Transition, the Evolution of Stock Market Efficiency and entry into EU: the case of Romania

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Abstract

In this paper we demonstrate that the measurement of stock market efficiency is an important activity in establishing whether eastern European countries satisfy the Copenhagen Criteria for EU membership. Specifically, we argue that developing an efficient stock market should be an important policy focus for countries with aspirations to join the EU as it helps to demonstrate the existence of a functioning market economy. We illustrate this issue by examining the evolution of stock market efficiency in the Bucharest Stock Exchange from its inception until September 2002. We use a GARCH model on daily price data and model the disturbances using the Student-t distribution to allow for 'fat-tails'. We find strong evidence of inefficiency in the Bucharest Stock Exchange in that the lagged stock price index is a significant predictor of the current price index. This result is robust to the inclusion of variables controlling for calendar effects of the sort that have been observed in more developed stock markets. The level of inefficiency appears to diminish over time and we find evidence consistent with stock market efficiency in Romania after January 2000.

JEL Classifications: G14; P34.

Key words: transition; stock market efficiency

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1. Introduction

The process of EU enlargement is now well under way and of the thirteen countries that have applied for membership of the EU, ten are transition economies from central and Eastern Europe.[2] Prospective entrants to the EU must satisfy criteria agreed by the EC Council in Copenhagen in June 1993. Among other things, the Copenhagen Criteria stipulates that membership of the Union requires:

- the existence of a functioning market economy;
- the capacity to cope with competitive pressure and market forces within the Union.

There is evidence that establishing appropriate financial and economic institutions is an important feature of successful transition from a centrally planned to a market economy (Young and Reynolds, 1995; EBRD 1998; Ibrahim and Galt, 2002). Well-functioning financial markets are vital to a thriving economy because these markets facilitate price discovery, risk hedging and the allocation of capital to its most efficient use. Because firms require equity as well as debt funds, capital markets play an important role in this process. Mendelson and Peake (1993) have argued that in market economies the availability of true equity prices is important for the establishment of appropriate hurdle rates for capital expenditures, and to provide investors with the confidence that they are not being cheated. They further argue that in transition economies, the sooner sound equity markets can be

[1] We would like to thank Victor Koznovski, Head of the Research and Development Department at the BSE for assistance in providing the data for this paper. We would also like to thank Wojtec Charemza, Kevin Dowd and Eric Pentecost for many useful comments and suggestions.

[2] These are Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

established, the sooner there will be sound benchmarks for enterprises to be privatised. The clear implication is that a functioning market economy requires an efficient capital market .[3]

This view is endorsed by the EBRD (1998) which has argued that "Markets tend to provide for an efficient allocation of resources when information about the goods or services being exchanged is widely available and reliable, when entry into the market by alternative providers is free, and when the exchange is not dependent upon an ongoing relationship between buyer and seller. Assuming that these preconditions are met, a securities market, like any other market, can deliver an efficient allocation of resources" (pp101). Dickinson and Muragu (1994) provide evidence of this in the case of Nigeria.

A large number of studies have examined stock market efficiency in a variety of contexts, usually by testing for deviations in asset prices from a random walk model. Several recent studies have analysed the behaviour of stock markets in emerging economies. However, the majority of these papers have focused on Pacific-rim countries in which industrial and financial development have been progressing in parallel (see for example, Bekaert and Harvey, 1995, 1997; Claessens, Dasgupta and Glenn 1995; Jochum, Kirchgassner and Platek, 1999). Economies that are emerging due to a process of transition represent a particularly interesting case, in that these countries have attempted to develop financial institutions in the context of industrial development that is relatively far advanced (EBRD, 1998). It is therefore important to assess the degree to which markets in these economies are informationally efficient and to record changes in information efficiency over time in order to gauge the prospects for successful transition from plan to market. Furthermore, in appropriate cases, the existence of financial market efficiency provides

[3] See also Levine (1997) who argues that stock markets enhance economic performance by enabling growing companies to raise additional finance at lower cost. Because these companies are less reliant on internal finance, they are able to grow more quickly.

supportive evidence of a functioning market economy and can be used to support the application of those countries seeking to join the process of EU enlargement.

Of all the applicant countries, Romania represents an especially good case study. Prior to the revolution at the end of 1989, the country had been a classic example of a centrally planned economy and no major reforms had been envisaged (Ibrahim, Cooke and Paton, 2002). The Mission Statement for the Bucharest Stock Exchange (BSE) makes the explicit statement that “The role of the Bucharest Stock Exchange is to encourage the development of a liquid and efficient capital market” (Bucharest Stock Exchange, 2001, p.1). Despite this, to date, no work at all has examined stock market efficiency in Romania.

Only a few papers have focused on stock markets in transition economies. For example, Emerson, Hall, and Zalewska-Mitura (1997) examine the efficiency of the markets for four specific shares in Bulgaria, whilst Gordon and Rittenburg (1995) examine the efficient market hypothesis using stock exchange data from Poland. More recently, Gelos and Sahay (2001) examine the correlation between weekly stock returns in transition countries and those in other developing economies. Of most relevance to this paper, Rockinger and Urga (2000) and Rockinger and Urga (2001) examine the efficiency of the Czech, Polish, Hungarian and Russian stock markets, focusing on whether these markets become more efficient and more integrated with better established markets over time. There are many reasons to suppose that the efficiency of capital markets in transition economies will increase over time. In the early days of a newly created market, trading is very thin, there exist only limited disclosure requirements on firms and opportunities for market participation are neither well distributed nor well understood by many potential investors. In these circumstances the actions of market participants are unlikely to accord with the efficient market paradigm. Following Rockinger and Urga (2001), we argue that the evolving efficiency in transition economies cannot be properly examined without an assessment of changes in time varying volatility.

In this paper, we examine the BSE for the presence of a number of different inefficiencies using daily stock market data from November 1997 until September 2002. We focus on the dynamics of efficiency and, in particular, whether there has been a tendency for any observed inefficiency to diminish as the country has developed its application for EU membership. We further extend the literature on the evolution of stock market efficiency by modelling the disturbance term in the GARCH framework using the Student-t distribution to allow for 'fat-tails'.

The rest of the paper is set out as follows: Section 2 provides a brief overview of the nature of transition and of the institutional, organisational and structural aspects of the BSE. In Section 3 we summarise our data. In Section 4, we outline our econometric methodology. We report the results of our efficiency tests in Section 5 and make some concluding remarks in Section 6.

2. The Nature of Transition

The term 'transition' became part of the economic vocabulary in the 1990s to describe the changes taking place in the economies of Central and Eastern Europe following the collapse of the Soviet Union. Transition describes the process of transforming an economy from plan to market and implies simultaneous dislocations in economic behaviour and major changes in multiple aspects of the economic system. Essentially transition involves discontinuity in the structure of opportunities and incentives and is identified by major institutional, legal and political changes in the economic system. Among other developments, the process of transition involves the institution of private property and the creation of markets to value newly privatised firms.

It is generally acknowledged that privatisation of both large scale and small scale enterprises is an essential part of the transition process along with the creation of an organised market to facilitate post privatisation share trading (EBRD, 1994, Young and Reynolds, 1995). The ability to transfer title to ownership of existing securities is important in allowing securities markets to function effectively. It is also important in promoting a climate likely to encourage secondary issues of securities and, ultimately in stimulating the development of a market for corporate control (Young and Reynolds 1995). Transition economies therefore provide a fertile ground for investigating stock market irregularities since transition involves establishing from scratch a modern capital market.

Romania has set in place many of the reforms required for transition since the collapse of communism in 1991. The new Romanian Constitution, adopted in December 1991, guarantees the right to ownership of private property. With few exceptions, all adult Romanian citizens received shares as a result of the mass privatisation process which transferred ownership of many formerly state owned enterprises to private citizens. Private markets now thrive where once they were thin, or even non-existent. Transition in Romania has progressed to the point where more than sixty per cent of GNP is currently accounted for by output from the private sector.

Of most interest here is the development of financial institutions in the transition process. Although the BSE began trading in 1882, it ceased trading in 1948 because, under communism, the whole economy was nationalised and private holdings of equity ceased to exist. The situation began to be reversed in the 1990s and in 1994 the Romanian Parliament passed the Securities and Stock Exchanges Act (Law No 51) which established the legal framework for a modern capital market. Soon after, the BSE was re-established and trading in equities began on 20th November 1995. The BSE is a public entity having the traditional departments of a stock exchange (trading, listing, and members), as well as a Registry Department and a Clearing and Settlement Department.

Company equity is listed on the BSE in two categories: a second (base) tier listing and a first tier listing. Any registered company can apply for a second tier listing, but first tier listings are available to Romanian registered companies only. The requirements for each listing differ and, depending on performance, a company with a base tier listing can apply for a first tier listing. As well as requiring a better standard of company performance, a first tier listing requires companies to satisfy a more stringent set of criteria designed to reduce investor risk and to create the conditions necessary for an orderly development of a market in the equity of listed companies.

Alongside the BSE, an over the counter market exists on which equity is traded in Romania. The Romanian Association of Securities Dealers Automatic Quotation (RASDAQ) was established in 1996 as a market for trading equity that resulted from the mass privatisation process. As well as offering a market in the equity of recently privatised firms, the RASDAQ also trades equity in other companies who similarly cannot meet the more stringent listing requirements of the BSE.

Compared with other exchanges in the region such as Hungary, Poland and the Czech Republic, the BSE has been slow to evolve and the capitalisation rate on the BSE remains low relative to these countries. Nevertheless, market capitalisation is growing rapidly and increased more than ten-fold between the end of 1995 and the end of 2001. At the end of 2001, the market capitalisation rate exceeded one billion US dollars, roughly equivalent to 3.56 per cent of Romanian GDP, and equity in 65 first and second tier listed companies was quoted daily on the BSE. This is a far cry from the first day of trading on the BSE when equity in only six companies was traded! Table 1 shows the evolution of trading activity on the BSE.

Table 1 here

Table 1 not only shows how the volume and value of activity on the BSE has grown, it also shows that the number of listed companies has fallen since 1999 and particularly during 2001. In earlier years, disclosure requirements for listed companies were poor by western standards, but in 2001 the BSE implemented a 'Corporate Governance Code' which introduced a raft of regulations designed to increase transparency. The aims of the 'Corporate Governance Code' are to promote equal treatment among shareholders, to protect the rights of minority shareholders and to set out the rights of shareholders and the duties of company boards towards them. The result was an immediate de-listing of 47 companies which did not comply with the new Code. The new requirements, by enhancing the transparency of companies whose stock is traded on the BSE, might be expected to enhance efficiency of the BSE. There is certainly no indication that the new regulations have hampered the evolution and growth of the BSE since, despite the large numbers of companies de-listed, the real value of market capitalisation in 2001 increased above the previous record level achieved in 1997.

The ten most actively traded stocks from tier 1 form the BET index and the remaining companies from tier 1, tier 2 and the over the counter market (excluding investment funds) form the composite Bucharest Exchange Traded Index (BET-C). In the BSE electronic trading system, each listed company is represented by one (or more) codes. These are referred to as symbols and each symbol represents a separate issue by the same company. All BSE indices are calculated using a market value weighted index such that each symbol weighting is proportional to the number of shares outstanding for that symbol. At the end of 2001, the equity of 65 first and second tier listed companies was traded daily on the BSE.

The BSE and the RASDAQ are regulated by the Romanian National Securities Commission (CNVM) set up in 1994. This is an autonomous administrative body whose role, among other things, is to support the functioning of efficient securities' markets, to protect the interests of investors against unfair, abusive and fraudulent practices and to inform holders of securities and to maintain a record of the activities of intermediaries and agents who operate in the market for securities. The CNVM also monitors the activities of bodies responsible for ensuring the proper functioning of the securities markets. Currently the CNVM has five full time members: a Chairman, a Vice-Chairman and three voting members. All are appointed by parliament for a fixed five-year term, renewable only once. From a technical and regulatory perspective, the BSE can be compared to stock markets in other East European countries.

3. The Data

In order to limit paper-based operations, the trading system of the BSE is a computerised order-driven system that allows the interaction of actual buying and selling orders in the market. The trading session consists of a continuous trading mechanism for securities listed in the base and first-tier categories. The official index for the BSE became known as the BET, which is an abbreviation of Bucharest Exchange Trading. BET closing prices are posted at the close of business on each trading day, which is at 14.15 for all listed companies. Likewise the settlement system is completely paperless and takes place three days after equity is traded.

The principles that underpin the construction of the BET were chosen to reflect the price movements in the most liquid ten stocks listed in the first tier of the BSE. The BET is a capitalisation-weighted chained value ratio and in this sense it is similar to indexes used on other exchanges. The BET index is quoted on a real time basis on the exchange trading system and the value of the index at the close of business in Bucharest (14.15 for listed companies) provides the data for this study. Up until 5th May 1997, the closing index is only reported for the Tuesday and Thursday of each week. For this reason, we exclude observations prior to this point.[4] We convert the index into $US using the dollar/lei exchange rate. The evolution of the index over this period is shown in Figure 1.[5]

Figure 1 here

We define returns on day t in the normal way as $R_t = \log(S_t/S_{t-1})$ where S_t is the value of the stock market index in US dollars at the close of trading on day t. This leaves us with 1348 observations on daily stock market returns. Figures 2a to 2c plot returns for three sample periods. Returns for the whole sample are plotted in Figure 2a. Returns during the early life of the BET (before 2000) are plotted in Figure 2b, and for the more recent period (after 1st January 2000) in Figure 2c. In each case we plot the normal curve that is implied by the mean and standard deviation of each sample. Inspection of these plots suggests evidence of non-normality, particularly in regard to the thickness of the tails. The impression is confirmed by the formal tests for normality that are presented in Table 2. In all three cases, we reject the null hypothesis of normality at conventional significance levels. Decomposing this result, we find strong evidence of kurtosis in all three cases. However, for both the early and the late samples, we do not find significant evidence of skewness.

Figures 2a to 2c here

Table 2 here

4. Empirical Methodology

A common starting point for testing of informational inefficiencies is to establish whether

[4] There is strong evidence of inefficiency for the period prior to the 5th May. Results are available from the authors on request.

[5] See Rockinger and Urga (2001). Note that the exchange rate adds an additional source of variation to measured returns. Given also that stock markets and exchange rate risk premia are often correlated (Morely and Pentecost, 1998), there is a case for measuring returns in Romanian Lei. In fact, the results without the exchange rate adjustment are very similar to those reported here.

past movements in asset prices can be used to predict profit opportunities. In our context, on the assumption of an efficient market, current returns should follow a random walk process and lagged returns should have no explanatory power. When estimating such models, it is important to take account of the impact of time-varying volatility, or Autoregressive Conditional Heteroscedasticity (ARCH) (Engle, 1982). Not doing so is likely to lead to biased and inconsistent estimates. There exist a whole class of models to deal with ARCH effects. Most common in the analysis of stock returns is the use of Generalised ARCH (GARCH) models (Bollerslev, 1986). In these models, the time-dependent volatility is estimated as a function of observed prior volatility, measured as the lagged value(s) of the squared regression disturbances and, also, lagged value(s) of the conditional variance. The order of the GARCH model is given by the number of lags in each case.

In general terms, a GARCH(p, q) model can be represented as follows:

$$R_t = \alpha_o + \sum_{i-1}^{k} \alpha_i R_{t-k} + \psi\sigma_t^2 + \varepsilon_t \tag{1}$$

where

$$\sigma_t^2 = \gamma_0 + \sum_{i=1}^{i=q} \gamma_i \, \varepsilon_{t-1}^2 + \sum_{i=1}^{i=q} \delta_i \sigma_{t-1}^2 \tag{2}$$

and where ε_t is assumed to follow a normal distribution with zero mean and variance σ^2; γ_i are the ARCH parameters; δ_i are the GARCH parameter(s). We use the Akaike Information Criterion (AIC) to determine the optimal lag length of the ARCH and GARCH parameters. Note that the presence of GARCH effects is consistent with informational efficiency, but only on the assumption that investors are risk neutral.

One extension to the standard GARCH form is the E-GARCH (or the related TARCH) form in which asymmetric volatility effects are allowed. In particular, a common hypothesis is that negative shocks may generate greater volatility than positive shocks.

However, Shields (1997) finds no evidence for asymmetric effects in his study of Eastern European stock markets. Further, the summary statistics discussed above do not provide strong evidence of asymmetries in our case. For this reason, we concentrate on the symmetric GARCH form in this paper.

It is common to estimate GARCH models on the assumption that the conditional disturbances follow a normal distribution. In fact, there is considerable evidence (see, for example, Connolly, 1989) that, in the context of stock market returns, the distribution of the disturbances is often characterised by fat tails or kurtosis. Indeed, the summary statistics on the raw returns discussed above is suggestive that this may be a problem in our case. For this reason, we use a GARCH-t model in which the error terms are assumed to follow a conditional student-t density with degrees of freedom given by ν. In this formulation, ν is a parameter which can be estimated by estimated from maximising the log likelihood function:

$$L(\theta,\nu) = \sum_{t=q+1}^{n} L_t(\theta,\nu) \tag{3}$$

where:

$$L(\theta,\nu) = log\{ B\left(\frac{\nu}{2},\frac{1}{2}\right)\} - \frac{1}{2}log(\nu-2) - \frac{1}{2}log\,\sigma_t^2 - \left(\frac{\nu+1}{2}\right)log\left(1+\frac{\varepsilon_T^2}{\sigma_t^2(\nu-2)}\right) \tag{4}$$

and θ is the set of remaining parameters in the model (see Bollerslev, 1987).[6]

A large literature exists that has examined the evidence for anomalous returns in a number of contexts related to ‘calendar effects’. Three effects that have received considerable attention are ‘the day of the week effect’, the ‘January effect’ and the ‘monthly effect’. With the ‘day of the week effect’ returns are hypothesised to be significantly lower on the first day of the trading week and abnormally high on the last trading day of the week (French 1980, Gibbons and Hess 1981, Keim and Stambaugh, 1984; Agrawal and Tandon, 1994; Fortune, 1999.)[7] With the 'January effect'returns are hypothesised to be significantly higher in January than in any other month (Rozeff and Kinney, 1976; Rogalski and Tinic, 1986; Gultekin and Gultekin,1983; Lee, 1992). Lastly, with the 'monthly effect' returns are hypothesised to be significantly higher in the first half of the month compared to the last half (Ariel, 1987). In order to control for such effects, we supplement equation 1 by the inclusion of dummy variables for the first trading day of the week (*Start of week*), for the final trading day of the week (*End of week*), for trading days in January (*January*) and for trading days in the first half of the month (*Start of month*).[8] We are particularly interested in the evolution of any observed inefficiency effects. This would be evidenced by parameter instability over our time period. We examine this possibility in the two ways. Firstly we report plots of the recursive regression estimates over time. We use a minimum of 10 observations to initialise the recursive regressions, although our results are robust to using a greater number than this. Secondly, we report a variation of our basic model in which the parameters are allowed to vary linearly with time. This is achieved by including an interaction variable between, for example, lagged returns and a time trend. A positive value on lagged returns, accompanied by a negative value on the interaction variable would imply increasing efficiency over time.

5. Results

We report our efficiency tests on the full sample of daily data between 6th May 1997 and 16th September 2002 in Table 3. In column 1 we report estimates of a general model including all the dummy variables described above. In column 2 we report estimate of a more parsimonious model. This is the final outcome of a model reduction strategy, in which all

[6] There exist alternative approaches to dealing with the issue of excessive kurtosis, for example using a stable Paretian process, mixture-of-normals distributions or a jump-diffusion process. For a discussion of these approaches see Dowd (2002).

[7] We test this hypothesis in such a way as to take account both of lower (higher) returns on a Monday (Friday) as well as lower (higher) return on the day following (preceding) national holidays. See, for example, Ariel (1990), Kim and Park (1994) and Mills and Coutts (1995) for a discussion of this 'holiday effect'.

variables with a coefficient insignificantly different to zero at the 10% level are dropped sequentially, subject to the appropriate diagnostic tests not revealing significant specification problems.

The estimates for the ARCH parameters and GARCH parameters of order one are strongly significant. No higher order of these parameters proves significant and, on the basis of the Akaike Information Criteria for model selection, we conclude that the first order model is optimal. The diagnostic tests for normality suggest strong evidence of non-normality in the error terms. Further, the degree of freedom parameter, ν, is estimated to be highly significant and with a value of between 3 and 4.5, depending on the sample. Taken together, these results provide strong justification for our use of the GARCH-t specification in place of the standard GARCH model. The diagnostic test for residual ARCH effects and the Portmanteau test for serial correlation are never significant at conventional levels and provide further support for the specification of the model. As a final refinement, we also experiment with an E-GARCH specification. The asymmetric parameter in this model is never found to be significant and the results are not reported here.

Table 3 here

The results in Table 3 for the whole sample suggest strong evidence of inefficiency in stock returns. Although we estimate the constant term to be insignificantly different to zero, the estimate for α_1, the coefficient on the first lag of returns, is positive and strongly significant (0.265, standard error = 0.035 in the simple model). The coefficients on further lags of returns are not significant in any specification and are not reported here. Thus we have *prima facie* evidence that past movement of prices could be used to predict future movements. Only two of our variables controlling for calendar effects are left in our most parsimonious model. The coefficient on the end of the week variable is positive, but only

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[8] We do not consider here the potential impact of calendar effects on the volatility parameters.

significant at the 10% level. Thus, we find weak evidence that returns are higher on the last trading day of the week compared to other days. We also find that returns are significantly lower in the first half of the month compared to the second half. This result is the exact opposite of that found by Ariel (1987). We find no evidence of differential returns on the first day of the trading week or in January.

Figure 3 here

Of primary interest to us here is the evolution of stock market efficiency in Romania. Specifically, is there any evidence that the stock market has become more efficient over time? To examine this, we plot in Figure 3 the recursive point estimates of the coefficients on lagged returns and the two significant calendar effects. In each case, we also plot upper and lower bounds to the estimate, given by the point estimate plus/minus two standard errors. The most striking feature of these graphs is the monotonic decrease over time in the estimate of the coefficient on lagged returns. This is strongly suggestive that efficiency of the BSE has been increasing over time. This is confirmed by the results from the time-varying parameter model, reported in column 3 of Table 3. The coefficient on the interaction term between lagged returns and the time trend is negative and strongly significant. Interaction terms for the dummy variables and for the volatility terms are not significant and are not reported here.

We further explore the issue of increasing efficiency by splitting our sample up into an early period and a late period. In particular, we are interested in identifying a point in time after which the BSE can be classified as efficient. After experimenting with different cut-off points, we settle on pre-2000 for our early sample and post-2000 for our late sample and we repeat our estimates for each sample.

Table 4 here

We report the results of the efficiency tests for the early sample in Table 4. Once again, the coefficient on the lagged dependent variable is positive and strongly significant (column 1). Further, its absolute value (0.418, standard error 0.051) is much higher than for the full sample. There continues to be weak evidence of an 'end of the week effect' and 'start of the month effect' for this sample, but no evidence of significant 'start of the week' or 'January' effects. The recursive estimates of this coefficient (plotted in Figure 4) suggest some evidence of increasing efficiency over time, although the estimates for the coefficient on lagged returns are much more stable than for the whole sample. This is confirmed by the time-varying parameter model (reported in Table 4, column 3). The coefficient on the interaction term between lagged returns and the time trend is negative, but is now insignificantly different to zero.

Figure 4 here

Table 5 here

We report the results of the efficiency tests for the late sample in Table 5. For this sample, none of the calendar effect controls exert a significant effect. Further, the coefficient on lagged returns is now only significant at the 10% level (coefficient = 0.083, standard error = 0.045). The recursive estimates (reported in Figure 5) for this coefficient are relatively stable, and at no point does the lower bound move above zero. The extreme value of the bounds that is evident on this graph is caused by a rise in the index of nearly 3% on a single day (17^{th} June 2002) and a subsequent readjustment on the following day. The reasons for this occurrence are unclear. The overall stability of the parameter in this sample is confirmed by the time-varying parameter model in which the coefficient on the interaction term between lagged returns and the time trend is not significantly different to zero.

To summarise, our results suggest that the BSE was characterised by significant inefficiency in the early years of its operation. In particular, lagged returns were strong predictors of current returns. There is also some evidence that calendar effects of the sort that have been observed in more developed stock exchanges were also present. From the start of 2000 to the present day, there is evidence that the stock market was broadly efficient. Lagged returns are only weak predictors of current returns over this period and there is no evidence of calendar effects.

Figure 5 here

6. Discussion and Conclusions

There is strong evidence that a well-functioning stock exchange is a vital ingredient in a successful market economy. Further, evidence of stock market efficiency is a useful indicator in establishing whether transition economies are able to satisfy the Copenhagen Criteria for EU membership.

The Romanian economy represents a particularly good case study of the dynamics of stock market efficiency in transition economies since, prior to transition, virtually no preparation for a movement towards the market had taken place. In this paper, we have found strong evidence that the BSE was characterised by weak-form inefficiency in its early years of operation. Specifically, current stock returns could have been used to improve significantly forecasts of future returns until round about the start of the year 2000. This result is robust to the inclusion of control variables for calendar effects such as the 'end of the week effect' and the 'start of the month effect'.

That the BSE suffered from such fundamental inefficiency is likely to have seriously hampered progress of the Romanian economy towards transition. It is striking to note that such inefficiency is still observed at least four years from the commencement of trading in

November 1995. A detailed examination of the reasons underlying this long period of evolution are beyond the scope this paper. However, it is reasonable to believe that in the early stages of the operation of the BSE, market participants are unlikely behave according to the efficient markets paradigm. As noted in the 2001 edition of the BSE annual report: “There were many obstacles to resuscitating the stock exchange but the most challenging was to be related to public awareness. The general public needed to become familiar with notions they forgot long ago or never knew at all, so that the stock exchange could become again, after an absence of almost 50 years, an institution accessible to all potential investors” (BSE, 2001, pp15).

Our results show that the extent of inefficiency on the BSE begins to diminish from January 2000 and one possible explanation of this is the growing awareness of the importance of standards of corporate governance in Romania. Prior to the introduction of the ‘Corporate Governance Code’ in 2001, the BSE, in collaboration with the OECD, hosted two high level conferences on Corporate Governance. The higher level of efficiency we find from January 2000 predates the introduction of the ‘Corporate Governance Code’ but might, to some extent have anticipated it. For example, the heightened awareness given to issues of corporate governance might well have encouraged listed companies to adopt more transparent procedures, which were reflected in improved efficiency on the BSE.

In testing whether the BSE is efficient, our analysis has also sought to assess whether there is supportive evidence that Romania satisfies the Copenhagen Criteria for entry into the EU. We have argued that an efficient capital market is a necessary pre-requisite for satisfying the key criterion of having a functioning market economy. There are, of course, other elements of this criterion that must be satisfied before Romania is admitted to the EU. However, an efficient financial market encourages efficiency in the allocation of resources and would better equip an economy to cope with competitive pressure and market forces within the Union. Our finding that the BSE has evolved to a state in which price setting passes conventional tests of market efficiency, provides evidence that Romania is one step closer to joining the Union.

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Table 1: Trading on the Romanian Stock Exchange: 1995-2001

Year	No of Trading Sessions	No of Trades	No of Shares Traded (Volume)	Turnover (Bn ROL)	Capitalisation (Bn ROL)	No of Listed Companies
1995	5	379	42,761	2	259	9
1996	84	17,768	1,140,000,000	15	231	17
1997	207	609,651	615,796,189	1,946	5,056	75
1998	255	512,705	966,804,827	1,846	3,922	126
1999	249	415,046	1,069,280,848	1,415	5,725	126
2000	251	496,996	1,828468,521	1,867	9,436	115
2001	247	348,658	2,213,096,602	3,782	38,573	65

Table 2: Summary Statistics for Daily Stock Market Returns

	Full Sample	Early Sample	Late Sample
Number	**1348**	**671**	**677**
Mean	**-0.070**	**-0.237**	**0.095**
Standard Deviation	**2.253**	**2.638**	**1.779**
Skewness	**-0.190****	**-0.154**	**0.062**
Kurtosis	**13.188*****	**12.238*****	**8.663*****
Normality	**11.092*****	**9.122*****	**8.696**

Notes
(i) The Early Sample covers 6th May 1997 to 31st December 1999. The Late Sample covers 1st January 2000 to 16th September 2002.
(i) *** indicates significance at the 1% level; ** at the 5% level;* at the 10% level.
(ii) The significance tests for skewness and kurtosis are based on D'Agostino, Balanger and D'Agostino (1990).
(iii) Normality is the Shapiro-Wilk test statistic for normality. This is normally distributed, based on the null hypothesis.

Table 3: GARCH Estimates of Stock Market Returns: full sample

	1	2	3
	General Model	**Simple Model**	**Time-varying Parameter Model**
Return (t-1)	0.267*** (0.035)	0.265*** (0.035)	0.529*** (0.073)
Start of week	-0.050 (0.097)	-	-
End of week	0.151 (0.098)	0.166* (0.094)	0.154* (0.091)
January	0.174 (0.169)	-	-
Start of month	-0.166** (0.079)	-0.171** (0.079)	-0.157** (0.079)
Return (t-1) * trend	-	-	-4.00 e-4*** (8.88 e-5)
Constant	-0.028 (0.061)	-0.028 (0.054)	-0.021 (0.056)
γ_0	0.986** (0.266)	0.978** (0.403)	1.300*** (0.283)
γ_1	0.443*** (0.091)	0.440*** (0.113)	0.501*** (0.097)
δ_1	0.410*** (0.097)	0.412*** (0.152)	0.309*** (0.084)
ν	4.056*** (0.484)	4.106*** (0.510)	3.746*** (0.433)
Log-Likelihood	-2663.6	-2664.3	-2651.0
AIC	5347.1	5344.6	5319.9
N	1347	1347	1347
Normality	938.92***	942.7***	882.3***
ARCH 1-2	0.009	0.007	0.080
Portmanteau	30.18	30.60	27.98

Notes
(i) Sample period is 7th May 1997 to 16th Sept 2002.
(ii) Dependent variable is the stock market return on day t, defined as $\log(S_t/S_{t-1})$ where S_t is the stock market index in $US at the close of trading on day t.
(iii) Figures in brackets are robust standard errors.
(iv) *** indicates significance at the 1% level; ** at the 5% level;* at the 10% level.
(v) Estimates are from a maximum likelihood GARCH (1/1) model.
(vi) ARCH 1-2 is an LM test statistic for 1st and 2nd order ARCH and is distributed as F^2_{N-k-4} where N is the number of observations and K is the number of parameters. Portmanteau is the Ljung-Box portmanteau statistic for misspecification based on up to 24 lags. Normality is a test statistic for skew and kurtosis and follows a $\chi^2(2)$ distribution.

Table 4: GARCH Estimates of Stock Market Returns: early sample

	1	2	3
	General Model	**Simple Model**	**Time-varying Parameter Model**
Return (t-1)	0.418*** (0.051)	0.418*** (0.052)	0.497*** (0.111)
Start of week	-0.066 (0.145)	-	-
End of week	0.238 (0.151)	0.261* (0.146)	0.264* (0.146)
January	0.290 (0.231)	-	-
Start of month	-0.208 (0.136)	-0.224* (0.134)	-0.215 (0.135)
Return (t-1) * trend	-	-	-2.36 e-4 (2.61 e-4)
Constant	-0.159 (0.102)	-0.151* (0.091)	-0.153* (0.091)
γ_0	1.665*** (0.529)	1.640*** (0.523)	1.742*** (0.555)
γ_1	0.524*** (0.140)	0.520*** (0.135)	0.535*** (0.141)
δ_1	0.309*** (0.109)	0.309*** (0.111)	0.287*** (0.109)
ν	3.586*** (0.531)	3.668*** (0.543)	3.601*** (0.536)
Log-Likelihood	-1398.8	-1399.6	-1398.99
AIC	2817.6	2815.2	2816.0
N	670	670	670
Normality	458.49***	462.8***	446.73***
ARCH 1-2	0.021	0.022	0.052
Portmanteau	24.76	24.58	24.78

Notes
(i) Sample period is 7th May 1997 to 31st December 1999
(ii) For other notes see Table 2, notes (ii)-(vi).

Table 5: GARCH Estimates of Stock Market Returns: late sample

	1	2	3
	General Model	**Simple Model**	**Time-varying Parameter Model**
Return (t-1)	0.078* (0.046)	0.083* (0.045)	-0.107 (0.225)
Start of week	-0.043 (0.129)	-	-
End of week	0.044 (0.118)	-	-
January	0.111 (0.234)	-	-
Start of month	-0.094 (0.100)	-	-
Return (t-1) * trend	-	-	1.878 e-4 (2.336 e-4)
Constant	0.065 (0.075)	0.029 (0.048)	0.024 (0.049)
γ_0	1.212** (0.498)	1.204*** (0.128)	1.263*** (0.491)
γ_1	0.461*** (0.141)	0.440*** (0.128)	0.449*** (0.126)
δ_1	0.225 (0.142)	0.234 (0.207)	0.208 (0.201)
ν	4.087*** (0.738)	4.149*** (0.743)	4.152*** (0.738)
Log-Likelihood	-1237.67	-1238.44	-1238.06
AIC	2495.3	2488.9	2490.13
N	677	677	677
Normality	220.87***	206.97***	210.90***
ARCH 1-2	0.879	0.970	1.059
Portmanteau	20.06	20.52	21.20

Notes
(i) Sample period is 3rd January 2000 to 14th May 2002.
(ii) For other notes see Table 2, notes (ii)-(vi).

Figure 1: Romanian Stock Market Index 5th May 1997 - 16th September 2002

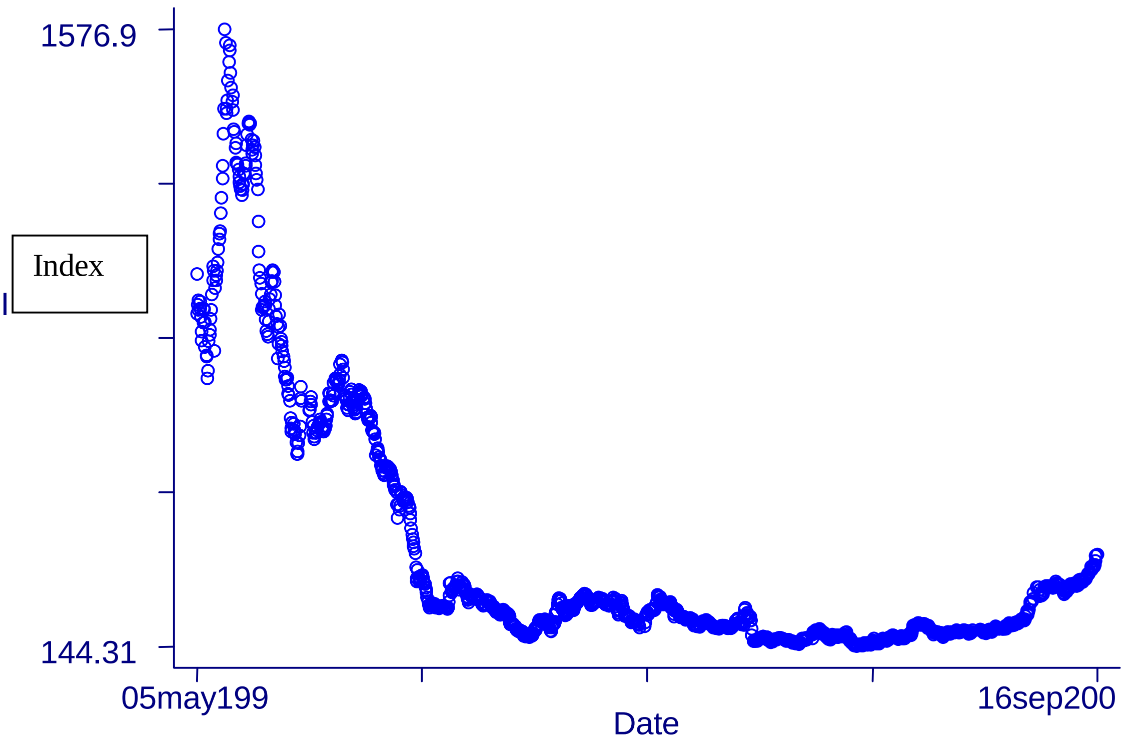

Figure 2a: Daily Stock Market Returns: 6th May 1997 - 16th September 2002

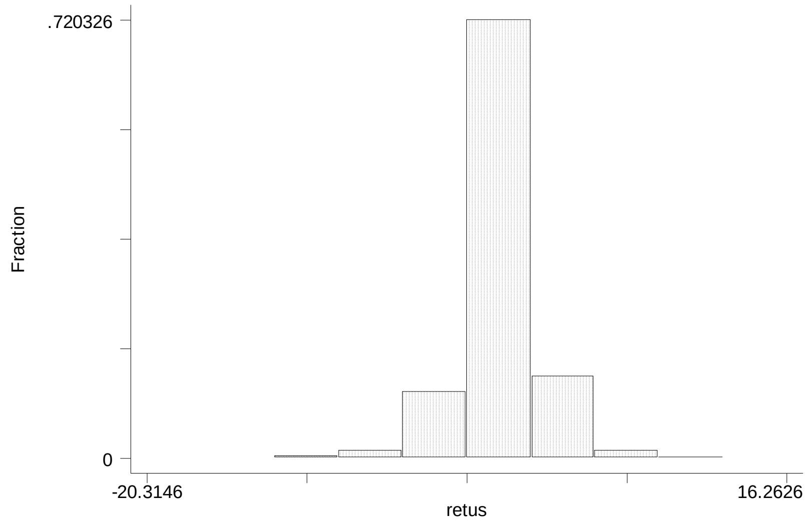

Figure 2b: Daily Stock Market Returns: 6th May 1997 - 31st December 1999

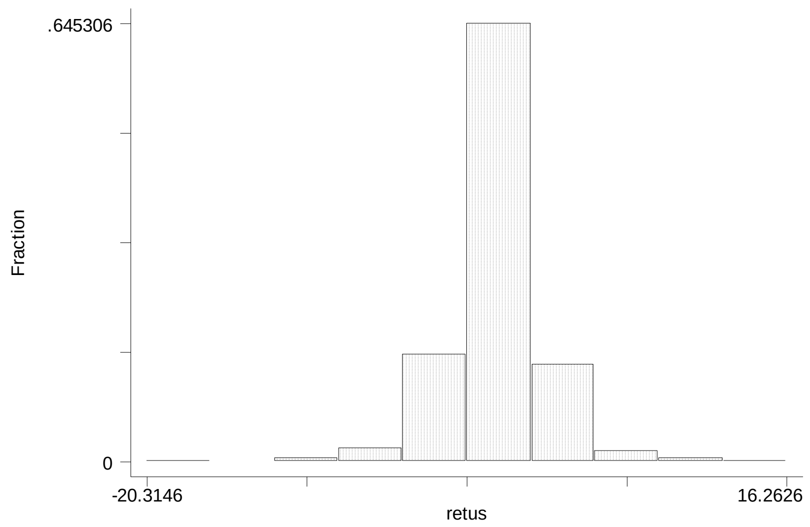

Figure 2c: Daily Stock Market Returns: 1st January 2000 - 16th September 2002

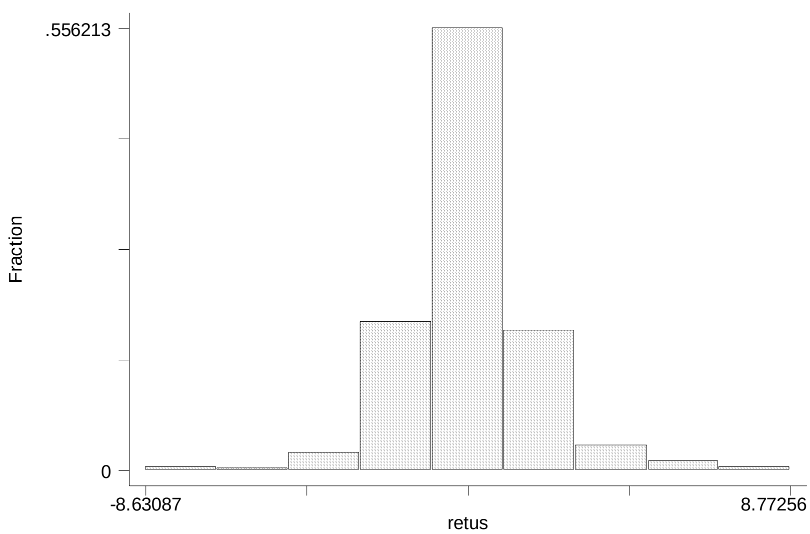

Figure 3: Recursive Estimates: full sample

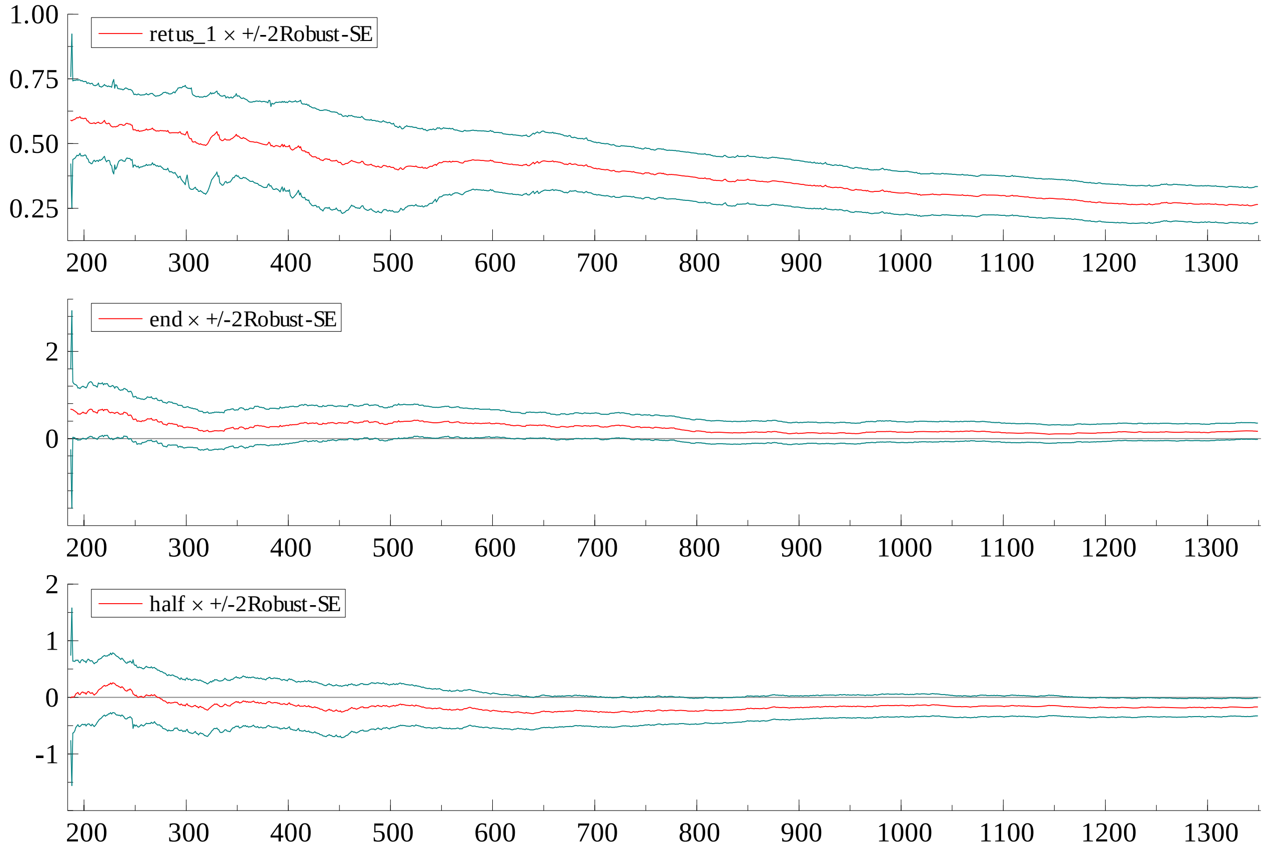

Figure 4: Recursive Estimates of Lagged Returns: early sample

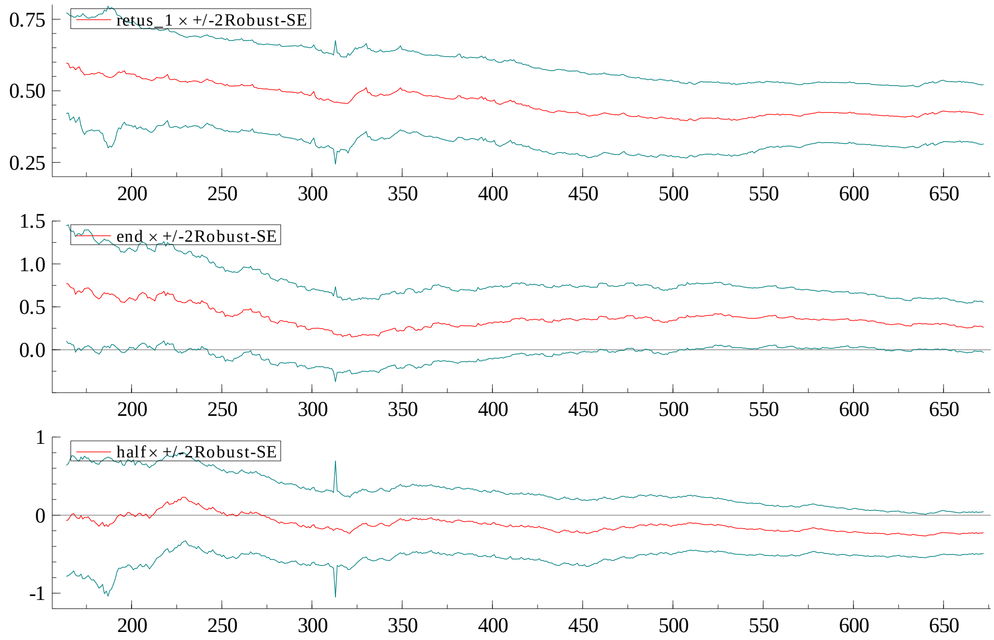

Figure 5: Recursive Estimates of Lagged Returns: late sample