BIS Quarterly Review.

Bertero, E. and Mayer, C.: 1990, Structure and Performance: Global Interdependence of Stock Markets around the Crash of October 1987, *European Economic Review* **34**(6), 1155–80.

Boyer, B. H., Gibson, M. and Loretan, M.: 1999, Pitfalls in Tests for Changes in Correlation, *Working paper*, Board of Governors of the Federal Reserve System.

Brunnermeier, M. K. and Pedersen, L. H.: 2007, Market Liquidity and Funding Liquidity, *Working Paper 12939*, National Bureau of Economic Research.

Caballero, R. J. and Krishnamurthy, A.: 2007, Collective Risk Management in a Flight to Quality Episode, *Working Paper 12896*, National Bureau of Economic Research.

Calvo, G. A., Leiderman, L. and Reinhart, C. M.: 1996, Inflows of Capital to Developing Countries in the 1990s, *Journal of Economic Perspectives* **10**, 123–39.

Cappiello, L., Gérard, B., Kadareja, A. and Manganelli, S.: 2006, Financial Integration of New EU Member States, *Working Paper*, European Central Bank.

Chan-Lau, J. A., Methieson, D. J. and Yao, J. Y.: 2004, Extreme Contagion in Equity Markets, *Working Paper*, International Monetary Fund.

Cox, D. R. and Peterson, D. R.: 1994, Stock Returns Following Large One-Day Declines: Evidence on Short-Term Reversals and Longer-Term Performance, *Journal of Finance* **49**(1), 255–67.

Cumperayot, P., Keijzer, T. and Kouwenberg, R.: 2006, Linkages between Extreme Stock Market and Currency Returns, *Journal of International Money and Finance* **25**, 528–550.

DeBond, W. F. M. and Thaler, R. H.: 1985, Does the Stock Market Overreact?, *Journal of Finance* **40**(3), 793–805.

Dovak, T.: 2007, Are the New and Old EU Countries Financially Integrated, *Journal of European Integration* **29**.

Dovak, T. and Podpiera, R.: 2006, European Union Enlargement and Equity Markets in Accession Countries, *Emerging Markets Review* **7**, 129–146.

Fazio, G.: forthcoming, Extreme Interdependence and Extreme Contagion Between Emergin Markets, *Journal of International Money and Finance* .

Forbes, K. and Rigobon, R.: 2002, No Contagion, Only Interdependence: Measuring Stock Market Comovements, *Journal of Finance* **57**, 2223–2262.

Hartmann, P., Straetmans, S. and de Vries, C. G.: 2004, Asset Market Linkages in Crisis Periods, *Review of Economics and Statistics* **86**(1), 313–326.

King, M. A. and Wadhwani, S.: 1990, Transmission of Volatility between Stock Markets, *Review of Financial Studies* **3**(1), 5–33.

Moore, T. and Wang, P.: 2007, Volatility in Stock Returns for New EU Member States: Markow Regime Switching Model, *International Review of Financial Analysis* **16**, 282–292.

Morris, S. and Shin, H. S.: 1998, Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks, *American Economic Review* **88**(3), 587–97.

Mundell, R. A.: 1961, A Theory of Optimum Currency Areas, *American Economic Review* **51**(4), 657–665.

Obstfeld, M.: 1986, Rational and Self-Fulfilling Balance-of-Payments Crises, *American Economic Review* **76**, 72–81.

Rogers, J. H.: 2007, Monetary Union, Price Level Convergence, and Inflation: How Close is Europe to the USA?, *Journal of Monetary Economics* **54**(3), 785–796.

Rose, A. K.: 2000, One Money, One Market? The Effects of Common Currencies on International Trade, *Economic Policy* **15**, 7–46.

Samitas, A., Kenourgios, D. and Paltalidis, N.: 2007, Financial Crises and Stock Market Dependence, *Working paper*, EFMA Annual Meeting.

Schinasi, G. J. and Smith, R.: 2001, Portfolio Diversification, Leverage, and Financial Contagion, *in* S. Claessens and K. Forbes (eds), *International Financial Contagion*, Kluwer Academic Publishers, Boston MA, pp. 187–223.

Table 1: Summary Statistics

	Number of Coexceedances				
	0	1	2	3	4+
Positive Coexceedances					
New EU East	1090 (64%)	429 (25%)	133 (8%)	50 (3%)	8 (0.5%)
Old EU	1296 (76%)	206 (12%)	56 (3%)	27 (2%)	125 (7%)
Negative Coexceedances					
New EU East	1130 (66%)	369 (22%)	123 (7%)	44 (3%)	44 (3%)
Old EU	1320 (77%)	176 (10%)	48 (3%)	28 (2%)	138 (8%)

Table 2: Geographical Effects

	New EU										Old EU									
	Negative Coexceedances					Positive Coexceedances					Negative Coexceedances					Positive Coexceedances				
Constant(1)	-1.10	(0.06)	***	&&&	###	-1.00	(0.06)	***	&&&	###	-2.02	(0.08)	***	&&&		-1.85	(0.08)	***	&&&	
Constant(2)	-2.24	(0.10)	***			-2.28	(0.11)	***			-3.63	(0.19)	***			-3.40	(0.17)	***		
Constant(3)	-3.63	(0.20)	***			-3.91	(0.23)	***			-4.20	(0.25)	***			-4.41	(0.27)	***		
Constant(4)	-4.09	(0.24)	***			-6.17	(0.60)	***			-3.13	(0.15)	***			-3.34	(0.16)	***		
$S^{new}(1)$	-0.28	(0.06)	***	&&&	#	0.34	(0.06)	***	&&&		-0.19	(0.08)	**	&&&		0.05	(0.08)			
$S^{new}(2)$	-0.52	(0.10)	***			0.68	(0.10)	***			-0.59	(0.13)	***			0.21	(0.13)			
$S^{new}(3)$	-0.74	(0.15)	***			1.32	(0.16)	***			-0.48	(0.17)	***			-0.02	(0.19)			
$S^{new}(4)$	-1.18	(0.15)	***			1.57	(0.30)	***			-0.20	(0.10)	**			0.12	(0.10)			
$S^{old}(1)$	-0.06	(0.08)		&&&		0.06	(0.07)				-0.60	(0.11)	***	&&&		0.31	(0.10)	***	&&&	
$S^{old}(2)$	-0.21	(0.12)	*			0.11	(0.12)				-0.76	(0.19)	***			0.62	(0.20)	***		
$S^{old}(3)$	-0.50	(0.17)	***			-0.32	(0.20)				-0.95	(0.24)	***			1.45	(0.25)	***		
$S^{old}(4)$	-0.59	(0.16)	***			-0.01	(0.41)				-1.64	(0.14)	***			1.69	(0.15)	***		
$S^{US}(1)$	-0.16	(0.07)	**	&&		-0.11	(0.07)				-0.15	(0.09)		&&&		0.10	(0.09)		&&&	
$S^{US}(2)$	0.06	(0.11)				0.02	(0.10)				-0.32	(0.15)	**			0.44	(0.15)	***		
$S^{US}(3)$	-0.20	(0.16)				-0.06	(0.17)				-0.31	(0.19)				0.09	(0.20)			
$S^{US}(4)$	0.21	(0.15)				0.03	(0.30)				-0.40	(0.11)	***			0.32	(0.11)	***		
Pseudo R-square	0.07					0.05					0.16					0.11				
Chi-square	226.2***					170.9***					434.1***					321.3***				

The table shows the parameter estimates arising from estimating the multinomial logit model for the negative coexceedance variable for the new EU (first part of the table), the positive coexceedance variable for the new EU (second part of the table), the negative coexceedances for the old EU (third part of the table), and the positive coexceedances for the old EU (fourth part of the table). Standard errors in parentheses. */**/*** indicate that the parameter is significantly different from zero at 10%/5%/1% level. &/&&/&&& indicate that the explanatory variable is significant at 10%/5%/1% level. #/##/### indicate that the parameter is significantly different after May 2004 at 10%, 5%, and 1% level.

Table 3: Asset Class Effects

	New EU									Old U								
	Negative Coexceedances					Positive Coexceedances					Negative Coexceedances					Positive Coexceedances				
Constant(1)	-1.11	(0.06)	***	&&&	###	-0.98	(0.06)	***	&&&	###	-2.03	(0.08)	***	&&&		-1.84	(0.08)	***	&&&	
Constant(2)	-2.23	(0.10)	***			-2.17	(0.10)	***			-3.60	(0.18)	***			-3.40	(0.17)	***		
Constant(3)	-3.51	(0.18)	***			-3.25	(0.16)	***			-4.23	(0.25)	***			-4.46	(0.28)	***		
Constant(4)	-3.64	(0.20)	***			-5.36	(0.46)	***			-3.22	(0.15)				-3.46	(0.17)	***		
C(1)	-0.18	(0.11)	*		###	-0.02	(0.10)		&&&		-0.36	(0.15)	**	&&&		0.17	(0.14)			&&&
C(2)	-0.05	(0.17)				0.49	(0.16)	***			-0.97	(0.26)	***			0.96	(0.24)	***		
C(3)	-0.23	(0.26)				-0.19	(0.27)				-0.82	(0.34)	**			0.76	(0.34)	**		
C(4)	-0.08	(0.26)				1.28	(0.55)	**			-1.16	(0.19)	***			1.19	(0.19)	***		
R(1)	0.00	(1.18)				0.29	(1.11)				0.46	(1.71)				2.27	(1.34)	*		&&&
R(2)	-1.50	(1.75)				-2.56	(1.63)				-2.36	(2.43)				-1.61	(3.03)			
R(3)	-2.59	(2.24)				-0.70	(2.91)				-5.09	(2.02)	**			-1.32	(3.68)			
R(4)	0.81	(3.26)				1.53	(5.63)				-1.57	(1.92)				-5.91	(1.94)	***		
$S^{old}(1)$	-0.28	(0.07)	***	&&&	###	0.15	(0.06)	**	&&&	#	-0.83	(0.11)	***	&&&		0.40	(0.10)	***		&&&
$S^{old}(2)$	-0.40	(0.10)	***			0.47	(0.10)	***			-1.38	(0.18)	***			1.16	(0.19)	***		
$S^{old}(3)$	-0.94	(0.14)	***			0.21	(0.17)				-1.46	(0.22)	***			1.67	(0.24)	***		
$S^{old}(4)$	-1.08	(0.13)	***			0.82	(0.30)	***			-2.09	(0.14)	***			2.15	(0.16)	***		
Pseudo R-square	0.03					0.01					0.16					0.13				
Chi-square	110.3***					44.7***					445.4***					364.0***				

The table shows the parameter estimates arising from estimating the multinomial logit model for the negative coexceedance variable for the new EU (first part of the table), the positive coexceedance variable for the new EU (second part of the table), the negative coexceedances for the old EU (third part of the table), and the positive coexceedances for the old EU (fourth part of the table). Standard errors in parentheses. */**/*** indicate that the parameter is significantly different from zero at 10%/5%/1% level. &/&&/&&& indicate that the explanatory variable is significant at 10%/5%/1% level. #/##/### indicate that the parameter is significantly different after May 2004 at 10%/5%/1% level.

Table 4: Volatility Effects

	New EU								Old U							
	Negative Coexceedances				Positive Coexceedances				Negative Coexceedances				Positive Coexceedances			
Constant(1)	-1.54	(0.45) ***	&&&	##	0.14	(0.44)	&&&		-3.07	(0.61) ***	&&&		-2.88	(0.57) ***	&&&	
Constant(2)	-4.52	(0.71) ***			-2.00	(0.67) ***			-5.29	(1.14) ***			-4.67	(1.01) ***		
Constant(3)	-5.84	(1.14) ***			-4.44	(1.14) ***			-6.31	(1.41) ***			-7.33	(1.51) ***		
Constant(4)	-5.70	(1.17) ***			-9.27	(2.79) ***			-4.38	(0.69) ***			-3.84	(0.71) ***		
$\sigma^{C}(1)$	0.19	(0.70)	&		-2.21	(0.69) ***	&&		0.79	(0.91)			0.78	(0.87)		
$\sigma^{C}(2)$	2.78	(1.06) ***			-1.01	(1.04)			3.60	(1.52) **			1.50	(1.53)		
$\sigma^{C}(3)$	2.56	(1.73)			1.65	(1.69)			1.51	(2.15)			3.82	(2.09) *		
$\sigma^{C}(4)$	0.61	(1.88)			2.95	(4.28)			0.65	(1.04)			-0.58	(1.10)		
$\sigma^{R}(1)$	-4.32	(1.84) **	&&		-4.30	(1.56) ***	&&&		-10.44	(3.56) ***	&&&		-1.94	(2.18)		&&
$\sigma^{R}(2)$	-2.39	(3.31)			-8.66	(3.37) **			-46.55	(17.90) ***			-3.57	(4.63)		
$\sigma^{R}(3)$	1.71	(4.31)			-7.60	(6.62)			-3.65	(6.78)			-21.10	(16.96)		
$\sigma^{R}(4)$	5.82	(3.32) *			9.85	(7.73)			-10.82	(4.37) **			-14.21	(5.08) ***		
$\sigma^{old}(1)$	0.49	(0.18) ***	&&&	##	0.33	(0.17) *	&&&	#	0.94	(0.23) ***	&&&		0.71	(0.22) ***	&&&	
$\sigma^{old}(2)$	0.77	(0.25) ***			0.81	(0.23) ***			0.67	(0.41) *			0.82	(0.37) **		
$\sigma^{old}(3)$	1.07	(0.36) ***			0.47	(0.40)			1.72	(0.42) ***			1.55	(0.42) ***		
$\sigma^{old}(4)$	1.85	(0.33) ***			2.05	(0.67) ***			2.00	(0.21) ***			2.14	(0.22) ***		
Pseudo R-square	0.02				0.02				0.07				0.06			
Chi-square	77.5**				51.8***				197.7***				161.5***			

The table shows the parameter estimates arising from estimating the multinomial logit model for the negative coexceedance variable for the new EU (first part of the table), the positive coexceedance variable for the new EU (second part of the table), the negative coexceedances for the old EU (third part of the table), and the positive coexceedances for the old EU (fourth part of the table). Standard errors in parentheses. */**/*** indicate that the parameter is significantly different from zero at 10%/5%/1% level. &/&&/&&& indicate that the explanatory variable is significant at 10%/5%/1% level. #/##/### indicate that the parameter is significantly different after May 2004 at 10%/5%/1% level.

Table 5: Persistence Effects

	New EU									Old U								
	Negative Coexceedances					Positive Coexceedances					Negative Coexceedances					Positive Coexceedances				
Constant(1)	-1.41	(0.08)	***	&&&		-1.12	(0.07)	***	&&&	##	-2.34	(0.10)	***	&&&		-2.11	(0.10)	***	&&&	
Constant(2)	-2.64	(0.13)	***			-2.58	(0.13)	***			-4.04	(0.21)	***			-3.61	(0.19)	***		
Constant(3)	-4.75	(0.29)	***			-4.12	(0.25)	***			-4.38	(0.26)	***			-4.38	(0.28)	***		
Constant(4)	-4.94	(0.31)	***			-5.06	(0.47)	***			-3.42	(0.15)	***			-2.78	(0.13)	***		
Own Lagged(1)	0.27	(0.07)	***	&&&		0.17	(0.07)	**	&&&		0.15	(0.07)	**	&&&		0.25	(0.06)	***	&&&	
Own Lagged(2)	0.35	(0.09)	***			0.45	(0.10)	***			0.31	(0.10)	***			0.31	(0.10)	***		
Own Lagged(3)	0.71	(0.13)	***			0.80	(0.14)	***			0.29	(0.13)	**			0.39	(0.13)	***		
Own Lagged(4)	0.69	(0.13)	***			-0.12	(0.53)				0.39	(0.06)	***			0.26	(0.07)	***		
Opposite(1)	0.33	(0.05)	***	&&&	##	0.12	(0.05)	**	&&&	NA	0.47	(0.09)	***	&&&		0.24	(0.09)	***	&&&	
Opposite(2)	0.42	(0.07)	***			0.36	(0.07)	***			0.76	(0.12)	***			0.45	(0.14)	***		
Opposite(3)	0.89	(0.09)	***			0.43	(0.10)	***			0.57	(0.18)	***			0.40	(0.21)	**		
Opposite(4)	0.97	(0.10)	***			0.29	(0.25)				0.99	(0.08)	***			0.47	(0.10)	***		
Pseudo R-square	0.08					0.02					0.09					0.02				
Chi-square	262.9***					75.5***					254.6***					70.8***				

The table shows the parameter estimates arising from estimating the multinomial logit model for the negative coexceedance variable for the new EU (first part of the table), the positive coexceedance variable for the new EU (second part of the table), the negative coexceedances for the old EU (third part of the table), and the positive coexceedances for the old EU (fourth part of the table). Standard errors in parentheses. */**/*** indicate that the parameter is significantly different from zero at 10%/5%/1% level. &/&&/&&& indicate that the explanatory variable is significant at 10%/5%/1% level. #/##/### indicate that the parameter is significantly different after May 2004 at 10%/5%/1% level.

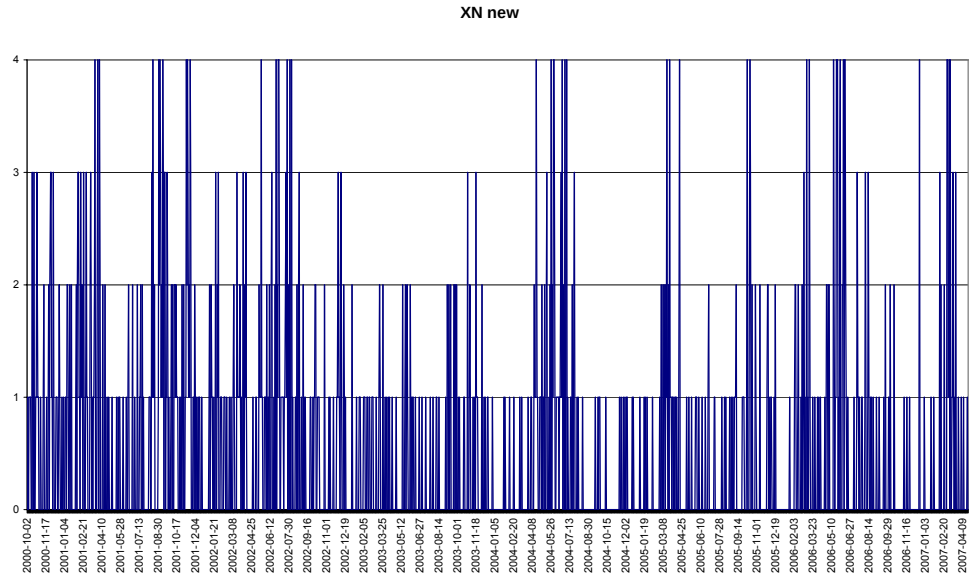

Figure 1: Time Series Plot of the Negative Coexceedance Variable for the New EU

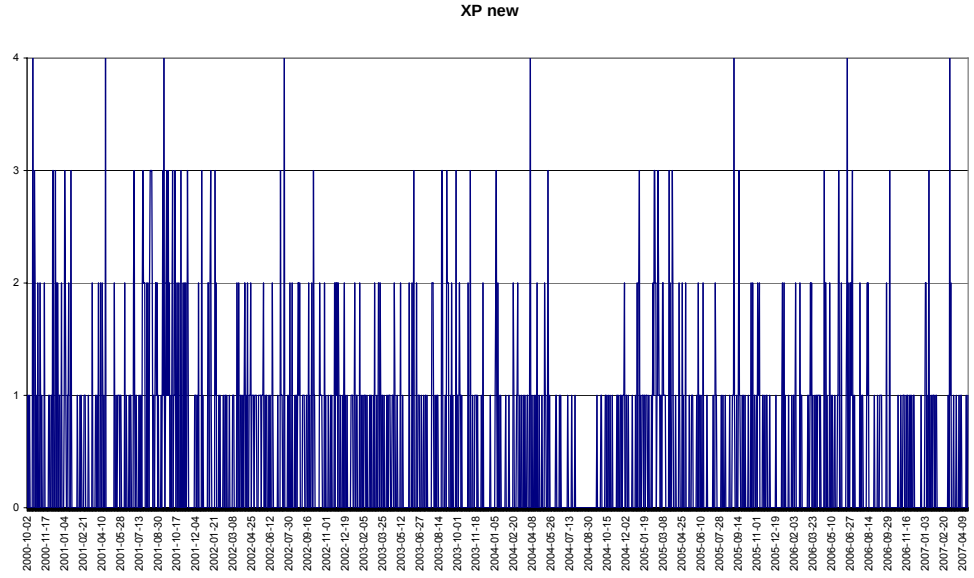

Figure 2: Time Series Plot of the Positive Coexceedance Variable for the New EU

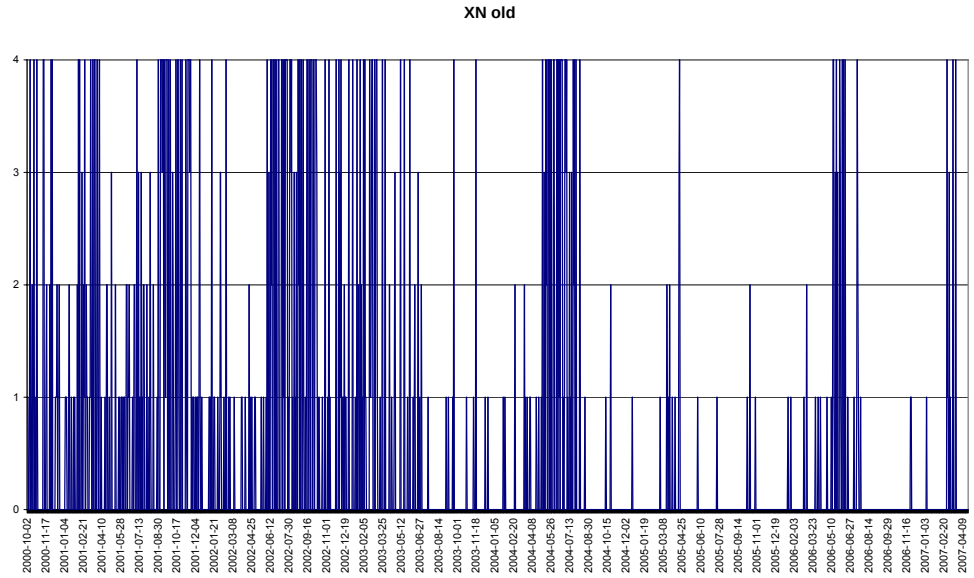

Figure 3: Time Series Plot of the Negative Coexceedance Variable for the Old EU

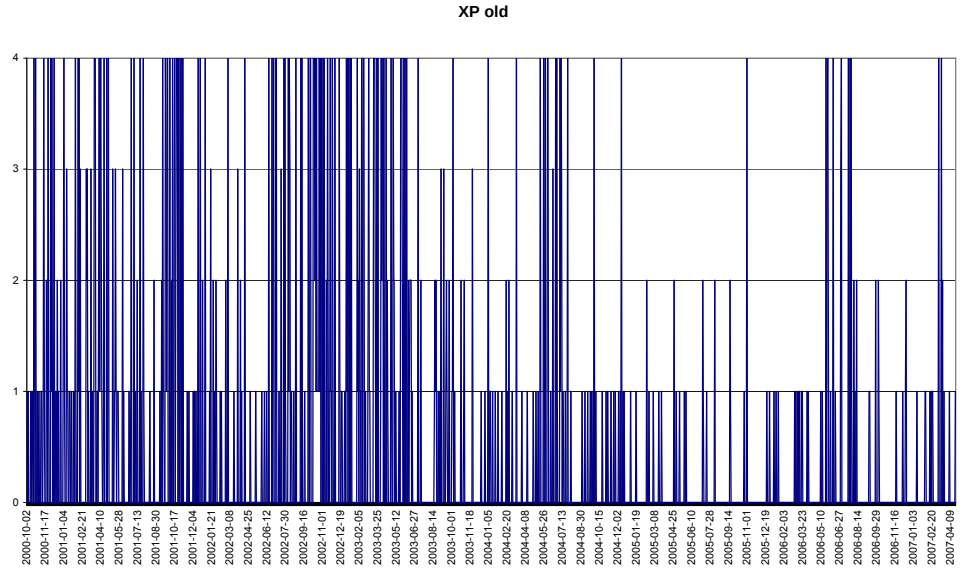

Figure 4: Time Series Plot of the Positive Coexceedance Variable for the Old EU

Research Papers 2007

2007-22 Tim Bollerslev, Uta Kretschmer, Christian Pigorsch and George Tauchen: A Discrete-Time Model for Daily S&P500 Returns and Realized Variations: Jumps and Leverage Effects

2007-23 Olaf Posch: Structural estimation of jump-diffusion processes in macroeconomics

2007-24 Torben G. Andersen and Oleg Bondarenko: Construction and Interpretation of Model-Free Implied Volatility

2007-25 Torben G. Andersen and Luca Benzoni: Do Bonds Span Volatility Risk in the U.S. Treasury Market? A Specification Test for Affine Term Structure Models

2007-26: Mark Podolskij and Daniel Ziggel: A Range-Based Test for the Parametric Form of the Volatility in Diffusion Models

2007-27: Mark Podolskij and Mathias Vetter: Estimation of Volatility Functionals in the Simultaneous Presence of Microstructure Noise and Jump

2007-28: Julie Lyng Forman and Michael Sørensen: The Pearson diffusions: A class of statistically tractable diffusion processes

2007-29 Niels Haldrup, Frank S. Nielsen and Morten Ørregaard Nielsen: A Vector Autoregressive Model for Electricity Prices Subject to Long Memory and Regime Switching

2007-30 Bent Jesper Christensen, Thomas Elgaard Jensen and Rune Mølgaard: Market Power in Power Markets: Evidence from Forward Prices of Electricity

2007-31 Tom Engsted, Stuart Hyde and Stig V. Møller: Habit Formation, Surplus Consumption and Return Predictability: International Evidence

2007-32 Søren Johansen: Some identification problems in the cointegrated vector autoregressive model

2007-33 Søren Johansen and Morten Ørregaard Nielsen: Likelihood inference for a nonstationary fractional autoregressive model

2007-34 Charlotte Christiansen and Angelo Ranaldo: Extreme Coexceedances in New EU Member States' Stock Markets