Developing Stock Markets in Transition Economies

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Abstract

In 1991, the Communist Government of the USSR was voted out of existence and this formally brought to an end in Central and Eastern Europe, as well as in other countries, to a failed political ideology that had endured for more than seventy years with massive implications for control and allocation of economic resources. The term ‘transition economy’ was coined to describe the economies of those countries that that were propelled were propelled as a consequence of this, into a process of transition from planned (or socialist) economy to a market-based economy. The implications of this were far reaching and as private property was re-introduced, stock markets had to be established so that equity could be traded in newly created privately owned bodies corporate. This posed enormous problems, not least because new generations, unaccustomed to the operation of capital markets, had grown up under socialism and viewed the newly created stock markets with suspicion and caution. One of the major challenges in the transition economies was therefore to educate investors and to explain to nature of risk capital. However, efforts to educate investors were somewhat confounded because, coupled with the absence of understanding, there was an absence of reliable information about the companies traded on the stock market and lack of trust in the operation of the market itself. In this thesis, we investigate the emergence and development of stock markets in ten Central and East European countries (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). As well as surveying their development we test whether the function efficiently and whether they are sufficiently development so as to exhibit comovement with the world’s major stock markets.

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CHAPTER 1

THE COLLAPSE OF COMMUNISM AND THE PROGRESS OF TRANSITION IN CENTRAL AND EASTERN EUROPE: A GENERAL OVERVIEW

1.1 The Legacy of Central Planning

In 1991, the Communist Government of the USSR was voted out of existence and this formally brought to an end in Central and Eastern Europe (CEE) as well as in other countries, to a failed political ideology that had endured for more than seventy years with massive implications for control and allocation of economic resources. In fact, economic change preceded political change and the collapse of central planning as a mechanism for allocating resources occurred spontaneously throughout CEE in 1989. Gradually markets emerged to fill the economic void left by the demise of central planning. The rise and subsequent fall of central planning ranks among the most significant events of the twentieth century posing major challenges to both economic theory and policy. By the late 1980s, the economic limitations of central planning had become abundantly clear and, following the fall of the Berlin Wall, countries that had maintained centrally planned economies embarked on the transition to market economies. For some countries the process of transition was slower than for others, but within twenty years after the start of transition, all the economies of CEE had functioning market economies.

The main economic feature of the former socialist countries with their centralised economies was the use of the plan as an instrument for guiding economic activity. Economic plans can, of course, be found in developed and developing countries with market economies, but the difference between these and the former socialist economies of CEE lies in the ideological orientation of the plan in the latter and the compulsory organisation of the entire economy through the plan.

In market economies, plans tend to set out the program governments intend to implement to achieve their aims without taking the form of a quantitative obligation or legally binding constraint on economic management. The plan’s intended outcomes are achieved (insofar as they are achieved) by creating the necessary economic conditions and incentives to encourage consumer choice and production decisions in accordance with the aims of the plan. In some cases, State spending will be undertaken to further the objectives of the plan. In contrast, planning in the former socialist countries was backed up by direct government intervention, usually in the form of instructions to production units involving rigid target levels of output to encourage the fulfilment of the plan in terms of achieving specified levels of output consistent with the plan. To make this possible, plans were embedded with both physical and financial features to ensure that the plan was internally consistent and that resource requirements necessary to ensure the plan's fulfilment would be available.

Over the years, reliance on the planning process to allocate resources created severe structural problems that the planning mechanism was quite simply unable to resolve. Soviet economic growth began to falter and slow in the early 1970s and this was the beginning of the end for the centrally planned economies. 1990 was a crisis year and vividly illustrates how inefficient the planning process had become. In that year Soviet agriculture achieved a record harvest, but there were food shortages all over the Soviet Union. Cities such as St Petersburg and Moscow were on the verge of starvation and yet food lay rotting in the fields as the harvest went ungathered because price controls made it unprofitable to take in the crop. To prevent starvation, food was sent from many parts of the world including the EU. Manufacturing was in a similar state of decay. In many cases the techniques of production were unchanged in decades. Many goods taken for granted in the West were simply not available in the Communist countries of the former Soviet Union (including the economies of CEE) and many of the products that were produced were of such poor quality that there was no export market for them. The problem was compounded because imports, many illegally smuggled in, were increasing and this adversely impacted on the growth of GDP in the region.

As the Communist system of planned economies collapsed, the aftermath left countries facing a plethora of problems which can be briefly summarised as follows:

- GDP was depressed and falling so that unemployment was rising and living standards were falling. Unemployment was a new phenomenon in the transition economies. In a State system of directed labour there was no official unemployment. There was therefore a complete absence of any kind of social security system to provide for those without work since such a system was unnecessary under central planning. Not only did enterprises provide employment; they also provided services like education, healthcare and housing for their employees. Organisation in the provision of these started to disintegrate causing economic and social upheaval.

- The current account of the balance of payments moved sharply into deficit as countries, unable to provide for themselves, relied increasingly on imports from the West. Worse still, the arrangements for international trade were centralised and corrupt, and during Communist times involved relatively little trade with countries outside the Communist bloc with no regard to comparative advantage.

- The collapse of central planning left the transition economies without functioning markets for labour, capital and consumer goods and services. Economic agents had been used to responding to directives and once the directives disappeared, a vacuum was left and countries foundered like rudderless ships without any mechanism for allocating resources.

- Furthermore, because all the means of production had been in State hands there was no legislative framework for enforcing property rights, the valuation and disposal of assets or the liquidation of unprofitable enterprises. In other words, the legal mechanism on which the creation of markets depends was missing so that there was no framework within which markets could emerge and develop.

- There was a complete lack of understanding about the operation of the price mechanism. There was no understanding of profit and loss accounting or of the profit motive. In some countries there was a small and undeveloped private sector mainly in agriculture, but in general there was little understanding of the nature and role played by the entrepreneur in market economies.

- Banking in the planned economies was a bookkeeping operation and credit was allocated according to the plan rather than in relation to some assessment of risk. Capital markets were non-existent so that anyone wishing to start a business found it difficult to raise venture capital.

The economic structures of planning were not based on notions of comparative advantage. Instead the structure was based on an exaggerated view of the importance of economies of scale and was designed to create interdependence with a view to establishing political control rather than promoting economic efficiency. The result was a highly concentrated system that left some countries heavily dependent on the production of a range of defence and capital goods for which there was now little demand. Under COMECON (Council for Mutual Economic Assistance - an economic organisation from 1949 to 1991 under the leadership of the Soviet Union that comprised the countries of the Eastern Bloc along with a number of Communist States elsewhere in the world) Belarus was awarded tractors, the Slovak Republic tanks, Bulgaria toothpaste and so on.

- The planned economies were almost universally characterised by energy inefficiency. The absence of any understanding of opportunity cost led to gross waste of energy. It is somewhat ironic that a wasteful energy policy coincided with a high endowment of natural resources in many countries in the former Soviet Union.

- Economic welfare and living standards in the former planned economies emphasised measures of GDP. No consideration was given to the notion that the environment was an economic resource and that externalities have an important bearing on welfare. As a result, the environmental consequences of production were ignored and environmental degradation occurred on an alarming scale with pollution as the major cause.

- When the planning process collapsed, the national banks of the transition economies were ill prepared to perform the functions of conventional central banks in market economies. In a command economy the national bank did perform some of the conventional functions of a central bank in developed economies, but the difference is that these activities were all part of a wider central plan. In centrally planned economies a cash plan ensured that enterprises could pay the wages of their workers and a credit plan allocated loans to enterprises to support their investment, stocks and work in progress. When the planning system collapsed there was therefore no mechanism for setting interest rates, managing the financial system, controlling money growth and so on.

- In the command economies everything was dictated by the plan and so no instruments of economic policy were in place to prevent economic collapse. Governments in market economies typically have two sets of policy instruments at their disposal: fiscal and monetary policy. In the centrally planned economies, fiscal policy instruments did not exist. Taxes were levied on State owned enterprises and private individuals paid income tax, but the purpose of levying taxes was to enable the State to perform executive functions such as the provision of law and order, defence and so on. Taxation and expenditure were therefore part of the national plan and were not designed to achieve any kind of macroeconomic objective. Consequently, fiscal policy instruments at the disposal of governments in the early stages of transition were not suited to the needs of emerging market economies.

1.2 Consequences of Economic Decay

As noted above, economic decay did not happen in the economies of CEE overnight. Instead decline became increasingly apparent throughout the 1970s onwards. This decline manifested itself in relatively low economic growth and the primary causes of this were:

1.2.1 Low Productivity Growth. The Communist growth strategy was based on increasing the quantity of labour and capital inputs with little emphasis on harnessing the gains from technological advances or exploiting comparative advantage. Communist economies were protected from competition and burdened with all kinds of rigidities with the result that product development and innovation were not regarded as important by most managers and planners, and those that did perceive their importance were incapable of effecting any kind of change.

Similarly there was little incentive to improve productivity. Planning involved setting targets for factory managers. However, if the targets were exceeded managers received no reward (financial or otherwise) and instead either found their target increased, or else the resources at their disposal were reduced, when the plan was revised. This was an incentive to underachieve and typically factory managers hoarded labour so that when workers had to be released in the summer to help with the harvest, they could cope with the extra strain.

1.2.2 Inefficient Allocation of Resources. There are all kinds of reasons why resources were misallocated in planned economies. Planners might well have been able to decide which goods were to be produced in the economy, but they had little power to persuade consumers to purchase products they didn't want to buy. More important was the fact that price controls were rigidly applied in an attempt to reduce inequality. This was an important part of Communist ideology, but it led to a situation where the price consumers paid for many goods and services was well below the free market price and consequently there was over consumption of some goods and shortages of others. The absence of price signals meant that planners had to guess how resources could most appropriately be allocated. The existence of long queues, flourishing black markets in goods that were otherwise unobtainable to the vast majority of people, and empty shelves, provided ample testimony to the failure of planning.

1.3 The Beginning of Reform

This was the foundation on which the transition economies had to build market economies and the gravity of these problems, which generated deep macro and microeconomic imbalances and an increasing gap between socialist economies and developed market economies in terms of living standards, made fundamental economic reform not just necessary, but inevitable. However, long before the failure of planning became evident, an awareness was building in many economies of CEE of the deficiencies caused by plan centralisation, control and isolation from the world economy to the extent that many CEE economies attempted piecemeal reform.

The first tentative initiatives to introduce decentralised decision taking through markets and new economic mechanisms were created in Poland, Romania and Hungary. However, the two pillars of socialist economies, collective resource ownership and the planning mechanism, remained untouched. Later, in Hungary and the former Yugoslavia, some decision-making powers were transferred from the centre to firms and local authorities, and planning directives were diminished. The aim was to encourage initiative by enterprise managers so as to develop effective and flexible production strategies more in keeping with the operation of free markets. However, the vast majority of the experiments aimed at 'reforming' socialism in CEE countries had negative results. The potential gains in terms of increased efficiency and productivity from decentralisation and the limited introduction of market forces failed to materialise because there was no change in the structure of resource ownership and financial markets, whose function is to allocate funds on the basis of risk assessment, did not exist.

Other factors that contrived to ensure the failure of these reforms were retention of the powers of patronage that left governments free to appoint directors of enterprises of their choice. However, probably the most important element in this litany of factors ensuring the failure of reform is that prices remained under central control which ensured a continuation of distortions in the allocation of resources. The limited results of these experiments in 'market socialism' and the increasing macroeconomic imbalances forced the CEE countries to develop fundamental post-socialist reforms that propelled the countries into transition and ultimately resulted in the creation of functioning market economies. The problem of State ownership of resources meant that when the planned economies collapsed, there was no legislative framework for enforcing property rights, the valuation and disposal of assets or the liquidation of unprofitable enterprises. In other words, the legal mechanisms on which the creation of markets depends was missing so that the foundations on which markets could emerge and develop were absent. This problem had to be resolved as part of the process of transition.

1.4 Introduction to Transition

The term ‘transition’ became part of the economic vocabulary in the 1990s to describe the changes taking place in the economies of the former Soviet Union following the collapse of that economic and political group of countries. This collapse unleashed forces for economic, social and political change, and the motives for economic change at least were based on the poor performance of centrally planned economies including inefficiencies in production, the absence of work incentives, lack of consumer choice, lengthy queues and poor-quality goods. The combined effect of these was to slow the growth of living standards so that in absolute terms they increasingly fell below those of developed market economies.

Prior to the start of this process, a great deal had been written about the transition from capitalism to socialism. However, virtually nothing had been written about the reverse since this was unimagined until the process actually began. When the Soviet Union collapsed, it collapsed with spectacular speed and there was no blue print mapping out the course to be followed to replace the planning mechanism with the market mechanism. As The Economist (1990) put it: “Hundreds of books have been written on the transition from capitalism to Communism but not the other way. There is no known recipe for unmaking an omelette” (pp 22).

In brief, 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 rule of law to enforce these property rights and the creation of markets to value products and assets including newly privatised firms.

In this introductory chapter, we shall see that whilst the nature of the reform process in transition is clear, the pace and scale of transition varied between countries. Some countries achieved market economy status relatively quickly. In others the pace has been slower and even now, 26 years into transition, in some countries, though not the countries of CEE, reform still has far to go.

One thing is clear: development differs fundamentally from transition. Development is an on-going and evolutionary process that follows a well-trodden path that all developed economies have at one time or another followed culminating in industrialisation of the economy. It involves a shift of population from rural communities to urban settlements. Typically development focuses on poorer countries with poverty defined in terms of a low per capita income compared to developed countries. In fact, less developed countries are also plagued by other problems such as high levels of malnutrition, low levels of life expectancy, low literacy rates, poor sanitation and so on. However, whilst it is easy to identify the characteristics of less developed countries; the characteristics of transition economies can sometimes differ markedly.

At the start of transition, the economies of CEE also had relatively low per capita incomes and shared many of the other characteristics of the less developed economies. However, they differed fundamentally from less developed countries in that they were already industrialised and urbanised, and they possessed an educated, and in many cases a highly skilled, work force. They had already experienced the rural-urban upheaval that industrialisation involves with large shifts of workers from agriculture to industry. A critical difference was that many of these shifts as they occurred under Communism were driven by government ideology over a very short time period in contrast to the more uncoordinated shifts seen through developing countries. Typically they had well-developed and relatively large manufacturing sectors, but they lacked the institutions that enable developed market economies to function. The transition economies also differed widely in economic structure, history, geography, resource endowments, culture and levels of debt. Note that even though central planning was a common feature of these countries, differences in economic structure existed. The countries of the Commonwealth of Independent States (CIS) had experienced over seventy years of central planning at the outset of transition, whilst for others central planning was imposed after the Second World War. Some countries such as the Czech Republic, the Slovak Republic, Hungary and Poland had implemented reforms prior to the onset of transition. In others such as Azerbaijan, Kazakhstan and Romania, the planning mechanism was strong and these countries functioned as classic text book examples of centrally planned economies.

It is clear that transition differs from development, but, since transition describes the process of transforming an economy from plan to market, it also differs from economic reform - although economic reform is clearly a part of the transition process. In all economies we can find examples of reform. For example, in the UK (along with other Western economies) over the last three decades and more, we have seen markets deregulated and whole industries privatised. The same changes have occurred in transition economies, but transition implies much more. As noted above, transition implies far more sweeping and all embracing changes than this and impacts on economic, legal, institutional and political dimensions of those economies that embark on transition. It also involves enormous economic change being driven through in a relatively short space of time.

This distinction between transition and reform is important because it is the specialist knowledge of economists that has provided the basic advice informing government decisions in the transition economies. The problem is that whereas reform can be analysed in terms of comparative statics, transition cannot. When analysing reform we might ask what are the consequences of deregulating the airline industry, what are the consequences of deregulating the capital market and so on. Transition is different because it alters the preferences of economic agents and revalues their skills and capital assets across the entire economy. In these circumstances it is difficult for economists to recommend policies that promote Pareto efficiency because the policies associated with transition are so fundamental they will change society's preferences and through this will change ideas about efficiency in the allocation of resources. In the early stages, transition was expected to consist of a series of successive shocks that were meant to provide an economic environment in which geo-political, economic, social and psychological factors were intertwined to improve living standards, increase stability and pave the way for the creation of a market economy. Lavigne (1999) identifies two different approaches to the transition process. One is attributed to the institutional views of the IMF and the OECD and is technical in nature, the other deals with a more micro-oriented approach implying that transition is primarily a learning process requiring a change of mentality, attitudes and behaviour.

Understanding the nature of reform, the magnitude of the task and its success in achieving transition can only be fully appreciated against the backdrop of the situation confronting the economies of CEE following the collapse of Communism which was most vividly illustrated when the Berlin Wall was dismantled in 1989. Whilst differences existed between the transition economies, the reform programs established at the very beginning of transition by newly formed governments had a common goal: the creation of a market economy. However, as the process of transition got underway, for many it ushered in a period of economic collapse and hyperinflation which revealed to all the full excesses of how markets operate. Tables 1.1 and 1.2 give some data on CEE countries in the early stages of transition. Table 1.1 vividly illustrates the severity of the economic dislocations that were taking place in these economies at that time. Not only did output collapse spectacularly in the early stages of transition plummeting to levels not experienced in the West since the Great Depression beginning in 1929, transition was accompanied by rampant inflation as Table 1.2 illustrates. However, Tables 1.1 and 1.2 also demonstrate that the countries of CEE experienced different states of economic collapse and this ended any notion that a single model or path of transition would be optimal for all countries. Instead, a specific economic model for each economy based on local characteristics came to be regarded as the only viable approach by policy makers.

Table 1.1: Growth in Real GDP in Central and Eastern European Economies 1989-1999

Country	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Bulgaria	0.5	-9.1	-11.7	-7.3	-1.5	1.8	2.1	-10.9	-6.9	3.5	2.4
Czech Rep	1.4	-1.2	-11.6	-0.5	0.1	2.2	5.9	4.8	-1.0	-2.2	-0.8
Estonia	-8.1	-6.5	-13.6	-14.2	-8.8	-2.0	4.6	4.0	10.4	5.0	-0.7
Hungary	0.7	-3.5	-11.9	-3.1	-0.6	2.9	1.5	1.3	4.6	4.9	4.2
Latvia	6.8	2.9	-10.4	-34.9	-14.9	0.6	-0.8	3.3	8.6	3.9	1.1
Lithuania	1.5	-5.0	-5.7	-21.3	-16.2	-9.8	3.3	4.7	7.3	5.1	-3.9
Poland	0.2	-11.6	-7.0	2.6	3.8	5.2	7.0	6.0	6.8	4.8	4.1
Romania	-5.8	-5.6	-12.9	-8.8	1.5	3.9	7.1	3.9	-6.1	-5.4	-3.2
Slovak Rep	1.4	-2.5	-14.6	-6.5	-3.7	4.9	6.7	6.2	6.2	4.1	1.9
Slovenia	-1.8	-4.7	-8.9	-5.5	2.8	5.3	4.1	3.5	4.6	3.8	5.2

Source: EBRD, Transition Report 2002

Table 1.2: Inflation in Central and Eastern European Economies 1989–1999

Country	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Bulgaria	6.3	26.3	333.5	82.0	73.0	96.3	62	123.0	1,082.0	22.2	0.7
Czech Rep	1.4	9.7	52.0	11.1	20.8	9.9	9.1	8.8	8.5	10.7	2.1
Estonia	6.1	23.1	210.5	1,076.0	89.8	47.7	29.0	23.1	11.2	8.2	3.3
Hungary	17.0	28.9	35.0	23.0	22.5	18.8	28.1	23.6	18.3	14.3	10.0
Latvia	4.7	10.5	172.2	951.2	109.2	35.9	25.0	17.8	8.4	4.7	2.4
Lithuania	2.1	8.4	224.7	1,020.5	410.4	72.1	39.6	24.6	8.9	5.1	0.8
Poland	251.1	585.8	70.3	43.0	35.3	32.2	27.8	19.9	14.9	11.8	7.3
Romania	1.1	5.1	170.2	210.4	256.1	136.7	32.3	38.8	154.8	59.1	45.8
Slovak Rep	2.3	10.8	61.2	10.0	23.2	13.4	9.9	5.8	6.1	6.7	10.6
Slovenia	1,306.0	549.7	117.7	207.3	32.9	21.0	13.5	9.9	8.4	8.0	6.1
United Kingdom											

Source: EBRD, Transition Report 2002

At the outset of the transition process there was therefore no consensus in the literature about its dimension and evolution. Actually, the phenomenon of transition was new and unprecedented and the term had never before been conceived by either classical or modern economists. The challenge raised by this process focused attention on the connections between microeconomic and macroeconomic variables, and also on the sequencing and timing of the whole transition process. A particular problem existed because lack of historical data prohibited the use of classical econometric techniques over longer time frames. For the most part therefore, early research on transition consisted of assessing the different reforms that would be necessary to develop embryonic market economies and the timing of their implementation.

The solutions to these problems had to be given by practitioners without the benefit of any theoretical foundation which meant that the early days of transition are characterised by a lack of any coherent strategy to be followed across time by successive governments. Practitioners relied on the interests of the moment and so short-termism was the key element of the public management process in the early years of transition. The lack of any clear strategy, generated by the urgency with which policies needed to be formulated and implemented, created an environment characterised by lack of economic culture concerning the construction and implementation of long-term objectives.

1.5 The Early Stages of Transition

1.5.1 Patterns of Transition

According to the IMF (2000) the main ingredients of the transition process were agreed upon fairly early. They are:

Liberalisation: the process of allowing most prices to be determined in free markets and lowering trade barriers that had shut off contact with the price structure of the world's market economies.

Macroeconomic stabilisation: primarily the process through which inflation is brought under control and lowered over time after the initial burst of relatively high inflation that followed liberalisation and the release of pent-up demand. This process required discipline over central government budgets and restraints on the growth of money and credit, that is, discipline in fiscal and monetary policies, as well as progress toward a sustainable balance of payments.

Restructuring and privatisation: the processes of creating a viable financial sector and reforming the enterprises in these economies to render them capable of producing goods that could be sold in free markets and of transferring ownership of firms into private hands.

Legal and institutional reforms: These are needed to redefine the role of the State in transition economies as a prelude to creating market economies and required establishing the rule of law to enforce property rights, as well as the introduction of appropriate competition policies.

Havrylyshyn and Wolf (1999) also set out the specifics of transition and argue that in a broad sense, transition implies:

- liberalizing economic activity, prices, and market operations, along with reallocating resources to their most efficient use;
- developing indirect, market-oriented instruments for macroeconomic stabilisation;
- achieving effective enterprise management and economic efficiency, usually through privatisation and deregulation;
- imposing hard budget constraints, which provide incentives to improve efficiency;

  and
- establishing an institutional and legal framework to secure property rights, the rule of law, and transparent market-entry regulations.

Both sets of criteria broadly involve the same changes and adjustment to achieve transition and it seems there was broad based agreement on what the process involved. However, differences existed in terms of timing the implementation of change and the extent of change required under the different criteria identified. However, Lavigny (1999) also identified reform of the banking system as an important element of the transition process which she argued must be carried out prior to privatisation because the expertise of financial intermediaries is essential if capital is to be allocated efficiently and newly privatised organisations are to function as commercial enterprises. Assessment of the risk-return profile of these enterprises would not have been possible before privatisation, and even after this, it would have remained impossible in the absence of banking reform because banking in the planned economies was a bookkeeping operation and credit was allocated according to the plan rather than in relation to some assessment of risk. Failure to apply commercial principles by the banks would have increased the probability of bank failure with the potential to generate systemic risk throughout the banking sector risking further economic collapse. This aspect of transition is considered in more detail in Chapter 2. Below we give more detail on those aspects of transition identified in the IMF (2000) report and by Havrylyshyn and Wolf (1999).

At the beginning of transition, important policy choices had to be made with respect to the speed and timing at which State assets were to be privatised and the economy liberalised. One approach favoured rapid change based on the belief that ‘shock therapy’ would quickly lead to the creation of functioning markets. In doing so, rationalisation and restructuring would be forced on firms since their very survival would depend on change. As part of this process, it was argued that hard budget constraints would be imposed on firms and as a result inefficient firms would be closed and resources released for use by more efficient organisations. It was also envisaged that this would facilitate new business start-ups and the institutions necessary for transition would emerge as a consequence of these changes. The problem with this approach, which in the event occurred in several of those economies which adopted this approach, is that restructuring, downsizing and closures would release resources, particularly labour, at a faster rate than existing firms could grow and new firms emerge to create employment opportunities and absorb the displaced labour. In fact, shock therapy led to a substantial decline in output, breath taking increases in unemployment and a reduction in economic growth. All of these adverse consequences were only reversed when structural adjustments had worked their way through and market institutions reached a sufficient state of development to support a functioning economy so that the process of transition was no longer constrained.

An alternative approach suggested was a more ‘gradualist’ approach to privatisation and liberalisation. The basic idea underlying this approach was that enterprises would scale back their operations and employment at an orderly pace thus allowing new start-ups to occur gradually leaving greater time for people to adjust to the changing conditions and become more aware of how markets operated and the opportunities they presented. In this model, the private sector would develop and expand in synchronisation with the decline of uneconomic enterprises which were a throwback to the days of central planning. As resources were released from these enterprises, they would be absorbed into the expanding private sector. Indeed, it was envisaged that their very availability would facilitate expansion of the private sector which otherwise might be stifled as inertia restricted resource movement and constrained the development and operation of markets. It was also envisaged that rather than relying on the spontaneous emergence of institutions that support transition, a gradualist approach would allow institutions, so necessary for macroeconomic stability and sustained growth, to develop in line with markets and private enterprise. However, this strategy was not without risk and a piecemeal approach to reform clearly allows the preservation of rents and creates powerful vested interests with an incentive to block further reform. This is exactly what happened in some countries. For example, Belarus, Bulgaria, Romania and Uzbekistan initially made progress with liberalisation and privatisation, but after three or four years of transition these processes were reversed to the extent that the pre-transition state was almost completely restored.

In the event, the transition economies tended to follow one of the two broad patterns along the lines outlined above. In the more advanced economies (broadly Central and Eastern Europe excluding Bulgaria and Romania) liberalisation was relatively rapid and was accompanied by sustained macroeconomic stabilisation and a comprehensive approach to privatisation which included large and small scale privatisations. In tandem with these developments, institutions were created that facilitated the operation of markets and the growth of private enterprise. In the less advanced economies, (broadly the CIS countries but also including Bulgaria and Romania) liberalisation proceeded at a slower and more uneven pace. Macroeconomic stabilisation was compromised by the existence of soft budget constraints which prevented markets from discharging their role of eliminating inefficient producers. The effect of this was to preserve the sub-optimal allocation of resources that had condemned the centrally planned economies to inefficiency and low productivity growth. By constraining the operation of market forces, progress in transition was necessarily limited. The preservation of inefficient organisations no doubt partially stifled the development of business awareness and entrepreneurship and, as a consequence, the rate of new start-ups was well below levels achieved in the more advanced transition economies.

It was initially envisaged by most that liberalisation and macroeconomic stabilisation could be undertaken fairly quickly, as could the privatisation of small-scale enterprises. However, the view was that privatisation of large-scale enterprises and legal and institutional reform would intensify at a later stage of the transition process and take a longer time to complete. In the event, macroeconomic stability and control of inflation were not achieved with the speed that some might have anticipated. This was partly because, as noted earlier, when the planning process collapsed, the national banks of the transition economies were ill prepared to perform the functions assigned to central banks in market economies leaving no mechanism for setting interest rates, managing the financial system, controlling money growth and so on.

We now turn our attention to the indicators of transition initially identified by the IMF (2000) in its World Economic Outlook.

1.5.2 Liberalisation

Whilst the process of liberalisation is clear and well understood involving freeing markets from central control and allowing decentralised decision taking, the pace and extent of liberalisation varied widely across the transition countries. Liberalisation is a relatively easy concept to digest, but measuring the extent to which liberalisation had taken place is a different matter. However, in its Transition Report of 1994, the EBRD unveiled its Index of Liberalisation which aimed to give some objective assessment of the progress of transition. This Index establishes a score card against which progress in transition can be measured and in so doing the Index also provides a basis for comparison. The entries in the Index have changed over the years and in the context of this thesis we focus only on 'Enterprises' and 'Markets'. A full list of what the scores in the Index imply is given in the Appendix on pages but we note here that a score of 4+ represents the standard achieved in an industrialised market economy. On this measure of liberalisation, considerable progress is clearly discernible throughout the first decade of transition by reference to Table 1.3 which shows that, except for Bulgaria, all other countries in the Table achieved a score of 4+ for privatisation of small scale assets with Bulgaria still achieving a 3+. Furthermore, with the exception of Estonia and Romania, all CEE countries in our sample, achieved a score of 4+ for trade and foreign exchange. Nevertheless, Estonia and Romania come close with a score of 4. In all other measures of liberalisation, 3 (±) were the most common scores. These results look very encouraging in terms of the early progress of transition. However, as Table 1.7 shows, the same Index indicates that the process of liberalisation was still not fully complete as late as 2014.

Table 1.3: Index of Liberalisation in 1999.

	Enterprsies Large Scale Privatisation	Small Scale Privatisation	Governance and Enterprise Restructuring	Markets Price Liberalisation	Trade and foreign Exchange Rate System	Competition Policy
Bulgaria	3	3+	2+	3	4+	2
Czech Republic	4	4+	3	3	4+	3
Estonia	4	4+	3	3	4	3-
Hungary	4	4+	3+	3+	4+	3
Latvia	3	4	3-	3	4+	3-
Lithuania	3	4+	3-	3	4+	3-
Poland	3+	4+	3	3+	4+	3
Romania	3-	4-	2	3	4	2
Slovak Republic	4	4+	3	3	4+	3
Slovenia	3+	4+	3-	3	4+	2

Note that transition indicators range from 1 to 4+ with 1 representing little or no change from a rigidly centrally planned economy and 4+ representing the standards of an industrialised market economy.

Source: EBRD Transition Report, 1999

1.5.3 Stabilisation

As with liberalisation, the first decade of transition was characterised by considerable variation in stabilisation and financial discipline across the region. Tables 1.1 and 1.2 show that the countries of Central and Eastern Europe had painful experiences with falling GDP and rising inflation during the early part of transition. Falling GDP could easily have been anticipated in the early years of transition as patterns of consumption changed and unproductive enterprises faced the unsympathetic winds of market forces. However, it does seem likely that the extent of the fall took many by surprise. Table 1.1 shows that although all CEE countries experienced falling real GDP, in some countries the fall was particularly severe.

The inflation experienced in all transition economies reached levels unthinkable in developed countries. In many of the transition countries there is little doubt that the major cause of inflation was increasing budget deficits especially because these tended to be financed by printing money. Table 1.4 shows the evolution of budget deficits in CEE throughout the first decade of transition and Table 1.5 details the growth of broad money over the same period. In the main, budget deficits remained relatively high throughout the first decade of transition, but as transition progressed the average size of the budget deficit fell throughout the region. The same is true of broad money growth though even as late as 1999, the rate of broad money growth would be alarming in developed economies. Certainly in the early days of transition, such rates of broad money growth were inconsistent with price stability and the relatively high rates of inflation documented in Table 1.2 are easily explained as a consequence of this.

In a cash-based economy, where government has a monopoly over currency issue, printing cash provides a straightforward alternative to raising taxes as a means of financing government spending. In the early years of transition, money emission was the primary route through which governments financed the growing gap between government spending and tax revenues and rising levels of inflation were the inevitable consequence. Rising budget deficits were inevitable and, on reflection, there also seems to be some inevitability that these would be financed by resorting to the printing presses. In the early days of transition, the tax base in transition economies was relatively small and the tax system was unsuited to a market economy. (Tanzi and Tsilbouris, 2000.) Indeed, in command economies taxation largely consisted of turnover taxes, taxes on enterprises and payroll taxes with the whole tax administration based on agreements between enterprises and government officials rather than on a codified system with tax bases and tax rates clearly defined in law. Coupled with this, the fall in output impacted negatively on tax revenues and expenditure increased as governments initially propped up failing State owned enterprises with soft budget constraints in an attempt to mitigate the fall in output. The clear implication is that in the early years of transition, fiscal policy was not available as an instrument of stabilisation. Neither could it be used to change incentives and preferences in labour and product markets the way it is in developed economies.

Table 1.4 General Government Budget Balances as a % of GDP

Country	1992	1993	1994	1995	1996	1997	1998	1999
Bulgaria	-5.5	-10.9	-5.8	-6.4	-10.4	-3.0	1.0	-3.6
Czech Rep	-3.1	0.5	-1.1	-1.8	-1.1	-2.1	-2.6	-5.0
Estonia	-0.3	-0.7	-1.3	-1.3	-1.9	2.2	-0.3	-3.0
Hungary	-7.2	-6.6	-8.4	-6.4	-3.0	-4.8	-4.8	-4.5
Latvia	-0.8	0.6	-4.0	-3.9	-1.7	0.1	-0.8	-3.8
Lithuania	0.5	-3.3	-5.5	-4.5	-4.5	-1.8	-5.8	-7.0
Poland	-6.7	-3.1	-3.1	-2.8	-3.3	-3.1	-3.0	-3.0
Romania	-4.6	-0.4	-1.9	-2.6	-4.0	-3.6	-3.3	-2.7
Slovak Rep	N/A	-7.0	-1.3	0.2	-1.9	-4.4	-5.8	-3.2
Slovenia	0.2	0.1	-0.3	-0.5	-0.2	-1.7	-1.4	-1.0

Source: EBRD Transition Report 2000

Table 1.5 Broad Money Growth (% change pa)

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bulgaria	110.0	53.6	47.6	78.9	40.3	117.2	356.8	11.9	13.0
Czech Rep	26.8	20.7	22.5	20.8	20.3	9.1	10.8	5.4	7.7
Estonia	NA	59.0	93.0	40.1	27.8	37.2	37.8	4.2	23.5
Hungary	35.7	27.6	15.7	13.0	18.4	40.9	19.8	15.5	15.6
Latvia	153.0	169.9	84.1	47.7	-23.1	19.9	38.7	5.9	8.0
Lithuania	143.0	245.3	100.2	63.0	28.9	-3.5	34.1	14.5	7.7
Poland	37.0	57.5	36.0	38.2	34.9	34.3	28.1	24.7	20.1
Romania	101.2	79.6	141.0	138.1	71.6	66.0	104.9	48.9	45.0
Slovak Rep	NA	NA	16.8	20.1	19.1	16.6	9.1	2.7	13.0
Slovenia	NA	131.6	64.2	50.8	25.9	21.8	34.1	25.4	12.1

Source: Transition Reports 1999 and 2003

Similarly, at the outset of transition, all CEE economies lacked a central bank and financial markets through which debt instruments could be traded and banks could relieve their funding shortages through transactions in the interbank market. The prevailing system under command economies was one in which monobanks, performed all banking functions. Roaf et al (2005) summarised it thus: “The Communist monobanks encompassed functions of money emission and foreign exchange management, commercial banking (in the sense of passively providing finance for transactions arranged by the planning agencies) and even deposit taking in some cases.”

(pp15) In this system, monetary policy was entirely passive and had no role in stabilising the macro economy. Before monetary policy could perform this role, monetary reform was necessary to transform the monobanks into a two-tier banking system which separated the macroeconomic and prudential role of a central bank from commercial banking. Central banks were quickly created by restructuring the national monobanks and these banks were given the conventional roles performed by central banks in developed market economies. The newly created central banks were immediately given considerable autonomy and the constitution of the Bundesbank was widely used as a model for designing the new central banks of CEE. (Healey and Ilieva, 2005.) Other banking functions (investments, customer deposit facilities and so on which are directly related to business) were transferred to newly created financial intermediaries which were immediately set up as private sector institutions. Unfortunately, the prevalence of soft budget constraints quickly meant that financial intermediaries developed bad loan problems. However, as with all private sector institutions, private firms learn how to survive or perish. Before the first decade of transition had passed, financial intermediaries were thriving throughout the CEE region.

1.5.4 Privatisation

For the transition economies, structural reforms aimed at changing the whole mechanism of the economic system and, among other far reaching reforms, privatisation of assets and the institution of enforceable property rights were central to the creation of a market economy. Privatisation is also a way in which governments raise finance and Megginson (2010) has estimated that by1999, over $1 trillion had been raised by governments world-wide from the sale of State-owned enterprises to private investors and corporations with over two-thirds of this being raised after 1989. However, the 'mass privatisation' programs broadly used by the transition economies actually raised relatively small sums of money for governments despite the fact that these privatisations involved by far the largest number of companies ever privatised.

The interpretation of the term 'privatisation' can differ from one country to another. In general, privatisation is taken to imply the sale of State-owned assets or equity to private investors. However, in the transition economies privatisation implies the transformation of almost an entire command economy into a market-oriented economy with ownership of private property rights enshrined in law.

The history of privatisation began with the election of Margaret Thatcher's Conservative Government in the UK in 1979 and became an essential ingredient of the transition of the former planned economies, including CEE countries, on their road to becoming market economies. As previously noted, governments of the former Communist countries of CEE sold or gave away many State-owned enterprises as part of a broader effort to transform themselves from command to market economies. While these programs resulted in a massive reduction of State ownership and were initially popular politically, they subsequently became unpopular in many countries (especially Russia) because they seemed to encourage the emergence of new oligarchs and a widening gap between low income individuals and the new elite. From the late-1990s onwards, CEE governments have all relied on the more standard methods of privatisation, that is, asset sales and share issuance programs. Table 1.6 gives information on the changing nature of private ownership of resources in the CEE economies for various years from 1992-2012. Apart from Slovenia, where the share of private sector output increased from 65per cent of GDP to 70 per cent of GDP, the share of private sector output has remained static from 2007.

Table 1.6: Private Sector Share of GDP (%) (Selected Years)

Country	Mid 1992	Mid 1995	Mid 1999	Mid 2007	Mid 2012
Bulgaria	45	45	60	75	75
Czech Republic	70	70	80	80	80
Estonia	65	65	75	80	80
Hungary	60	60	80	80	80
Latvia	60	60	60	70	70
Lithuania	55	55	70	75	75
Poland	60	60	65	75	75
Romania	40	40	60	70	70
Slovak Republic	60	60	75	80	80
Slovenia	45	45	55	65	70

Source: EBRD Transition Reports (Various)

Megginson (2010) mentions five types of techniques used through which assets have been privatised:

1. Asset sale, or trade sale, which implies the direct sale of a company to another company or group of investors.

2. Share Issue Privatisation (SIP), which deals with the public offering of common stock to private investors on national or international markets.

3. Voucher privatisation, which means the distribution of exchangeable purchase rights to citizens for free. These vouchers can then be converted into shares in State-owned enterprises.

4. Concessions, which governments grant to private entities that receive the right to operate assets in exchange for an amount paid in advance.

5. The public-private partnership, which uses project finance techniques to build public assets with private capital.

In CEE, assets were mostly privatised through asset sales. One reason for the preference of this approach is that asset sales can be executed more rapidly than SIPs. It is also the case that asset sales might attract foreign investors (if this is desired by policy makers) and can protect strategic assets through well-crafted selling conditions. On the other hand, some empirical research results (See for example, Gupta, Schiller and Ma 1999) suggest that they typically raise less revenue than SIPs. A further problem with asset sales is that they are opaque and are therefore likely to reduce trust in the privatisation process.

By comparison, SIPs, the next most widely used instrument of privatisation, have the advantage of raising more revenue for the government whilst at the same time allowing for discrimination that favours, for example, domestic investors over foreign investors (if this is desired by policy makers). They are also the most transparent method of privatisation and allow for the development of national stock markets by encouraging equity trades in these markets. Against this, SIPs are difficult to undertake and require considerable organisation involving legal formalities and heavy sunk costs.

Consequently, SIPs are only economically viable when relatively large State-owned enterprises are privatised.

Bortolotti, Fantini, and Siniscalco (2004) estimate the determinants of the fraction of privatisation revenues that come from public offerings (SIPs) for privatisations in 49 countries. They find that the greater the selling government's deficit and the more conservative the selling government, the more likely it is that privatisation will occur through public offerings. Fluck, John and Ravid (2007), examine the auction versus private negotiation choice for emerging market governments wishing to divest assets in a politically constrained environment that limits the government's set of choices. They find that the degree of political constraints are instrumental in determining which mechanism is more successful in raising funds.

Using a sample of 2,477 privatisations that raised $1,189 billion in 108 countries over the period 1977-2000, Megginson, Nash, Netter, and Poulsen (2004) examine why 938 firms were privatised using share offerings (in public capital markets), but 1,539 companies were privatised via trade sales (in private markets). They find that SIPs are more likely to occur in countries with less developed capital markets and suggest that this may be due to the political need to boost these markets by increasing liquidity and absorptive capacity. This is in keeping with the results of Subrahmanyam and Titman (1999) who find evidence that SIPs can jump-start stock-market development and trigger gains in economic growth and efficiency by encouraging the creation of the so-called 'equity culture'. We return to this issue in the next chapter.

Megginson, Nash, Netter, and Poulsen (2004) also provide results in support of the hypothesis that a country's political and legal environment affects financing decisions. They find that governments that have less State control over the economy tend to privatise State-owned companies via asset sales. Investors are more willing to make the substantial investments through asset sales when there is a stronger commitment that they will be able to maintain ownership of those assets without undue government intervention.

They also find that the stronger the legal and political environment in providing protection to minority interests, the more likely the firm is to be privatised via a SIP.

Firm-specific characteristics, such as the size of the offering for sale and the profitability of the State-owned company, also impact the favoured method of privatisation. Larger offerings and more profitable State-owned enterprises are more likely to be privatised through SIPs and the public capital markets. Existing public capital markets are better able to absorb the largest offerings and asymmetric information problems are fewer for larger and more profitable offerings which thus attracts more potential investors.

1.6 Identifying the Institutional Framework

We have referred above to the creation of institutions as a crucial aspect of the transition process, but these institutions were neither identified nor defined in our discussion. In fact, there are many definitions of institutions, but for our purposes institutions are taken to imply some aspect of society that serves to organise economic behaviour. In particular, the major elements of a market economy are: -

Firms and households are basically decentralised decision takers and are responsible for decisions concerning consumption and, through that in a market economy, for production. Decisions are motivated by the structure of incentives which form the basis of the allocative mechanism and are based on the allocation of ownership rights and the rules and regulations which limit economic actions and behaviour. In the former Soviet Bloc countries of CEE, the existence of an economic plan placed considerable constraints on the activities of firms since for most, all decisions relating to output and employment were taken centrally. Decisions by consumers were decentralised for most products, but long waiting lists existed for many of these such as cars, washing machines and so on. At the outset of transition, both firms and households had to learn the implications of decentralised decision taking. This was particularly problematical for those firms which had only experienced soft budget constraints, but which were sometimes quickly and brutally exposed to the harsh realities of hard budget constraints. Inevitably standards of governance were poor by Western standards and before firms could effectively perform their traditional role in market economies, adequate governance structures had to be put in place. Table 1.7

shows that as late as 2005, sixteen years after the start of transition, much still remained to be done in many CEE countries in terms of creating sound governance structures.

Table 1.7: Country Transition Indicator Scores 2014

	Enterprises Large Scale Privatisation	Small Scale Privatisation	Governance and Enterprise Restructuring	Markets Price Liberalisation	Trade and foreign Exchange Rate System	Competition Policy
Bulgaria	4	4	3-	4+	4+	3
Czech Republic	NA	NA	NA	NA	NA	NA
Estonia	4	4+	4-	4	4	4-
Hungary	4	4+	4-	4+	4+	3+
Latvia	4-	4+	3+	4+	4+	4-
Lithuania	4	4+	3	4+	4+	4-
Poland	4-	4+	4-	4+	4+	4-
Romania	4-	4-	3-	4+	4+	3+
Slovak Republic	4	4+	4-	4+	4	3+
Slovenia	3	4+	3	4	4+	3-

Note that transition indicators range from 1 to 4+ with 1 representing little or no change from a rigidly centrally planned economy and 4+ representing the standards of an industrialised market economy.

Source EBRD Transition Report 2014

Markets are the mechanisms through which goods and resources are exchanged between firms and households and through the process of exchange, markets determine the allocation of resources throughout the economy. The existence of markets gives expression to the development of economic opportunities and encourages both productive and allocative efficiency through the development of competitive pressure. In many of the planned economies free markets existed for some products. For example, many people sold excess produce from their gardens on street stalls at prices determined outside of the central plan. However, before transition free markets were limited and comparatively insignificant in the centrally planned economies. Consumers and producers were therefore obliged to learn the lessons of market participation and in the event these lessons had to be learned quickly since the collapse of the planning mechanism occurred without warning and at spectacular speed.

Financial institutions provide a crucial link in the integration of transactions over time. They provide facilities for savers and opportunities for firms and households to borrow to finance their consumption and short term investment plans. Without banks, markets can only function at high cost (Fries and Taci 2002). Banks mobilise and allocate capital efficiently and prudentially to facilitate the process of saving and investment that promotes long term growth and prosperity. By providing money transmission facilities, banks also aid the development of stock markets by ensuring that settlement procedures operate efficiently giving confidence in the execution of buy and sell orders.

The development of functioning stock markets is fundamental to the transition process since they provide the means through which long term savings are made available to firms to fund long term investments. This involves the sale of stock giving rights of ownership which are irredeemable on demand, but which can subsequently be transferred to other stake holders in the secondary market.

The State plays an important role in market economies by providing a set of rules within which other institutions (firms, households and markets) operate. These rules give protection against fraudulent or dangerous activities and attempt to ensure that information disseminated among individuals and institutions is accurate and not deliberately misleading so that the conditions are created to facilitate rational decision taking by all economic agents. In the absence of these rules, risk taking by entrepreneurs and investors generally would be discouraged and consumers and firms would take sub-optimal decisions that would lead to lower value transactions, and, in the extreme, to the pursuit of value reducing activities.

In market economies, the State also has a responsibility to avoid market failure as far as possible. This again can be done through the creation of rules that restrict the growth of monopoly and through direct provision of public goods and merit goods that would otherwise not be produced at all, or, in the case of merit goods, would be under-produced in relation to the socially optimal level if provision were left entirely to the market. The State also intervenes to alter the structure of preferences by granting subsidies to merit goods to encourage consumption and taxing demerit goods to discourage consumption. In any case, State involvement is funded through tax revenues and here again the State has a responsibility to ensure that taxes are collected in ways that do not cause unintended side effects and have little influence, except where such influence is intended to discourage production and consumption decisions that reduce total utility, for example because they impose social costs on society that are not priced by the market.

1.7 Progress in Transition

At the outset of transition, many envisaged that the process would be rapid and that building market oriented economies would lead quickly and inexorably to rapidly rising living standards and strong economic growth. In the event, the process has been complex, difficult and lengthy. Neither has it been smooth nor of uniform pace in every country. Some countries progressed quite rapidly, whilst in others, progress was laboured and proceeded at a relatively slow pace so that change occurred gradually. It seems strangely naive that uniformity in transition experiences could ever have been expected since economies vary widely in so many different ways, as this chapter has shown.

1.7.1 EBRD Indicators of Transition

It is now more than twenty five years since the process of transition first began in CEE. A very early development was the reunification of Germany which clearly eased the process of transition for the former East Germany because it was, and remains even now, heavily subsidised by the former West Germany. However, other countries have also achieved considerable success in the process of transition and Bulgaria, the Baltic States, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, and Slovenia have all joined the European Union. Slovenia was first to join the euro in 2007 followed by the Slovak Republic (2009) Estonia (2011) Latvia (2014) and Lithuania (2015). Since a condition of entry into the EU is that countries satisfy the

Copenhagen Criteria which stipulate, among other requirements, that a country must have a functioning market economy, it is clear that for these countries transition is now complete. A general indication of how far transition has progressed in Central and Eastern Europe can be gleaned from Table 1.7 which shows country transition indicators as they stood at 2014. Comparison with Table 1.3 shows that, although progress has been made by all countries since the earlier period, no country has yet achieved a score of 4+ across the board. Interestingly, Romania experienced a decline in its score for 'Governance and Enterprise Restructuring' and Slovenia experienced a decline in its score for 'Large Scale Privatisations' compared with the situation in 1999 as indicated in Table 1.3. Nevertheless, although transition is clearly complete for all the countries of CEE, several are still not fully comparable with developed market economies on all indicators set by the EBRD.

1.8 Macroeconomic Developments

Along the way, there have been bumps and reversals and early in the process of transition, the financial crisis in Russia in 1998 adversely impacted on progress. At this time, many of the former transition economies of CEE still had strong trading links with Russia and, when Russia devalued the ruble, this led many foreign investors to withdraw their funds from the transition economies of CEE. As Dezseri (2013) notes "Every time Russia has experienced a financial crisis, there has been 'contagion' to the financial markets of Central and Eastern Europe. This phenomenon is partly a reflection of perceptions rather than realities. Large numbers of Western investors still handle their dealings with the transition economies as if they constitute a single bloc disregarding the difference, both in macroeconomic fundamentals and in progress toward reform between Central and Eastern Europe on the one hand, and Russia and other CIS countries on the other." (pp 178).

As a direct consequence of the flight of foreign capital, the confidence of domestic investors declined and the prices of stocks in companies with heavy Russian exposure fell significantly generating a contagion effect which led to a general fall in share prices with stock market indices falling in Hungary by 44 per cent, by 25 per cent in Poland and the Czech Republic, and by around 5% in the Slovak Republic. (Dezseri

2013). The heavy exposure of many of the region's banks to the Russian economy further meant that capital losses from exchange rate movements and falls in asset prices precipitated banking crises throughout CEE. However, as Tables 1.1 and 1.2 suggest, the financial crisis in Russia does not appear to have had a major negative medium term or long term impact on the course of transition in CEE. Indeed, before the crisis began, concern was growing over the large amounts of 'hot money' flowing into the region which was driving many CEE countries' exchange rates upwards. "Some of these currencies were being traded near the top of their official trading bands. Exporters feared that overvaluation would choke off economic growth, while the monetary authorities feared that they would have to cut interest rates prematurely, thus jeopardising the fight against inflation." (Dezseri 2013 pp178.) The Russian crisis completely changed the situation and had a positive impact on the prospects of the transition economies. 'Hot money' deserted the CEE region seeking a home elsewhere so that exchange rate pressure evaporated. Again as Dezseri (2013) notes "So much 'hot money' has left the region that the Polish zloty, the Hungarian forint, and other currencies that were under pressure were being traded comfortably in the centre of their rolling trading banks in the spring of 1999. It has become possible once again to cut interest rates without driving up inflation." (pp178.) Tables 1.1 and 1.2 therefore provide supporting evidence that the Russian financial crisis did not exert a powerful impact on either growth or inflation in the transition economies of CEE. Output dipped during the crisis but it had been falling across the region in the years prior to the crisis and inflation continued its downward path. It is, of course, possible that the Russian financial crisis exacerbated the decline in output and may have impeded further progress in reducing inflation. To the extent that this is true, the effects seem negligible and were quickly reversed. A decade earlier, the effects of the Russian financial crisis would almost certainly have had a far more serious impact on the economies of CEE because of the integrated nature of these economies with Russia. It is a measure of how far transition had progressed within a decade that the Russian financial crisis had a negligible impact at best on the CEE economies and passed almost unnoticed in some countries.

The second decade after the process of transition began was, for the most part, a period of expansion and growth, accompanied, again for the most part, by declining inflation. However, there is no doubt that towards the end of the second decade, as the global financial crisis erupted, the economies of CEE, no longer by then transition economies, were in deep crisis. As Table 1.8 shows, in 2008, most countries in the region experienced a slowdown in economic growth. Hungary and Romania bucked the trend, but across the board output continued its downward spiral in 2009. Ironically, in terms of the region's economic progress and prospects, this was an encouraging sign. Two decades earlier, a financial crisis in the West would have had comparatively little impact on the countries of CEE because of their closer integration and economic ties with the former Soviet Union. In 2009 these economies were more fully aligned with the West and the most graphic demonstration of this was that, like the rest of Europe and the USA, the financial crisis had a quite abrupt and devastating impact throughout CEE with the Baltic countries experiencing the severest fallout with output declines in excess of 14 per cent. Latvia experienced the worst excesses of this downturn which continued into 2010 and, even by the end of 2014 the negative effects of the recession had still not been fully recouped. Despite this, most of the CEE countries had returned to positive growth by 2010. Nevertheless, the whole of the CEE region learned a harsh lesson: membership of the EU and increasing integration with the West does not simply confer benefits. It also comes with risks and costs and whilst Europe and the West stagnated, Russia and many of the former CIS countries experienced growth.

Table 1.8: Growth in Real GDP in Central and Eastern European Economies

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bulgaria	5.4	4.0	4.8	4.5	6.6	6.0	6.5	6.9	5.8	-5.0	0.7	2.0	0.5	1.1	1.7
Czech Rep	3.9	2.6	1.5	3.2	4.9	6.4	6.9	5.5	2.7	-4.8	2.3	2.0	-0.9	-0.5	2.0
Estonia	7.9	6.5	7.2	6.7	6.5	9.5	10.4	7.9	-5.3	-14.7	2.5	8.3	4.7	1.6	2.1
Hungary	5.2	3.8	3.5	2.9	4.8	4.3	4.0	0.5	0.9	-6.6	0.8	1.8	-1.5	1.5	3.6
Latvia	6.9	8.0	6.4	7.5	8.9	10. 2	11.6	9.8	-3.2	-14.2	-2.9	5.0	4.8	4.2	2.4
Lithuania	3.9	6.4	6.8	9.0	4.9	6.4	7.4	11.1	2.6	-14.8	1.6	6.1	3.8	3.3	2.9
Poland	4.0	1.0	1.4	3.8	5.1	3.5	6.2	7.2	3.9	2.6	3.7	4.8	1.8	1.7	3.4
Romania	1.8	5.3	4.9	5.2	8.4	4.2	8.1	6.9	8.5	-7.1	-0.8	1.1	0.6	3.4	2.9
Slovak Rep	2.0	3.8	4.6	4.5	5.2	6.5	8.3	10.7	5.5	-5.3	4.8	2.7	1.6	1.4	2.4
Slovenia	4.1	2.7	3.5	2.7	4.4	4.0	5.7	6.9	3.3	-7.8	1.2	0.6	-2.6	-1.0	2.6

Source: Eurostat

Control of inflation is another element of macro stabilisation and, as Table 1.2 shows, the early years of transition were catastrophic in this sense with rates of inflation measures in three, and for Estonia and Lithuania four, digits were experienced. Rates of inflation of these magnitudes are unimaginable in developed economies and led to economic misery for the majority of the population. This explosion of inflation was caused by excess demand occasioned by deferred consumption decisions earlier in the period, wage increases, rising import prices (including oil) and rising central government budget deficits financed by printing money. In a cash-based economy, where government has a monopoly over the issue of currency, printing cash provides a straightforward alternative to raising taxes as a means of financing government spending. In the early years of transition, money emission was the primary route through which governments financed the growing gap between government spending and tax revenues. In any economy there are three ways in which a budget deficit can be financed:

1. Increasing taxation;
2. Increasing the note issue or borrowing from the banking system – both of which will increase the money supply and, in the latter case, will increase government debt;
3. borrowing from the public or from abroad – which increases government debt.

In the early days of transition, the tax base was relatively low and so, even though budget deficits were low by developed economy standards, increasing taxation as a method of financing budgetary expenditures was not viable in the early stages of transition. Moreover budget deficits increased as governments found it difficult to cut back on expenditures and many allowed the continuation of soft budget constraints for several years after the commencement of transition. There was also a problem with selling debt to the public because in developed economies this is usually done through the stock market and, in the early stages of transition, these were absent in the countries of CEE. Borrowing from abroad also posed problems because of the relatively high default risk since foreign debt must be repaid in foreign currency and some doubt existed about whether the transition economies would be able to raise the necessary foreign currency to service and repay any debt bought by foreign nationals or institutions. Inevitably governments resorted to the printing press to finance their deficits and this generated hyperinflation which, in some cases, took almost a decade to reign back.

Against this constellation of inflationary factors, output was declining as exposure to markets forced structural change on industrial enterprises which were unable to respond to the change in consumer preferences at a rate sufficient to take up the slack generated by the closure of uneconomic firms. After the first decade of transition, inflation in most CEE countries was at impressively low rates given the experiences of the early and middle years of the decade.

Again there have been set backs along the road to sustained low inflation and different countries had different experiences because of country specific factors such as the state of business activity, the conduct of monetary and fiscal policies, the differing effects of changes in world prices on individual economies and so on. As Table 1.9 illustrates, throughout the region inflation gathered momentum from 2004 onwards until 2008. Latvia experienced the worst excesses of inflation which peaked at 15.3 per cent in 2008. This was followed by Bulgaria which recorded a peak of 12 per cent in 2008 and was closely followed by Lithuania which recorded a peak of 11.1 per cent in 2008 and Estonia which recorded a peak on 10.8 per cent in the same year. After the highs of 2008, inflation was increasingly brought under control mainly because of tight monetary and fiscal policies applied by all CEE central banks and governments respectively and by the economic slowdown that began in 2011 and continued into 2013. By 2013, no country in the region experienced inflation that differed substantially from levels close to the targets set by central banks in similarly developed countries.

Table 1.9: Inflation in Central and Eastern European Economies 2000-2014

Country	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Bulgaria	9.9	7.4	5.9	2.3	6.1	6.0	7.4	7.6	12.0	2.5	3.0	3.4	2.4	0.4	-1.6
Czech Rep	4.0	4.7	1.8	0.2	2.6	1.6	2.1	3.0	6.3	0.6	1.2	2.1	3.5	1.4	0.4
Estonia	4.0	5.8	3.6	1.3	3.0	4.1	4.4	6.7	10.8	0.2	2.7	5.1	4.2	3.2	0.5
Hungary	9.8	9.2	4.8	4.9	6.8	3.5	4.0	7.9	6.0	4.2	4.9	4.0	5.7	1.7	-0.3
Latvia	2.6	2.5	1.9	3.0	6.2	6.9	6.6	10.1	15.3	3.3	-1.2	4.2	2.3	0.0	0.7
Lithuania	1.0	1.5	0.3	-1.2	1.2	2.7	3.8	5.8	11.1	4.2	1.2	4.1	3.2	1.2	0.2
Poland	10.1	5.5	1.7	0.7	3.6	2.2	1.3	2.6	4.2	4.0	2.7	3.9	3.7	0.8	0.1
Romania	45.7	34.5	22.5	15.4	11.9	9.1	6.6	4.9	7.9	5.6	6.1	5.8	3.4	3.2	1.4
Slovak Rep	12.0	7.3	3.0	8.5	7.5	2.8	4.3	1.9	3.9	0.9	0.7	4.1	3.7	1.5	-0.1
Slovenia	8.9	8.4	7.5	5.6	3.7	2.5	2.5	3.8	5.5	0.9	2.1	2.1	2.8	1.9	0.4

Source: Eurostat 2015

1.8.1 Fiscal Policy

One of the main instruments to achieve macroeconomic stabilisation in any economy is fiscal policy. Fiscal stance can be measured by the size and direction of the general government structural balance. In this sense, the stance of fiscal policy in the economies of CEE has shown clear signs of consistent improvement since the early years of transition when, as Table 1.4 shows, the state of the budget deteriorated markedly from the outset of transition and into the early 90s. At the outset of transition, fiscal imbalances deteriorated because the tax system was not geared to the needs of a market economy and inflows of revenue declined because, as the economies of CEE were exposed to the forces of the market, output inevitably collapsed and it took time for recovery, adjustment, and the implementation of a properly codified tax system in line with that in place in modern industrial economies. However, as Table 1.10 shows, most countries brought down their fiscal imbalances during the 1990s, albeit some more quickly than others.

By 2000, all CEE countries had overhauled their taxation system and VAT had been introduced by all. As well as a major source of government revenue, VAT was introduced as a means of improving the allocation of resources by reducing distortions in product and factor markets. However, to maintain fiscal sustainability, it was also necessary for countries to bring down public expenditure. To achieve this, subsidies to firms were reduced or eliminated and defence spending was trimmed. Against this, social expenditures have increased as governments took more responsibility for provision in this area which, under the command system, had formerly been the responsibility of employers.

Even as transition was completed and economic development progressed, fiscal imbalances in some CEE economies remained outside the 3 per cent of GDP ratio normally regarded as the ratio associated with economic stability by Western policy makers, as Table 1.10 shows. However, there is no doubt that on average, fiscal imbalances had improved and for many countries, the budget deficit was well within the ratio of 3 per cent of GDP. In 2013, Slovenia, with a ratio of -13.8 remained well outside the target and the only other country to breach the 3 per cent ratio was Poland with a ratio of -4.3 per cent. There is no doubt that the drive towards meeting the fiscal obligations enshrined in the Maastricht criteria provided impetus to improving the magnitude of the general government budget balance throughout the entire CEE region, and membership of the euro (for those that have joined) has placed them in the fiscal straight jacket of the Stability and Growth Pact.

Table 1.10 General Government Budget Balances as a % of GDP Average 2008-2013, 2012 and 2013

Country	Average 2008-2013	2012	2013
Bulgaria	-1.1	-0.5	-1.9
Czech Rep	-3.3	-4.2	-1.5
Estonia	-0.6	-0.2	-0.2
Hungary	-2.1	-0.2	-2.4
Latvia	-4.5	01	-1.1
Lithuania	-5.2	-3.3	-2.2
Poland	-5.4	-3.9	-4.3
Romania	-4.6	-2.5	-2.5
Slovak Rep	-4.9	-4.5	-2.8
Slovenia	-5.6	-3.1	-13.8

Source: Adapted from Rapacki et al (2015)

Despite the encouraging figures shown in Table 1.10, there is no doubt that the fiscal position of countries in the CEE region, like other countries, has deteriorated because of the global financial crisis in 2008 and the economic downturn that followed has led to falling tax revenues and rising expenditures. Rising government deficits impact on levels of public debt and the combined effect is to reduce the credibility of countries experiencing these. This leads to rising interest rates and, in some cases, a decline in the flow of direct foreign investments and foreign credits – especially for those countries currently outside of the euro.

1.8.2 Monetary Policy

In keeping with global trends, central banks in most CEE countries have now adopted inflation targeting as the anchor for monetary policy, though for five of them (Estonia, Latvia, Lithuania, the Slovak Republic and Slovenia) this is a de facto consequence of their participation in the euro. Of the remaining economies of CEE, only Bulgaria, which has a currency board, has not adopted inflation targeting as a nominal anchor for monetary policy. That this policy has succeeded in maintaining impressively low rates of inflation is shown in Table 1.9. This was partly because of the more relaxed approach to monetary policy adopted by many central banks in the region. For example, some countries, including Hungary, Latvia and Romania, relaxed reserve requirements in order to pump liquidity into the financial sector. The Vienna Initiative, launched by European banks and governments at the height of the first wave of the financial crisis in January 2009, provided a framework for safeguarding the financial stability of emerging economies by ensuring that foreign banks did not make rapid and disorderly withdrawals of funds that would have caused financial chaos.

1.8.3 Banking and Capital Market Developments

Under Communism, financial markets were non-existent since they served no purpose and had to be created from scratch once the Soviet Union disintegrated in 1989. Without financial intermediation and a functioning stock market, a market economy cannot be created. Progress in creating a monetary sector providing financial intermediation and an efficient capital market has been impressive throughout the CEE region. For this to happen, a sound regulatory framework had to be created with strong legal foundations backed up by the emergence of institutional investors in the form of pension funds and insurance companies. (Institutional investors are more formally defined as “Specialised financial institutions which manage savings collectively on behalf of small investors towards a specific objective in terms of acceptable risk, return maximisation and maturity of claims” (Davis, 1996 pp64)) It is also a prerequisite for the creation of a transparent and efficient capital market. Testimony to the resilience of the financial sector is the way it has withstood the financial crisis (EBRD 2010).

One widely used measure of financial market development is the ratio of domestic lending to private sector to GDP. This measure indicates the width and depth of financial intermediation. Table 1.11 details the changes that have taken place in this indicator between 1995 and 2012. Whilst for most CEE countries impressive progress is clearly discernible, the average for industrialised Western countries is around 160 per cent implying the CEE region as a whole still has far to go.

Table 1.11 Domestic Lending to the Private sector as a Percentage of GDP 1995 and 2012

	Domestic lending to Private Sector (% GDP)	
Country	**1995**	**2012**
Bulgaria	39.9	71.4
Czech Rep	70.8	56.7
Estonia	16.2	77.4
Hungary	22.6	56.8
Latvia	8.1	67.6
Lithuania	14.7	51.0
Poland	16.0	53.7
Romania	N/A	45.0
Slovak Rep	36.4	45.0
Slovenia	25.2	87.4

Source: World Bank, World Development Indicators

Like financial markets, capital markets were also extinguished under Communism and,had to be created from scratch. Stock markets were not created immediately and required the creation of a properly functioning financial sector to facilitate the transfer of funds between stock market traders. However, by the mid 1990s, all countries in the CEE region had emerging stock markets. As might be expected, market capitalisation was relatively low at the outset of transition, but grew as confidence grew and the privatisation programmes gathered momentum. Table 1.12 gives some relevant details. Again, market capitalisation lags well behind the levels of developed Western stock markets with the UK and the USA having market capitalisation rates of 115.5 per cent of GDP.

Table 1.12 Market Capitalisation a Percentage of GDP 1995 and 2012

	Market Capitalisation (% GDP)	
Country	**1995**	**2012**
Bulgaria	0.5	13.0
Czech Rep	28.3	18.9
Estonia	21.8	10.4
Hungary	5.4	16.9
Latvia	0.2	3.9
Lithuania	2.0	9.4
Poland	3.3	36.3
Romania	0.3	9.4
Slovak Rep	4.9	5.0
Slovenia	1.5	14.3

Source: Standard and Poor's Global Stock Market Factbook 2000 and 2014

At the outset of transition, there were many reasons to suppose that capital markets would not be efficient and that efficiency of these markets would develop 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 with little knowledge of marketing, profit and loss accounting and so on. In these circumstances the actions of market participants would be unlikely to accord with the efficient market paradigm. However, as we shall see later in chapters 4 and 5, a battery of tests confirm that stock markets in the CEE region are informationally efficient and have been for a number of years.

This is important because there is evidence that establishing appropriate financial and economic institutions is an important feature of successful transition from a centrally planned economy 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 established, the sooner there will be sound benchmarks for enterprises to be privatised. The clear implication is that an efficient capital market is helpful in creating the conditions necessary for a functioning market economy.

1.8.4 Trade and Payments

The web of trade and payments arrangements binding countries of CEE under the CMEA assistance arrangements is incompatible with liberalised trading arrangements and currency convertibility. It is therefore informative to reflect on the extent to which the countries of CEE have become more open economies, that is, dependent on exports and imports to and from a variety of destinations, and in particular the extent to which they have become integrated with Western Europe since transition began. Specific details about the structure of trade among the CEE countries prior to transition is scant to say the least, but Table 1.13 gives details of exports for four CCE countries in 1989. The degree of interdependence is striking and, although generalisations cannot be made, the implication is that the structure of trade throughout the pre-transition CEE was dominated by trade within the Soviet Union. For example, reflecting on the Russian financial crisis of 1998, Roak et al (2014) have noted that "The shock from the Russian financial crisis reverberated both regionally and globally. In the region, it was felt most strongly through the collapse of Russian imports which halved in the months following the (ruble's) devaluation." (pp 31) The authors go on to note that the Baltics were particularly hard hit because their export shares to Russia were in the region 20-25 per cent of total exports. Nevertheless, as Table 1.1 indicates, setbacks were quickly overcome and transition progressed remorselessly onwards.

Table 1.13: Shares of some CMEA in exports of member Countries; Shares of the USSR in exports of member Countries (1989 – percentage of total exports)

	CMEA/Total		USSR/CMEA	
Country	**X**	**M**	**X**	**M**
Bulgaria	83	73	79	74
Hungary	39	39	62	56
Poland	35	32	60	56
Romania	40	55	58	59

Source: Michopoulos and Tarr (1991)

Table 1.14: Foreign Trade and its Direction (2012)

Country	**Trade as %age of GDP**	**Main Directions of Trade (% of total)**							
		W Europe		**CSEE**		**CIS**		**Other**	
		X	M	X	M	X	M	X	M
Bulgaria	69	45.9	43.9	23.0	17.6	6.2	24.6	24.9	13.9
Czech Republic	75	63.6	56.4	21.1	19.8	5.1	7.7	10.2	16.1
Estonia	90	54.4	57.0	17.9	28.5	15.3	6.7	12.4	7.8
Hungary	86	56.4	53.6	26.2	19.3	6.0	10.4	11.4	16.7
Latvia	62	32.5	40.9	34.8	39.0	22.8	14.1	9.9	6.0
Lithuania	83	36.3	36.2	27.2	22.5	29.6	35.6	6.9	5.7
Poland	46	63.4	60.6	17.5	11.1	9.7	14.0	9.4	14.3
Romania	43	56.0	58.6	18.3	22.1	6.3	10.3	19.4	9.0
Slovak Republic	93	54.9	43.4	37.5	29.6	4.0	11.1	3.6	15.9
Slovenia	74	51.2	55.3	29.9	20.0	6.6	1.8	12.3	22.9

Source: Rapacki et al (2015)

Table 1.14 gives details of exports and imports as a percentage of GDP for the CEE region and also records the percentages of exports and imports traded with Western Europe, Central and South Eastern Europe, the Commonwealth of Independent States and other destinations as a percentage of the respective total values in 2012. The emergence of Western Europe as the dominant trading partner for CEE countries is clear. Overall, with respect to trade, Poland is the most integrated country with 63.4 per cent of its total exports to Western Europe and 60.6 per cent of its total imports from the same region, and the least integrated country is Lithuania. But even here, Western Europe is still the dominant trading region with 36.3 per cent of exports destined for Western Europe and 36.2 per cent of imports coming from the same region. For the smaller economies of CEE, the value of trade as a percentage of GDP falls within the range of any other small open economy which, according to the World Bank, typically record values which range from 50- 90 per cent (World Bank, 2012). The larger economies of Poland and Romania recorded a lower ratio of trade to GDP indicating a lower degree of openness. Nevertheless, in all cases the importance of Western Europe as a trading partner is clear, though the Central and South Eastern European region also remains important in trade flows. However, just as striking as the importance of Western Europe is the decline of the CIS in terms of trade flows with CEE. Latvia, Lithuania and Bulgaria still maintain strong trading links with the CIS, but for other CEE countries the CIS is considerably less important and certainly far less important than it was at the start of transition.

Continuing balance of payments deficits predictably remained a problem throughout the CEE region as transition progressed throughout the 1990s. However, even as transition progressed and was completed, deficits remained stubbornly persistent in some countries and, until recent times, remain so more than twenty five years since transition began. For example, for countries in the region the average current account deficit deteriorated from 7 per cent of GDP in 2004 to 10 per cent of GDP in 2008 (Balázs and Jevčák 2015). Paradoxically, for many CEE countries, the financial crisis resulted in an improvement in their external payments situation as declining economic growth reduced imports by more than exports, and by 2013, on average, countries were recording a small surplus. Table 1.15 gives more specific details.

Table 1.15 Current Account Balances 2009-2014

Country	2009	2010	2011	2012	2013	2014*
Bulgaria	-8.637	-1.45	0.083	-1.119	2.253	0.045
Czech Rep	-2.336	-3.67	-2.111	-1.567	-0.53	0.615
Estonia	2.542	1.799	1.355	-2.484	-1.128	0.053
Hungary	-0.812	0.28	0.752	1.899	4.143	4.248
Latvia	8.036	2.316	-2.795	-3.261	-2.337	-3.115
Lithuania	-0.33	-3.848	-1.19	1.601	-0.368	0.213
Poland	-3.962	-5.463	-5.151	-3.55	-1.328	-1.221
Romania	-4.493	-4.586	-4.626	-4.522	-0.81	-4.681
Slovak Rep	-3.459	-4.737	-4.984	0.947	1.52	0.161
Slovenia	-0.698	-0.079	0.225	2.651	5.607	5.773

*Estimates
Source: IMF, World Economic Outlook Databases

It is clear that some countries had much stronger current account positions than others and the region as a whole clearly has a relatively high propensity to import which implies an inefficient and uncompetitive production base. The significance of current account deficits depends not only on their size, but also on the mechanism through which they are financed. Unless current account deficits are offset by autonomous, rather than accommodating, capital inflows, the domestic economy and the external value of the currency are weakened and, as foreign debt grows, this reduces the potential for future economic growth. A deficit financed by an autonomous inflow of foreign capital does not restrict future growth to the same extent and might even enhance it.

Historically, the volume of foreign debt (public and private) for countries within the region has not been a cause for concern and has been comparable with IBRD standards for less and medium developed economies (Rapacki, et al 2015). However, in more recent years, foreign debts have increased significantly in several countries in the region. As Table 1.16 shows, in 2013 foreign debt in Hungary, Latvia and Slovenia considerably exceeded 100 per cent of GDP and in Bulgaria, foreign debt stood at 97.2 per cent of GDP and at 90.8 in Estonia. In all other CEE countries foreign debt was less than 80 per cent of GDP which is consistent with IBRD targets for countries at the stage of development within the target group of countries that are the subject of this investigation. Despite this, in most CEE countries the ratio of foreign debt to public debt is relatively high, and this, coupled with the strengthening real exchange rate, (see Table 1.16) indicates that current account deficits were largely financed by flows of capital to the private sector and this implies autonomous financing of the current account deficit. To that extent, current account deficits in CEE countries are financed by autonomous investment and, to the extent that this autonomous investment is real investment in capital assets rather than portfolio investment, economic growth is likely to be enhanced. This is particularly important since it might otherwise provide a brake on future growth when overseas debt falls due for redemption and must be repaid. In these circumstances, domestic investment and consumption will necessarily have to be reduced as overseas debt is repaid and this will be easier if investment has been in productive assets and has generated greater growth.

Table 1.16 Public and Foreign Gross Debt as a Percentage of GDP

Country	**Public Debt 2013**	**Foreign Debt 2012**
Bulgaria	42.7	97.2
Czech Rep	47.9	47.4
Estonia	11.3	90.8
Hungary	79.2	130.3
Latvia	32.1	139.8
Lithuania	39.3	73.3
Poland	57.5	74.4
Romania	39.3	77.3
Slovak Rep	54.9	77.2
Slovenia	73. 0	115.6

Source: Rapacki et al (2015)

1.8.5 Exchange Rates

By and large, the economies of CEE opted early for some sort of pegged exchange rate system with some requiring softer pegs than others. However, as economies have evolved, so preferences for different exchange rate systems have evolved. The firmest peg of all has been established by those countries adopting the euro, but Bulgaria, through its currency board, also has a very firmly pegged exchange rate. Of the remaining countries of CEE, the Czech Republic and Romania have a managed float and Hungary and Poland have free floating exchange rates.

Table 1.17 gives details of the behaviour of the real exchange rate over 2005-2013 for those CEE countries that have not joined the euro. The upward march of the real exchange rate over the period implies some strength in the external position of those countries represented in Table 1.17. This is encouraging because it is consistent with a market view of the external position of countries in the region being financed in a sustainable medium term way.

Table 1.17 Changes in the Real Effective Exchange Rate (Selected Countries) 2005-2013 (2005 = 100)

Country	2013 2005 = 100	Average Annual Growth Rate
Bulgaria	123.3	2.6
Czech Rep	118.7	2.2
Hungary	102.6	0.3
Poland	101.3	0.2
Romania	105.4	0.7

Source: Rapacki et al)

On the whole, and despite the stubbornness of deficits in the recent past in some countries, there has been no significant deterioration in external positions for the region across the board (as business cycle theory predicts) as economies recovered from recession. As Rapacki,, et al (2015) have noted, most CEE countries have brought their current accounts closer to equilibrium and some (Hungary, the Slovak Republic and Lithuania) have even achieved a surplus.

The improvement in external balances was largely attributable to a fall in investment along with an increase in the gross savings ratio in most countries (Balázs and Jevčák 2015). This is important because, along with budget deficits, the state of the current account restricts the implementation of an active policy designed to promote prosperity and growth.

1.9 Conclusion

For all CEE countries in this investigation, transition is complete and all countries have functioning market economies displaying many of the features of a fully developed economy. In less than two decades these countries witnessed the birth of enterprise, the creation of independent central banks and a stable banking sector fit for the needs of a market economy. These countries have created functioning stock markets which are informationally efficient and modelled along the lines of those in developed market economies. They have overhauled their tax systems and have public debt at levels which range from relatively low to relatively high when judged against the widely accepted level of sustainability at sixty per cent of GDP. They have become open economies and all have now joined the EU. Predictably, economic progress in some countries has exceeded that in others, but given the state of economies throughout the CEE region when the Soviet Union collapsed, progress across the board has been impressive and, in the longer term at least, continuous. Despite this, no country in the CEE region has yet reached a state of development comparable to that of Western Europe so more progress is possible yet.

CHAPTER 2

THE EMERGENCE OF STOCK MARKETS IN TRANSITION ECONOMIES

2.1 Introduction

As the process of transition gathered momentum, industries were privatised and control was transferred from the State to private individuals. Largely as a response to this, stock markets were created so that individuals could transfer ownership of equity received through the privatisation process to other individuals and institutions on organised markets that could objectively value their worth.

Stock markets, once a feature of all CEE economies, were extinguished under Communism and had to be created from scratch because it is impossible to have a functioning market economy unless a country also has a functioning stock exchange (EBRD 1998). A stock exchange provides an institution that enables companies to raise risk capital and provides benchmark rates of return against which risk can be assessed. It therefore facilitates the growth of companies and through this the allocation of reslources to meet the changing demands of consumers that characteriss the operation of a market economy. A great deal of the early literature on stock market development in transition economies focussed on microstructure. Microstructure basically refers to market design which is crucial to the development and functioning of efficient stock markets because it impacts on market capitalisation, liquidity, and the emergence of trust. The problem for the transition economies was that there was no blueprint which gave an established route from start to finish leading to the creation of a functioning and efficient stock market. Instead there were examples of efficient stock markets in developed countries and stock markets at various stages of development, in some cases embryonic, in emerging economies. However, there was nothing to guide the creation of stock markets from scratch in economies emerging from decades of central planning and the suppression of market forces.

During the era of planned economies, new generations, unaccustomed to the operation of capital markets, had grown up and viewed the newly created stock markets with suspicion and caution. One of the major challenges in the transition economies was therefore to educate investors and to explain to them the nature of risk capital. However, efforts to educate investors were somewhat confounded because, coupled with an absence of understanding, there was also an absence of reliable information about the companies traded on embryonic stock markets. The information that was disclosed by companies was often inaccurate or incomplete, and was frequently based on different accounting standards and practices. Moreover, reliable information and corporate governance structures of the type common in developed market economies were not in place and companies were subject to few, if any, mandatory disclosure requirements. Indeed the information that was disclosed by companies often embodied mistakes and inaccuracies and was based on different accounting standards as the system of business accounting was changing so as to be brought more into line with internationally accepted standards (Kawalec and Kluza, 2000). Besides, the management of newly privatised corporations were not used to the rules of a market economy and this led to mistakes and intentional abuses of power in traded companies. This increased the informational problems and risk analysis involved in stock exchange trading.

Encompassing all of these issues was the absence of a regulatory framework to establish the rules within which a market economy could be created and develop and a stock market could emerge and function efficiently as an integral part of that process. The legal systems of the different transition countries had to be changed substantially so as to incorporate rights to the ownership and disposal of private assets, to provide guarantees to investors over the proper use of investment funds, to create a legal base for the existence of the stock market, to define legally the different financial instruments traded on the stock market, to provide a consistent set of accounting standards, to reform laws concerning the tax system and so on. All of these are taken for granted in developed market economies and these therefore provided the blueprint suitable for market realities to emerge and function in transition economies.

Creating functioning stock markets is therefore essential for the growth and development of a functioning market economy. In developed economies, stock markets perform many roles that promote the allocation of capital to its most efficient uses and through this enhance the functioning of the economic system generally so as to promote growth, wealth creation and employment. When stock markets function efficiently, growing companies are able to raise additional finance at a lower cost than would otherwise be the case. In the absence of a stock market, such companies would be compelled to rely on internal finance which would ultimately stifle their growth. Stock markets therefore provide a source of new funds for companies, but they also provide a secondary market in equity which gives investors confidence that they can cash in their purchases of equity relatively easily when the time comes and, in an efficient market, at fair value prices reflecting all available information. Without the ability to dispose of holdings of equity, economic agents would be largely unwilling to buy a stake in the ownership of joint stock companies which is essential if growing companies are to finance expansion. Reluctance to buy equity in certain companies is also essential if inefficient companies are to be eliminated through natural selection and resources are to be allocated to their most efficient use. Stock markets also give companies a choice of financing options that enables them to adjust the balance between equity and debt in ways that accord with their aims and current prospects. By being less reliant on debt, companies are more likely to survive an economic downturn that might otherwise force those companies with relatively high gearing ratios out of business. Moreover, once stock exchanges are established, they are likely to lead to improved governance systems and by enforcing minimum disclosure requirements on firms they increase transparency for investors and facilitate more optimal choices.

The basic function of any market is price discovery and this refers to the ability of the market to value assets at their fair value price. In the case of equity markets, fair value prices reflect the underlying prospects of the firm and, as those prospects change, in an efficient market the fair value price of the firm's equity will change to reflect these changed prospects. The speed and accuracy with which exchanges respond to new information about changes in the underlying fundamentals are important indicators of market efficiency for an exchange. There are two main factors that influence the efficiency of price discovery on a stock exchange. One is simply the fairness and integrity of prices. Price integrity is far more likely to be achieved when there are legal regulations governing all aspects of trading and stock exchange monitoring procedures are in place to prevent manipulation and front-running whereby brokers use known, but not executed, purchasing decisions that are likely to push up prices of assets purchased on their own account, before executing the trade on behalf of their client. Price integrity also requires regulations to prevent fraud in general, self-dealing and the use of inside information. Secondly, and equally important is the information structure available to investors. The extent of information on firms that is readily and easily available to investors partly determines how well prices reflect the fundamentals. This information structure is enhanced through accounting rules, disclosure requirements and corporate governance standards. These are often dictated by exchange listing requirements or by security market regulators and, in establishing their stock markets, the transition economies of Central and Eastern Europe attempted to formulate rules that would encourage price integrity. (See for example, Harrison and Paton 2005.)

Price discovery is important to investors because it directly impacts on the risk of holding stock. In particular where information asymmetries exist, traders with private information can exploit their advantage to the detriment of traders with access to only publicly available information. Easley et al (2002) have shown that uninformed traders, knowing that they are potentially at a disadvantage, will demand a greater risk premium to hold stocks where they perceive the existence of greater private information risk. Further evidence consistent with this finding is provided by Botosan (1997) who has shown that a one unit difference in the disclosure measure is associated with a difference of approximately twenty eight basis points in the cost of equity capital after controlling for market beta and firm size; and by Bhattacharya and Daouk (2002) who find that enforcement of insider trading laws lowers the cost of capital. Furthermore, LaPorte et al (2000) show that laws on corporate governance impact on returns because of their influence on the way that returns are split between insiders and outsiders.

Arising out of all of this is the clear implication that market design should focus on reducing execution costs and facilitating price discovery. Unfortunately there is no unique blue print for establishing a stock market from scratch that will achieve these goals. It is hardly surprising therefore that the transition economies attempted to import design features from functioning stock markets in the developed countries that delivered these goals. However, this approach posed problems in terms of deliverable results because developed markets achieve their goals partly as a result of being open to international competition and in the early stages of stock market development in the transition economies, this was disallowed. Market liquidity and turnover are also important in enabling developed stock markets to perform and achieve their goals. However, in the early days of stock market creation in the transition economies, market liquidity and turnover were low by any standards and initially at least, they typically opened only one or two days a week and usually for only a few hours each week.

In developed markets, the stock of large companies is often traded on more than one market so price discovery might take place in multiple markets with the possibility of arbitrage, and liquidity might be greater in an overseas market than in the domestic market. (See for example, Harrison and Moore, 2010.) However, in the early stages of transition, even relatively large companies in the domestic economy were comparatively small by international standards and therefore price discovery and liquidity were confined to the domestic market. In many cases, stock markets in the transition economies were opened to foreign investors relatively quickly after their creation. However, in the uncertain environment that existed, especially in the early stages of transition, it was always more realistic to assume that the investor base in the transition economies would be comparatively small and local. (See for example, Coval and Maskowitz 1999; and Hubermann 2001.) Nevertheless, many companies in the transition economies, even at the outset of transition, were clearly going to grow into companies capable of having their stock traded on global markets.

To the extent that defection of the largest firms from national markets to global markets happened, this might serve the best interests of international investors and might lower the costs of capital for the firms concerned, but it also had implications for the design of stock markets in these countries. In particular, the revenue of an exchange is mainly volume driven and an often quoted rule of thumb is that ninety per cent of an exchange's revenue is derived from ten per cent of its listed companies. The fear existed that the migration of larger companies would result in a loss of revenue to the newly created stock markets that might stifle their growth. However, in the event such fears proved to be unfounded and the empirical evidence suggests that the increased exposure of a country to global markets raised the investment profile of a country and enhanced trading activity. (See for example, Sofianos and Smith 1996; Karolyi 1998 and Hargis and Ramanlal 1998.) However, the transition economies also introduced product diversification enabling trade in futures and options, as well as exchange traded funds as soon as was practicable. This also enhanced their growth and gave added impetus to liquity and trading volume.

Stock markets will be fully emerged when they are both informationally efficient and fully integrated into the world's stock markets with company equity trading on more than one developed and efficient market. The benefits of this are both micro and macro. At the macro level, capital market integration enlarges the menu of assets available to both savers and borrowers. By designing savings vehicles in a more attractive way and extending the reach of financial intermediation, saving is encouraged and the utility of a given volume of savings to the holders of financial assets is enhanced. Similarly, on the borrowing side the introduction of new borrowing instruments facilitates and, perhaps more importantly, helps improve stock market quality. If secure and liquid assets are readily available, yielding real rates of interest comparable with those available elsewhere, savings are less likely to be retained by firms for low productivity investments and/or diverting into inflation hedges.

Another macroeconomic benefit stems from closer international links among capital markets and financial institutions. The integration among capital markets makes it easier for savings raised in mature economies to be used to finance high yielding investment in economies with higher growth potential. This promotes economic growth in two ways: by improving the efficiency of investment and by strengthening the discipline of governments and central banks to pursue sound economic and financial policies.

2.2 Problems Inhibiting Stock Market Development

Once stock markets were established in the transition economies of Central and Eastern Europe, three issues needed to be addressed before further development could take place

- The threat posed to transparency and standards of disclosure in equity markets in general, and minority shareholder rights in particular.
- The need for growth of institutional investors to trade in equity markets.
- The conflict between trends towards decentralised decision taking that characterises market economies and ambitions to centralize trading in the interests of promoting transparency

We discuss each of these issues in turn and they do, in any case, provide a theme running throughout this chapter.

2.2.1 The Threat Posed to Transparency and Standards of Disclosure in Equity Markets in General and Minority Shareholder Rights in Particular.

A major stumbling block to stock market development in transition economies was the lack of transparency in deal making and investor protection once trading activity began to develop and markets for corporate control came into existence. Stock markets will only continue to grow and develop if investors have confidence in the standards of fairness, accountability and protection given by, and enforced through, appropriate legislation. In this context, it is possible that certain methods of privatisation have been open to abuse and management/employee buyouts are especially conducive to the emergence of non-transparent practices. We discuss methods of privatisation later.

2.2.2 The Need for Growth of Institutional Investors to Trade in Equity Markets

Institutional investors have emerged as the dominant trading agents in all stock markets in recent decades. Their increasing importance is mirrored in the growing impact institutional investors have on the functioning of financial markets as well as their own reliance on and need for market depth, liquidity and efficient infrastructure. Unsurprisingly, institutional investors were slow to develop in the transition economies of Central and Eastern Europe. However, as the basic elements of market economies such as the right to own private property and freedom to decide what to produce (subject to restrictions covering, for example, poisons, explosives, armaments and so on) were put in place, institutional investors gradually emerged. We return to this issue later.

2.2.3 The Conflict Between Trends Towards Spontaneous Market Fragmentation and Ambitions to Centralise Trading in the Interests of Promoting Transparency

Market fragmentation can occur for two reasons. One is the development of a superior market which is more attractive to investors because it is technologically superior. The development of an electronic trading system would be an example of this. The second reason is that order flow, that is, the action of brokers to route buy and sell trades to market makers, can fragment a market if satellite markets offer faster execution and lower commissions. The latter can be detrimental to orderly stock market development since it enhances the potential for higher returns in one market compared to other markets.

2.3 The Role of Stock Markets in Economic Growth

The creation of a reliable monetary system in the emerging markets is necessary for stock market development because it facilitates the creation of an efficient and reliable payments mechanism. The absence of this would stifle the growth of trade on an organised market and through this, the economy generally. Its creation represents an economic endeavour meant to gather the involvement of important resources and persuasion of policy makers to include the necessary infrastructure at the very core of their reform agendas. Empirical support for this has been provided by a growing amount of research analysing the relationship between the operation of the financial system and economic growth. (See for example, Levine, 2004.) The empirical and theoretical works generally show the dependence of domestic savings, capital accumulation, technological innovation and income growth on the size and quality of the financial sector within a national economy.

Notions on the role of the financial sector in promoting economic growth date back at least as far as Schumpeter (1934) who argued that financial sector development is an important factor encouraging economic growth primarily because of its effect on levels of capital accumulation, savings and technological innovation. The financial sector performs its role through a variety of supportive mechanisms which play a crucial role in driving sustainable growth which encourages the emergence and expansion of companies and in this way provides the pressing need for the development of a functioning stock market. A wide range of evidence surveying ever increasing numbers of countries and using ever more sophisticated techniques, confirms this finding. A survey provided by Levine (2004) confirms that countries with better-functioning banks and financial markets grow faster partly because of this than economies with less well functioning financial markets. A major factor explaining this result identified by Levine (op cit) is that better-functioning financial systems succeed in easing the external financing constraints on companies which are seen as an important impediment to the expansion of companies, and this in turn is a mechanism through which financial development encourages growth.

In his review of the connection between financial sector development and economic growth, Levine (2004) identifies five functions of financial markets that are instrumental in this context. In particular, financial systems:

- *Produce information ex ante about possible investments and allocate capital.*

This feature of financial systems relies on their ability to make information available to all market participants. Bagehot (1873) realised that the requirement for capital to reach the most profitable firms is that investors, that is, providers of capital, have good information about firms, managers and market conditions. The presence of financial intermediaries reduces the costs of acquiring and processing information and thereby improves resource allocation (Boyd and Prescott, 1986). The benefit of developing financial markets comes from the fact that in the absence of intermediaries, the cost of information may inhibit investment decisions and hence reduce economic development. Bhattacharya and Pfeiderer (1985), and Ramakrishnan and Thakor (1984) also develop models where financial intermediaries arise to produce information on firms and sell this information to savers.

Greenwood and Jovanovic (1990) mention the importance of securities' markets in improving information on firms, managers, and economic conditions for the acceleration of economic growth. The selection of the most promising firms is therefore facilitated through the provision of higher quality information made available through the financial markets.

An important issue frequently raised in the literature is the direction of causation between finance and growth. Greenwood and Jovanovic (op cit) model the dynamic interactions between finance and growth in which growth is achieved when more economic agents have the financial resources to make use of financial markets. This encourages economies of scale in information gathering and risk assessment, and improves the ability of financial intermediaries to produce better information with positive implications for growth. In this way their modeling sheds light on the intertwined dynamics of finance and growth and reveals the negative relationship between income distribution and financial development during the process of economic development generally.

The provision of information in the market also has important implications for technological innovation in the sense that banks help in the identification and selection of those entrepreneurs with the best chances of successfully initiating new goods and production processes (King and Levine, 1993b; Blackburn and Hung, 1998; Acemoglu, Aghion, and Zilibotti, 2002).

As far as stock markets are concerned, Levine (2004) identifies their important role in stimulating the production of information about firms. The possibility to trade in large and liquid markets allows for an efficient way to profit from information issued by the participants through arbitrage (Grossman and Stiglitz, 1980) and sets the stage for even more liquidity in a self-stimulating system (Holmstrom and Tirole, 1993). Intuitively, with larger and more liquid markets, it is easier for an agent who has acquired information to disguise this private information and make money by trading in the market. Thus, larger, more liquid markets will boost incentives to produce this valuable information with positive implications for capital allocation (Merton, 1987).

The final argument made by Levine (2004) shows that despite the many ways in which stock markets facilitate and encourage economic development in general, the imperfections that are characteristic features of many emerging markets (see Harrison and Paton, 2005, for example) give rise to market inefficiency and this adversely impacts on growth through the obvious channels, but also by impeding investment in human capital (Galor and Zeira, 1993).

- *Monitor investments and establish standards of corporate governance after providing finance*

The way in which providers of capital succeed in monitoring, sometimes through direct involvement, the activities of firms and induce managers to maximise firm value has important implications for the stimulation of growth in general. The separation between management and ownership raises the 'agency problem' which can only be solved by proper corporate governance mechanisms such as professional and independent auditing of accounts.

By the same reasoning, the involvement of all stakeholders of a company, from creditors to institutional investors and regulators, allows for good corporate governance through their relations with managers which seems likely to improve resource allocation and utilisation thus facilitating better selection of successful projects, not least, through the provision of more reliable information.

To the extent that shareholders and creditors effectively monitor firms and induce managers to maximise firm value, this will improve the efficiency with which firms allocate resources and make savers more willing to finance production and innovation. In turn, the absence of financial arrangements that enhance corporate governance may impede the mobilisation of savings from disparate agents and also keep capital from flowing to profitable investments (Stiglitz and Weiss, 1983). Thus, the effectiveness of corporate governance mechanisms directly impacts firm performance with potentially important effects on national growth rates.

One of the means through which healthy corporate governance features are induced in a market is to ensure that provision is made for the protection of minority shareholders and by developing the conditions for businesses to be owned by a diverse group of stockholders. Such a structure of ownership may effectively encourage the development of corporate governance by independently voting on crucial issues, such as mergers, liquidations, and fundamental changes in business strategy. Starting from at least Berle and Means (1932) however, many researchers have argued that small, diffuse groups of equity holders may encounter a range of barriers to exerting sound control over corporations. Levine (2004) notes that on the one hand the market frictions that are common to developing countries have the potential to induce managers to follow their own favoured projects to the detriment of other equity holders whilst, on the other hand, the fact that small shareholders usually lack the expertise to provide effective monitoring of managers potentially gives rise to a 'free rider' problem when economic agents take advantage of being able to use a resource without paying for it such that each of the small stock owners expects the others to act in their own self-interest with the result that the quality of monitoring might diminish.

A reaction to the poor governance exercised by small uncoordinated and disparate groups of shareholders is to favour large concentrated ownership and this is an important element in the principal-agent problem (Grossman and Hart, 1980, 1988; Shleifer and Vishny, 1997; and Stulz, 1988). However, there exists a long list of research papers (starting with the theoretical identification of the issue in Jensen and Meckling 1976) showing evidence that large shareholder concentration tends to influence the board of directors to alter business activities in ways that best serve the large shareholders' interests with less than optimal effects. Indeed, the stream of literature produced in this area overwhelmingly documents the negative implications of these actions (Morck, Wolfenzon, and Yeung, 2005, La Porta et al., 1998; Faccio and Lang, 2002).

The fact that neither diffuse nor concentrated shareholders guarantees effective standards of corporate governance encouraged the search for other instruments. Levine (2004) mentions the power of liquid equity markets, debt contracts and banks, each of which have their respective pros and cons.

The same seminal work of Jensen and Meckling (1976) argues that well functioning stock markets seem to be one of the most important solutions to the corporate governance problem. Efficient stock markets, as is well documented, instantaneously reflect new information about firms. This generates benefits such as (i) performance-linked instruments that are issued to managers as compensation packages thus linking their interests to those of the shareholders (Diamond and Verrecchia, 1982; and Jensen and Murphy, 1990); (ii) easier takeover of poorly managed companies which sets the stage for benefits from new managers being elected according to performance and again aligning their interests to those of the shareholders (Scharfstein, 1988; and Stein, 1988).

An amelioration of the corporate governance problem may arise through debt contracts. Townsend (1979), Gale and Hellwig (1985) demonstrate that these contracts may drive down costs of monitoring the firm for insiders so that managers need to comply with the interests of the shareholders.

In terms of intermediaries, Diamond (1984) develops a model in which a financial intermediary improves corporate governance. The intermediary mobilizes the savings of many individuals and lends these resources to firms. This ‘delegated monitor’ economises on aggregate monitoring costs and eliminates the free-rider problem since the intermediary, by monitoring the risk of debt default, does the monitoring for all of the investors. Furthermore, as financial intermediaries and other corporate bodies develop long-run relationships, this can further lower information acquisition costs.

In terms of economic growth, a number of models show that well-functioning banks influence growth by boosting corporate governance. Bencivenga and Smith (1991 and 1993) show that financial intermediaries that improve corporate governance by economising on monitoring costs will reduce credit rationing and thereby boost productivity, capital accumulation, and growth. Sussman (1993) and Harrison, Sussman, and Zeira (1999) develop models where financial intermediaries facilitate the flow of resources from savers to investors in the presence of informational asymmetries with positive growth effects. Focusing on innovative activity, De La Fuente and Marin (1996) develop a model in which intermediaries arise to undertake the particularly costly process of monitoring innovative activities. This improves credit allocation among competing technology producers with positive implications for economic growth.

- *Facilitate the trading, diversification, and management of risk*

A functioning financial system provides risk diversification resources which will help promote long-run economic growth by encouraging savings thus allowing potentially profitable projects to develop. Levine (2004) considers that there are three important categories of risk that impact the way in which finance relates to economic development: cross-sectional risk diversification, intertemporal risk sharing, and liquidity risk.

The discussion on cross-sectional diversification relies on classical reckoning that financial intermediaries provide the tools for diversification in the investors' quest for risk mitigation. This process drives attention to riskier, high-return projects, which receive financing exactly due to this phenomenon hence producing beneficial effects for the whole economy in the sense that they encourage growth by means of implementation of technological innovations (Gurley and Shaw, 1955; Patrick, 1966; Greenwood and Jovanovic, 1990; Saint-Paul 1992; Devereux and Smith, 1994; and Obstfeld, 1994). One example of note is the modeling structure proposed by Acemoglu and Zilibotti (1997) which shows that, starting from the assumption of risk aversion which usually usually characterises providers of capital, diversification positively impacts on economic growth by widening the range of productive activities and thus reducing the impact of a negative shock impacting on any one industry. The stimulation of innovative activity is mentioned and supported by King and Levine (1993b).

Besides cross-sectional risk diversification, financial systems may improve intertemporal risk sharing. Allen and Gale (1997) investigated the opportunity of risk mitigation in a cross-generations investment. Their findings are that long-lived intermediaries can facilitate intergenerational risk sharing by investing with a long-run perspective thus offering returns that are relatively low in boom times, and relatively high in slack times.

The last type of risk that is mentioned by Levine (2004) is liquidity risk. He mentions that "Liquidity is seen as the cost and speed with which agents can convert financial instruments into purchasing power at agreed prices. Risk in this area is created by the uncertainties associated with converting assets into a medium of exchange". (pp 692.)

In fact, the existence of high liquidity is required for the provision of capital to projects which require long-term capital commitment. Usually these projects are the ones that are mostly revolutionary in terms of technological innovation with characteristics similar to laboratories or research and development units. The possibility to transform ownership of these long-lived projects into cash (the exit facility) encourages investors to include those projects offering higher expected returns in their diversified portfolios thus providing the necessary long-term capital. The existence of financial intermediaries facilitates this outcome.

One aspect of research in this area refers to the modeling trials of savers that are facing two investment alternatives – a relatively low return project, which is liquid and quite certain, and a relatively high-return project which is less liquid and more uncertain. The inducement of uncertainty by the use of probabilistic shocks that is meant to create a risky environment shows that liquid projects are usually preferred. The work of Diamond and Dybvig (1983) who evolved the model, assumes that information about the shocks received by other individuals is prohibitively costly implying that agents cannot verify whether other agents received shocks. It is this which generates the need for operational financial markets. The extension of the model provided by Levine (1991) and further extended by Bencivenga, Smith, and Starr (1995) provides an environment in which markets (secondary markets in the latter paper) exist and show that agents do not question the existence of shocks that impact on other agents. The conjecture produced by the latter paper illustrates how the reduction of trading costs in the secondary market increases the probability of success of longer-run projects by ensuring access to capital.

Hedging against liquidity risk is important to commercial banks that construct diversified portfolios aimed at achieving an optimal mix of liquid and illiquid investments. They therefore have an incentive to promote high-return less liquid investments which generate growth in the long-run and promote economic development.

- *Mobilise and pool savings*

Another benefit of a functioning financial system deals with the power of pooling funds to be invested in diversified portfolios with a reduced burden caused by transaction costs and informational asymmetry problems. Levine (2000) shows that a better financial system helps to encourage increased savings, the exploitation of economies of scale and provides incentives to overcome the problem of investment indivisibilities. In this way, the collected funds can be used to invest in high cost projects that can attract resources by syndicated loans and may induce technological innovations and newly developed products.

Levine (2004) investigates the importance of trust that investors need to have in financial intermediaries for them to develop their activities. Similarly, as shown by Boyd and Smith (1992), the concentration of funds depends on the ability of 'mobilisers' to convince savers of the soundness of their investments. The relationship with economic growth follows the same root as arguments mentioned in the previous sections, respectively the fact that large productive projects that require long-term financing cannot be developed without the possibility of access to large pools of capital developed by groups of sound financial intermediaries. The benefit of such a pool of funds is twofold – on the one hand households are provided with investment vehicles for longer periods of time and new financial instruments are created, and on the other hand high innovative long-term projects have access to resources that are needed for their development. The result is that economic growth is encouraged in those economies that succeed in mobilising funds on a sufficiently large scale to facilitate growth.

The importance of savings is also highlighted in many other papers as the main engine driving the development of stock markets. Wright, Chrisney and Vives (1995) argue that in Latin American markets, savings are a lower percentage of GDP than in the Asian countries. They further argue that capital markets encourage household savings as well as a switch from real assets to financial assets. The provision of new financial assets can reduce risk and encourage longer term investments and this is also likely to lead to increased private sector savings.

- *Ease the exchange of goods and services*

Economies exist to facilitate exchange and the more efficiently this takes place, the more economies will grow. One model built on the connections between exchange, specialisation and innovation is that of Greenwood and Smith (1996) who argue that increased specialisation requires an increased volume of transactions the costs of which are instrumental for the success of specialisation and increased productivity. The model assumes that lower transaction costs do not directly stimulate the appearance of new production technologies, but expand the set of opportunities and define better levels of the market with respect to the ability to generate more specialised production processes.

There is a wide consensus among researchers that sustained economic growth requires more, rather than less, macroeconomic stability. Even though the financial system might be supposed to produce stability through optimal risk allocation that is meant to protect the whole economy from shocks in the dynamics of economic variables, there is a stream of literature including, for example, Easterly, Islam and Stiglitz (2000), that documents the tendency of the financial system to offer opportunities for speculation and bubbles that can increase volatility and in so doing increase the probability of financial crises. The experience of the last 20 years in emerging markets shows that contagion may impair economic performance if integration is not accompanied by proper development of domestic financial markets. Indeed one important aspect of the development of financial markets quoted in the literature is that financial innovation is usually faster than the infrastructure created for market surveillance and this is true of developed, as well as developing, financial markets. This provides a source of on-going risk that cuts right across all financial markets as innovation and the search for profitable opportunities encourages developments that precede and necessitate surveillance and regulation.

2.4 The Role of the Financial System in Supporting Stock Market Development

The development of sound financial markets goes hand in hand with the development of stock markets because private firms cannot grow without financial intermediaries to support their activities. Moreover, settlement of stock market transactions would be impossible without a functioning banking system. In this context, using data from 44 industrial and developing countries from 1976 to 1993, Demirguc-Kunt and Levine (1996) investigate the relationship between stock market development and financial intermediary development and find that the countries with better developed stock markets also have better developed financial intermediaries. Thus, they conclude that stock market development goes hand-in-hand with financial intermediary development with the combined result leading to greater growth of a nation's economy

The issue is therefore how to develop a financial system that facilitates and supports economic growth in the context of financial stability. Historically, many financial crises have involved bank failures that stemmed from poor regulation and supervision. Financial stability is synonymous with a reduction of volatility in the main economic variables including interest rates, exchange rates and, of course, stock prices, by creating an environment in which the failure of financial institutions is less likely. An event such as a run on a bank could quickly develop into a systemic crisis through contagion with potentially serious consequences for economic growth. There are, however, disagreements over how to sequence financial sector development in developing countries. Lin et al (2009), argue that these countries should make the first step the creation of domestic financial institutions in the form of small banks that could help small-scale manufacturing firms which form the bulk of firms in poorer countries. Lin et al (op cit) further argue that the size and sophistication of the financial institutions from the developed countries may not be appropriate for the low-income countries and advise local governments to resist the temptation of building 'modern' stock markets in the early period of their country's development. However, as noted below, there are many academics who disagree with this view.

Banerjee (2015) finds no evidence that, unlike domestic banks, foreign banks contribute to economic growth and also that, as expected, neither does he find evidence of the failure of big financial institutions to be too detrimental for the economy. Still, he points to the fact that small banks may not be able to build portfolios of credits that allow for the financing of riskier projects, while the stock markets, by the power of diversification, are more likely to achieve this. However, the efforts required for the implementation of a securities market, at least in terms of regulation and creation of supervisory bodies might not be compensated by the benefits of the presumably functioning stock market. Moss et al (2007) find that stock markets might not be able to provide capital in poorer countries and that local financial institutions might more suitably provide this. On the other hand they argue that the choice between local banks versus stock markets is not actually what governments in these countries are facing.

Instead, it should be their objective to create the legal and financial framework necessary to promote access to credit in appropriate cases for firms seeking funding. They also note that stock markets are helpful in promoting stock market development in emerging economies by allowing individuals to participate in privatisations, as well as offering multinationals the opportunity to list their local subsidiaries.

Singh (1997) also finds that the existence of a functioning local banking system plays an important role in generating growth for a developing country, while stock markets continue to represent only a small part of the financial system. However, when dealing with the problem of promoting small banks as a solution for the development of financial markets, she also thinks that the size of financial institutions might affect the optimal allocation of capital as small banks are usually very much exposed to local shocks which confers on them a fragility that keeps them away from the financing of riskier firms or new projects. As a consequence, she proposes a two-tier banking system intended to achieve the goal of optimal financing within the economy. The first layer would consist of small financial organisations like banks and microfinance institutions that cover the needs of 'subsistence' entrepreneurs. The second layer would comprise larger banks that would serve the 'transformational entrepreneurs', that is, economic agents with the potential to create jobs and hence to grow into large scale organisations. The difference between the two types of entrepreneur resides in their different propensities to take risks and their financing needs. The 'transformational' entrepreneurs are businesses that may need more sophisticated financing tools that could only be provided by financial institutions of an appropriate size.

Another perspective on this matter is provided by Beck et al (2009) who consider that there is enough evidence for the structure of the financial systems in developed countries not to be replicated as such in the developing economies. In fact, the appropriate form of this system is dependent on the particular conditions existing in the country such as the legal and political systems, as well as the type of economic activities prevailing in the economy. On the other hand, Beck et al (op cit) consider that the focus should not be on the form of financing techniques or the size of the businesses that are providing the capital, but on the formation of an environment that allows for competition among financial institutions to encourage useful credit risk and liquidity services to the 'real' economy. One important issue that is added here is the decision to make small banks in the USA the mainstay of the financial system in the first three quarters of the twentieth century and the lessons this process may provide. Thus Beck et al (op cit) show that the policy of restricting banks from establishing branch networks with a view to creating lots of small banks and limiting the emergence of large banks generated local banking monopolies that impeded the entrance of newcomers and reduced the efficiency of credit allocation thereby slowing economic growth. Local banks have the obvious advantage of possessing better knowledge of local firms (which in the case of local monopolies could also inhibit the activities of some, not preferred, companies) but larger banks are known to have proprietary scoring processes that gives them the power to diversify risks and this facilitates access to capital for even the most risky projects. Another conjecture deals with the fact that surveillance of large banks might be difficult due to their sophistication, but, on the other hand, in the case of small banks the process of surveillance could be problematical because of their number – regulators sometimes have to rely on statistical sampling in order to draw conclusions about the whole system.

Zingales (2009) also provides analyses concerning the priority of the types of financial intermediaries to receive attention from policy makers. His arguments follow the lines already mentioned by approving the improper extrapolation of the structures found in the developed economies to the low income countries, but he also highlights the difficulties of creating the legal and political infrastructure that securities markets require. Because of this he proposes the creation of a sound foundation for the banking sector, but that this ought to take place within an environment that should also serve as a basis for the development of stock markets which would normally be expected to happen later on and be triggered by economic growth. However, he considers that the present needs of an emerging market economy are better answered by the development of a fragmented banking system founded on the grounds of better knowledge of the local specifics of economic activities. He argues that large State-owned banks are usually a major barrier to this achievement as they control the territory and maintain political consensus.

Another conjecture on this topic is provided by Thoma (2009) who is also in favour of developing small banks and microfinance companies, but also highlights the fact that these companies need more sophisticated financial products and services, including hedging instruments such as hedging price risks through futures markets, insuring against crop failures, purchasing farm equipment through pooling arrangements and managing seasonality problems. Small banks can also help in achieving these objectives due to their local knowledge, and can also overcome issues like the lack of history and information on the existence and use of the more sophisticated products. On the other hand, Khwaja (2009) argues that the theoretical arguments that small firms succeed better in providing capital to the small companies because their knowledge does not wipe out the possibility for large financial institutions to achieve the same goal. The empirical evidence shows that small banks usually have small clients, but this may be due to the fact that larger institutions have already attracted the larger, more reliable, borrowers. Therefore, in cases where the larger banks are absent, smaller banks will be able to attract these clients. Khwaja (op cit) also argues that higher growth countries may create room for more banks in the sense that growth will produce an increase in the small bank industry and not that the existence of these banks will necessarily create growth.

Looking at Latin American markets, Wright, Chrisney and Vives (1995) provide a structural framework for capital markets existing in the emerging markets in general. This framework is summarised as follows:

- The need for complete markets. Financial markets should meet the needs of the real economy and this includes the provision of a wide range of choices available to investors.
- The need for many maturities, from overnight to long term instruments at both fixed and variable rates. This can generate a longer yield curve which is necessary for the implementation of monetary policy, as well as for risk management purposes at the microeconomic level.
- The need to provide for the temporary placement of funds through the operation of effective money markets. The creation of a large selection of

commercial paper will help alleviate the working capital problems of firms in an effective manner.

- The need for listing. Equity markets are usually characterised by reluctance of closely held companies to divulge information to the public and an unwillingness to dilute voting power and control of the firm. However, the need for an exit mechanism for investors highlights the importance of listing.

Historically bank based measures were used as key indicators to measure the relationship between finance and economic growth, but the focus has slowly shifted to stock market indicators. Levine and Zervos (1998) argue that well developed stock markets are able to offer different kinds of financial services than the banking system and may therefore provide a real alternative for investment and growth than that offered by a developed banking system. They specifically mention that increased stock market capitalisation might improve an economy's ability to mobilise capital and diversify risk. Levine and Zervos (1998) further demonstrate that various measures of equity market activity are positively correlated with measures of real activity across different countries and that the association is especially strong in developing countries. Using cross country regressions and data for 41 countries for the period 1976-93, Levine and Zervos (1998) conclude that after controlling for initial conditions and various economic and political factors, the measures of banking and stock market development are robustly correlated with the current and future rate of economic growth, capital accumulation and productivity improvements. Atje and Jovanovic (1993) using a similar approach also find a significant correlation between economic growth and the value of stock market trading relative to GDP.

Recent sustained economic growth in Eastern European Countries is shown to be driven both by capital accumulation and total factor productivity changes, with the latter making a major contribution. (Arratibel, Heinz, Martin, Przybyla, Rawdanowicz, Serafini and Zumer, 2007) In a setting characterised by deep product and labor market reforms, enterprise privatisation and banking sector restructuring and by increasing international trade and financial integration, strong FDI inflows are not surprisingly found to have played a primary role in boosting productivity and sustaining long-term economic growth.

Whilst earlier research often stressed the role of the banking sector in economic growth, in the past two and a half decades stock markets surged and the share of the emerging markets in total worldwide market capitalisation has increased considerably. Demirguc-Kunt and Levine (1996), Singh (1997), Levine and Zervos (1998), and Garcia and Liu (1999) find that stock market development plays an important role in predicting future economic growth. It is an integral part of a well functioning financial system and in this chapter we look at the development of these markets in CEE countries by analysing certain key indicators.

Levine (1997) and Liu (1998) show that indirect finance provided through the financial intermediaries is many times more important in raising capital than raising direct finance through the financial markets, especially in developing countries. However, most of this evidence is based on bank based measures of financial development and the emphasis has subsequently shifted in favour of stock market indicators due to the increasing role of stock markets in emerging economies. For example, Atje and Javanovic (1993), Garcia and Liu (1999), Levine and Zervos (1998) and Singh (1997) show that stock market development is positively and robustly associated with long-run economic growth.

2.5 The Importance of Privatisation

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, 1998, 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).

The general pattern followed was to incorporate the operating procedures of stock markets from the developed economies including, as soon as feasibly possible, an electronic order book which matches buy and sell trades as a continuous process. The ultimate aim was to open up newly created stock markets to competition and this was impossible until, among other developments, comparable procedures were in place and operating efficiently. Markets in developed economies were already opened up to competition, listing of overseas companies and unrestricted trading by foreign nationals. Competition unleashes powerful forces that shape institutions subjected to them and to all intents and purposes stock markets in developed countries have become global stock markets rather than simply national stock markets. The absence of the same competitive forces in the newly created stock markets in the transition economies meant that, initially at least, they would never function in anything like the same way as stock markets in developed countries. However, it also became quickly apparent that problems emerge when market regulators try to impose a structure that has worked well in other countries and in effect try to regulate a stock market into existence.

Stock markets in the transition economies were created as a consequence of the privatisation programmes inituiated in these economies. Table 2.1 shows the methods used to privatize assets in CEE countries.

Table 2.1 Origins of Stock Markets in the Transition Economies of Central and Eastern Europe

Mandatory Listing after new Privatisations	**Voluntary Initial Public Offerings**	**Mandatory Listing of Minority Packages during Privatisation**
Bulgaria	Estonia	Poland
Czech Republic	Latvia	-
Lithuania	Hungary	-
Romania	Poland	-
Slovak Republic	Slovenia	-

Source: Claessens et al (2000)

In the first group are stock markets created to transfer ownership rights among investors who received assets under the mass privatisation programmes. It was envisaged that in this group there would be a rapid transfer of ownership and so little was done to put in place a strong regulatory framework so as not to impede the transfer of assets. Most of the markets were small in terms of capitalisation and since, in general, companies in the first group had no immediate intention of raising equity funds, few showed any interest in the possible implications of a stock exchange listing such as increased access to risk capital

. At first these markets listed a large number of stocks, but in the event many of these proved to be rather illiquid and were quickly de-listed. There are several other reasons why companies were de-listed and these are summarised by Claessens et al (2000): "First, by listing on stock markets, corporations were less likely to avoid paying taxes. Second, the cost of external credit was quite high relative to the cost of bank credit. This was especially the case where large firms could lobby politicians for directed credit. Finally, the disclosure requirements of listed companies made it harder for corporations to conduct non-market based transactions." (pp 8) Notwithstanding this, once the markets became more established through transactions on the exchanges, the number of stockholders fell and ownership became more concentrated.

The second group started with a small number of stocks and certainly far fewer than the number which became available under the mass privatisation programmes. All of the stocks in the second group were offered in traditional ways using IPOs. However, in this case, the number of stocks available for trade quickly increased as more corporations sought and were granted a listing.

Poland alone is in the third category, not because it is the only transition economy that could fit into this group but because it is the only CEE country in this group and it is these countries that are the focus of our attention in this thesis. Countries in this group had a mass privatisation programme and the plan was to develop the privatisation programme and the stock market in parallel. Again the number of companies initially listed was far below the numbers listed under the mass privatisation programs, but over time the number of companies listed rose steadily.

A number of studies use aggregate data to assess the effect of privatisation on economic performance. Using data from developing, as well as developed nations, Plane (1997) finds that privatisation has a significant positive effect on economic growth. Davis, Ossowski, Richardson and Barnett (2000) carried out an empirical investigation of the relationship between privatisation and measures of fiscal performance. Using macroeconomic and privatisation data from 18 countries, they find that when privatisation proceeds are transferred to the budget, they tend to be saved and used to reduce domestic financing.

Remarkable differences exist across the transition economies in the strategy of privatising large and medium-sized firms. Hanousek, Kocenda and Svejnar (2008) mention that Poland and Slovenia moved slowly in privatising State-owned enterprises, relying instead on 'commercialisation' where firms remained state-owned but were run by somewhat independent appointed supervisory boards rather than directly by the State; and on the creation of new private firms. Estonia and Hungary proceeded effectively with privatisation of individual State-owned enterprises by selling them one by one to outside owners which provided much-needed managerial skills and external funds for investment in the privatised firms.

As Table 2.1 above shows, Bulgaria, the Czech Republic, Lithuania, Romania and the Slovak Republic opted for rapid mass privatisation gaining the advantage of speed, but it led to poor corporate governance as the existing management were unwilling to improve efficiency. (Svenjar, 2002) As part of this process, the Czech Republic, Lithuania and, to a lesser extent, the Slovak Republic carried out equal-access voucher privatisation whereby a majority of shares of most firms were distributed to citizens at large. While this approach may have been more egalitarian and one of the best in terms of speed, it did not generate new investment funds. (Svenjar 2002.) Nor did it bring revenue to the government. Instead, it resulted in dispersed ownership of shares and, together with a weak legal framework; it simply resulted in poor corporate governance. The poor corporate governance often permitted managers or majority shareholders to appropriate profit or even assets of the firms at the expense of minority shareholders. (Svenjar, 2002)

2.6 Factors Impacting on Stock Market Development in Transition Economies

The literature on stock market development in transition economies has identified several factors that promote stock market development. In a detailed account by Levine and Zevros (1998) several factors are set out as crucial in encouraging stock market development. We discuss each in turn.

2.6.01 Macroeconomic Stability

Macroeconomic stability generally, and, in particular, relatively low inflation are very important in promoting stock market development. In times of relatively rapid inflation, investors might well prefer to invest in property or foreign currency as these provide a superior store of value (Boyd, Levine and Smith, 2000). Alternatively, if inflation pushes up the return on bonds as the Fisher effect implies, funds will be diverted away from stocks into bonds which will provide more certain protection than the risky environment of equity returns since high rates of inflation might force other, potentially healthy firms, to close because of rising costs. It is clear from Table 1.1 that, to a greater or lesser extent, the former transition economies of CEE experienced a collapse of output at the start of transition and, as table 1.2 illustrates, this was accompanied by chronic levels of inflation unimaginable in developed economies. These are not macroeconomic conditions that are most likely to favour stock market growth and development. However, by the late 1990s, as Tables 1.1 and 1.2 illustrate, the countries of CEE were experiencing positive rates of growth of GDP and for most, inflation was down to single digit figures. Even those still experiencing relatively high rates were experiencing a downward trajectory of inflation.

In the earlier part of the 90s, the relatively high rate of inflation left real returns on stock market investments in negative territory after adjusting for risk. Of all the CEE countries only Hungary and Slovenia offered investors higher returns than those from bank deposits between 1994-99, and only in Hungary did stock market returns categorically outperform the return on bank deposits. In Bulgaria, the Czech Republic, Latvia, Lithuania, Romania and the Slovak Republic, bank deposits yielded a positive, but relatively low, annual return of about two per cent in real terms. (Claessens et al (2000).

2.6.02 The Legal Environment

Another factor of major importance in stock market development is the degree of shareholder protection since investors will be more confident that they will not be the victims of some fraudulent activity or other schemes designed to unwittingly separate them from their savings. Instead, they are likely to be more confident and willing to accept risk because they will be protected by laws relating to securities and companies (Schleifer and Vishny, 1997)

Zalewska (2008) addresses the questions about whether the emerging markets will ever mature, when this might happen and what the dependent factors are. She argues that the long-run growth of markets is strongly correlated with the development of the rule of the law and a country's ability to implement it. Monitoring, regulation, and shareholder protection are all vital for securing efficiency of stock market operations and trading, and as a result to secure a lower investment risk environment. Emerging markets are particularly weak in this regard. There is a strong negative correlation between a country's level of economic development measured in terms of its national wealth, and the extent of lawlessness in that country. Countries that suffer from corruption, poor efficiency of governmental institutions and officials, political instability, etc., are those that remain poor. In consequence, the development of stock markets in such countries is hampered and may not be possible at all.

It is difficult to find an objective measure of the extent of a country's lawlessness as there are many aspects to it, and these are themselves often difficult to measure since, by their very nature, they are secretive and concealed. Zalewska (2008) presents six possible measures (voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption) for the eight geographical groups of countries globally distinguishing between countries that have developed stock markets, emerging stock markets and those that do not have stock markets. The results provide evidence of substantial differences between the developed stock markets and stock markets in emerging economies. Across all four regions that have developed stock markets, the average scores of the developed markets in these regions are positive. In contrast, the emerging markets are negative with the exception of Central and Eastern Europe and the Caribbean. The overwhelming conclusion is that the emerging markets require clear regulatory characteristics and that this requirement needs be taken into account when the financial systems are designed and developed.

One of the main arguments in favour of regulation is the fact that investors tend to prefer companies that are monitored by regulatory bodies whether these are selforganised or initiated by government action. This assertion comes probably from the hard reasoning that it is better to invest in companies that comply with some rules and fill reports, than with those that do not. When monitoring is provided by government bodies, this argument also implies that in the event of failure there is a higher probability of State intervention than otherwise might be the case. In this context, Claessens, Lee, Zechner (2003) consider the EBRD index of financial regulation and effectiveness and argue that the four countries with the highest regulation indices in the Central and Eastern European region (Hungary, Poland, Slovenia, and Estonia) saw an increase of 52% in the number of firms listed between 1996 and 2002. They also saw an increase in their market capitalisation of 191%. At the other end of the spectrum, the four countries with the lowest scores (Latvia, the Czech Republic, Lithuania, and the Slovak Republic) experienced a decrease in the number of firms listed by 31%, and an increase in market capitalisation of only 11%. Notwithstanding these findings, the authors do not conclude that regulation necessarily generates the kind of development reported above since many factors impact on the dynamics and regulation is simply one of them.

Poor protection of investor rights is reported by La Porta et al. (1997, 1998) as a factor discouraging the development of financial intermediation in any country. They further argue that this is a consequence of the civil law type of legal system existing in the emerging markets of Central and Eastern Europe which has determined the concentration of company ownership structures and given insufficient legal protection to minority shareholders. On the other hand, Glaeser et al. (2000) favour the enforcement of strong independent government regulations to be used as compensation for a weak and ineffective legal system arguing that the Polish regulatory body turned out to be more effective than the more liberal approach adopted in the Czech Republic. Pistor et al. (2000), Berglof and Bolton (2002) also find that weak development of capital markets in transition economies is caused by poor law enforcement, rather than the existence of inappropriate legislation.

Pistor, Raiser and Gelfer (2000) show that weak corporate governance in transition economies cannot be solved simply by radical improvements in the legal framework for the protection of shareholder and creditor rights. Legal reforms in these areas are impressive and, indeed, many of the countries of the former Soviet Union which received legal technical assistance from the US can boast higher levels of investor rights than either France or Germany. However, it is unlikely that in the immediate post 2000 period, future development of the law will be matched by the development of financial markets and the absence of effective legal institutions will provide an effective constraint on enforcement of the law.

The main conclusion of Pistor, Raiser and Gelfer (2000) is that legal effectiveness has overall much greater explanatory power for the level of equity and credit market development, than the technical quality of the law on the statute books. Previous research by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) shows that effective law enforcement does not compensate for low quality of the law. The evidence produced by Pistor, Raiser and Gelfer (2000) demonstrates that the reverse is also true: high quality laws are not a substitute for weak institutions that are unable to enforce the law effectively.

The authors also show that history (or heritage) is also important for the effectiveness of legal institutions. They argue that the low levels of legal effectiveness seem to be rooted in lack of legal modernisation in pre-Soviet Russia, even though there is wide agreement that legal reforms matter. The reforms that were enforced in the inter-war period set the stage for some legal institutions that continue to function even now. This implies that differences between countries that succeeded in laying foundations for a modern legal order in those years, and those that have never been exposed to this kind of modernisation, cannot be eliminated by issuance of laws of good quality.

2.6.03 Institutional Investors

Stock market development is impossible without the emergence of institutional investors such as investment and mutual funds, pension funds and insurance companies because of the funds they make it possible for firms to raise. However, at the outset of transition, institutional investors were small in size and number compared to the financial sector in developed economies. Indeed, the activities of institutional investors involved the creation of new sectors in the emerging transition economies. Institutional investors were therefore relatively small participants in stock market activities at the outset of transition.

Of the three types of institutional investor identified above, the largest and most important in transition economies were the mutual funds. Investment funds mainly emerged as a consequence of the mass privatisation funds used to transfer ownership of assets during privatisation. Basically voucher privatisation kick started industry development by calling overnight for the creation of voucher investment funds. In the initial years of transition however, these hastily formed investment funds were only lightly regulated. This created room for abuse of small shareholders, but also encouraged stock market growth. However, as the stock market grew, regulatory reform quickly followed in order to increase investor confidence. Further impetus was given to establishing sound regulations in those countries that applied for EU membership in order to comply with various EU directives such as those dealing with governance, traqnsparency and so on. Table 2.2 gives some relevant information on the size of the different groups of institutional investor in 2000.

Table 2.2: Assets (% of GDP) Held by Institutional Investors in the Transition Economies of CEE in 2000.

Country	Investment and Mutual Funds	Pension Funds	Insurance	Total
Bulgaria	5	0	1	6
Czech Republic	8	2	9	19
Estonia	5	0	3	8
Hungary	12	4	3	19
Latvia	5	0	1	6
Lithuania	6	0	0	6
Poland	8	2	5	15
Romania	8	0	0	8
Slovak Republic	6	0	4	10
Slovenia	5	0	4	9

Source; Claessens et al (2000)

Table 2.2 shows that even by 2000, institutional investors did not play a large part in stock market activity compared with say the UK where institutional investors held stock market assets to the value of 250 per cent of GDP. Table 2.2 also shows that of all three classes of institutional investor, investment and mutual funds were overwhelmingly the more important in every transition economy in 2000. Pension funds were the next most important group of institutional investor, though they were significantly less important than investment and mutual funds. Hungary had the largest pension fund sector in 2000 in terms of GDP, but even here this group of institutional investors only accounted for 4 per cent of GDP in 2000 - despite a funded occupational pension scheme being introduced seven years earlier in 1993. For comparison, the same group in the UK accounted for assets with a value of 10 per cent of GDP in 2000. Nevertheless, this category of institutional investor might be expected to grow rapidly as transition gathers momentum because many governments in transition economies are committed to giving tax incentives to encourage savers to participate in private pension schemes which take decades to build in size.

The insurance industry in transition economies in 2000 developed later than other institutional investors. This group of institutional investor was therefore the least significant in terms of the value of assets held of all the three groups. A notable exception was the Czech Republic where the insurance market was relatively well developed. It was also, however, dominated by foreign companies! Ironically, progress in developing the insurance market was, in part, due to its success in being established. Indeed an major constraint on growth of the insurance market in transition economies was their vulnerability to competition from larger international competitors which were able to charge lower premiums in order to gain market share. This, of course might not be relevant if foreign owned companies were willing to invest in firms to the same extent as domestic insurance companies.

The emergence of a class of institutional investors is important in the development of stock markets for several reasons. One important reason is that they usually have more funds than smaller investors which enables them to press for the lowest possible transactions costs thereby boosting liquidity in terms of equity turnover in the market. (Bloomesteine, 1998) The effect of this is to reduce the cost of capital which will increase access to capital for liquidity constrained firms. Institutional investors, because of their power, are also likely to be instrumental in establishing and promoting sound standards of corporate governance. As Cvetanovic (2006) puts it "As large and diversified investors with strong preference orientation, they have the potential and incentive to press for value maximising firm governance" (pp2).

Claessens et al (2000) analysed the importance of each of the factors impacting on stock market development discussed above. To do this, they constructed time series data for the period 1994-99 for market capitalisation, market turnover, inflation, institutional assets and minority shareholder protection. The main findings of Claessens et al (2000) are that "The simple correlation coefficients among these variables suggest that market capitalisation is positively correlated with single digit inflation, the size of institutional investor assets, and high shareholder protection – and is negatively correlated with triple digit inflation and low shareholder protection. Market turnover is positively related to the size of institutional investor assets and is negatively related to triple digit inflation and low shareholder protection. The correlation coefficients are all significant at the 5 per cent level." (pp 11)

Other studies have also confirmed the importance of the institutional framework and have focused on the importance of creditor rights in developing banking systems which, by providing financial intermediation services have, among other things, enhanced investment and encouraged stock market growth in transition economies. (See for example, La Porta et al, 1999 and Levine et al, 2000.)

2.6.04 Market Capitalisation

Countries with better stock market fundamentals like a stable macro economy, better laws and accounting rules, stronger disclosure requirements and so on, generally have larger stock markets measured by market capitalisation as a share of GDP. Of all the CEE nations only three: the Czech Republic, Estonia and Hungary had capitalisation to GDP ratios comparable to those of other emerging markets as shown in Table 2.3. The United Kingdom and USA are included for comparison.

Table 2.3: Market Capitalisation in Transition Economies, 1994–2000 (Percentage of GDP).

				Year			
Country	**1994**	**1996**	**1998**	**2000**	**2004**	**2008**	**2012**
Bulgaria	N/A	N/A	8	5	10	31	14
Czech Republic	14	31	21	25	19	27	18
Estonia	N/A	10	28	36	44	19	9
Hungary	3	12	29	34	23	23	13
Latvia	0	3	6	8	11	8	4
Lithuania	1	11	10	11	23	16	10
Poland	3	6	13	21	22	32	30
Romania	N/A	N/A	3	2	10	11	11
Slovak Republic	8	12	5	3	4	7	26
Slovenia	4	4	13	12	26	40	15
UK	16	137	161	166	116	95	113
USA	74	101	151	147	126	110	108

Note: Excludes over-the-counter (OTC) traded issues.

Source: Claessens, S. Djankov, S. and Klingebiel, D. (2000) Stock Markets in Transition Economies, Financial Sector Discussion paper N0 5, World Bank and Standard and Poor's Global Stock Markets Fact Book 2002 and Federal Reserve Bank of St Louis

2.6.05 Market Turnover and Growth

Market turnover, defined as the value of trading over market capitalisation, is a very important indicator for measuring the effect of stock markets on growth (Levine and Zervos 1998). Among the transition economies of CEE, market turnover was highest in Hungary, the Czech Republic, and Poland in the early years of transition (See Table 2.4). Overall, markets in transition economies were less liquid than stock markets in developed economies and these markets trail developed countries' markets significantly. This lower market turnover can mostly be attributed to ownership concentration, a relatively limited free float of the currency, and the international cross listings among large firms. Stock markets in transition economies are dominated by a small number of firms. As a result, the high concentration of market turnover defined as turnover of the top 5 percent of listed firms as a percentage of total turnover was relatively high in most transition economies as at March 2000. Yet at an average of 75 percent, it was similar to that of other stock markets. Poland was the least concentrated market in terms of turnover at about 40 percent as Table 2.4 shows.

Table 2.4: Market Turnover in Transition and Comparator Economies, 1994-2000 (percentage of market capitalisation).

Country	Year 1994	1995	1996	1997	1998	1999
Bulgaria			3	0		
Czech Rep	6	3	0	7	7	1
Estonia			9	8	8	4
Hungary	2	7	2	6	12	3
Latvia		2	5	5	4	1
Lithuania		7.3		8	6	3
Poland	77	2	5	8	4	2
Romania			2	3	6	8
Slovak Rep	6	9	34	9	4	8
Slovenia	8	1	2	1	5	8
United Kingdom	8	8	7	4	3	2

Note: The share for March 2000 was annualised under the assumption that the turnover for the last three quarters of the year will be the same as for the first quarter.

Source: Stock exchange websites and information departments; Beck, Demirguc-Kunt, and Levine 1999.

2.6.06 Foreign Financing

Many large, publicly listed companies in transition economies had sought equity financing abroad. At the end of 1999, 72 corporations from transition economies had American depository receipts (ADRs) listed on the New York Stock Exchange or the Nasdaq, and 61 corporations from transition economies were listed in London. Corporations listed abroad (in New York, London, and Frankfurt) accounted for an average of 18 percent of domestic stock market capitalisation in transition economies in 1999 (Claessens et al, 2000). In Estonia, Hungary, Latvia, and the Slovak Republic, companies listed abroad accounted for about one-third of domestic market capitalisation. On average by the mid 2000, the value of the shares traded abroad was almost half of the value traded on local markets and the number of shares traded abroad was twice as high as the number of shares traded locally. Incentives to list abroad are particularly strong in transition economies as corporations have been able to attract more easily funds at lower costs and better terms, and have tapped into wider investor bases and investors have been able to acquire and sell shares at more liquid exchanges. (Black and Gilson, 1999)

This offshore migration has been especially strong among larger corporations with relatively high market capitalisation and many of the firms listed abroad are involved in resource extraction or telecommunications. But new, internet-related firms have also listed and raised capital abroad, especially firms from the Czech Republic and Hungary. The disappearance of big companies that trade only domestically, deprived local exchanges of liquidity which must have adversely impacted on stock market development. (Claessens, Djankov and Klingebiel, 2000)

2.6.07 Market Liquidity

Liquidity simply refers to the ease and cost with which investors can trade assets and the most liquid markets are those that provide ease of trade at relatively low cost. The costs of trading include transactions costs, the time it takes to execute the trade and the price impact of trades. These are usually collectively referred to as execution costs and the role of market design is to create the conditions that most effectively encourage the emergence and spread of liquidity. Technology is clearly important in promoting liquidity and different trading systems can dramatically alter the execution costs of trades. Size is also important in promoting liquidity because increased trading volume lowers transactions costs. However, volume is encouraged by the efficiency with which the price discovery mechanism discharges its role of accurately reflecting the true value of stock traded.

The most widely quoted theoretical argument relating liquidity and market returns is usually referred to as the collateral-based view. This view argues that a major fall in asset prices adversely affects the value of financial intermediaries' capital and increases their margin calls. The result is that financial intermediaries' are compelled to liquidate their positions, thereby inducing wider bid-ask spreads and increasing the price response to trading. Since net withdrawals are a function of the intermediaries' performance, when the value of assets drop the short-term inflow of funds decreases forcing financial intermediaries to sell, adding to the price downturn, and generating a spiralling fall in some liquidity measures. (See for example, Vayanos, 2004; and Brunnermeier and Pedersen, 2007.) It follows that market liquidity is closely related to intermediaries' funding requirements, and this mutually reinforcing relation can generate sudden spikes in illiquidity indicators. While collateral-based theories assume that outside capital does not enter the market during downturns, fire-sale theories highlight precisely the role of outside capital: lower asset prices reward liquid outside buyers who profit from illiquid asset holders. (See Acharya and Schaefer, 2006 for several explanations.) Fire-sales (namely, forced wide-spread selling from distressed funds when investors redeem their capital *en masse*) put downward pressure on prices as outside buyers demanded additional compensation for providing liquidity.

A large literature exists on the relationship between trading activity and stock market returns. For example, Benston and Hagerman (1974); Gallant, Rossi and Tauchen (1992); Hiemstra and Jones (1994) Datar et al.1998 Lo and Wang (2000). Amihud and Mendelson (1986) demonstrated that common stock with lower liquidity yielded a significantly higher average return after controlling for risk and other factors. Jones (2001) and Amihud (2002) show that time series expected return is an increasing function of liquidity that is proxied by turnover. Pastor and Stambaugh (2001) find that expected returns are cross-sectionally related to liquidity risk. Amihud and Mendelson (1986) illustrate that the relative spread on stocks is negatively correlated with liquidity characteristics such as trading volume, the numbers of shares outstanding, number of market markers trading the stock and the stock price continuity. They also demonstrated the importance of market microstructure factors as determinants of stock returns. However, microstructure also focussed on the type of trading mechanism adopted. Traditionally trading systems are either order-driven or quote-driven. Order-driven systems allow the continuous interaction of buyers and sellers who post limit orders that are executed by computers matching buy and sell orders within each limit price category. Quote-driven systems, on the other hand, provide liquidity through the actions of dealers who offer buy and sell quotes and in doing so, provide liquidity to the market. In general, order-driven systems have replaced quote-driven systems since, by allowing customers to interact, they generally reduce execution costs and increase liquidity.

The bid and ask spread as used by Amihud and Mendelson (1986) is now a well-established measure of liquidity and transparency in the market. Market volatility as measured by the absolute value of the contemporaneous market return is positively associated with changes in the bid-offer spread and market returns are negatively associated with changes in the bid-offer spread. (Cordial et al. 2001) Chordia et. al. (2000) also demonstrate a strong cross-sectional relationship between dollar trading volume and various measures of bid-ask spread and market debt.

The ability to create liquid markets is therefore one of the most important functions that stock markets provide. Investors are generally reluctant to take on the risk involved with many potentially relatively high return projects which require long term commitment of capital thus giving rise to higher default and liquidity risks. Consequently, without liquid stock markets, these potentially relatively high return projects might not attract sufficient levels of investment. In contrast, liquid stock markets allow investors to change their portfolios quickly and relatively cheaply making investment less risky and thus facilitating more profitable investments. (Levine (1991) and Bencivenga, Smith and Starr (1996).

Market liquidity is measured in two ways. First, the ratio of Value Traded (VT) to GDP which measures the value of equity transactions relative to the size of the economy (GDP) will be calculated. Secondly, the ratio of total value traded to total market capitalisation (MC) called turnover ratio. This measures the value of equity transactions relative to the size of the equity market.

These two liquidity indicators do not directly measure how easily investors can buy and sell securities at posted prices. However, they do measure the degree of trading in comparison to the size of both the economy and the market. Therefore they positively reflect stock market liquidity on an economy wide and market wide basis. Moreover, these two measures complement each other. (Garcia and Liu, 1999) The value traded (VT) to GDP ratio which indicates the size of the stock market relative to GDP has improved significantly in all the CEE countries except for the Slovak Republic for the period considered. Not surprisingly, those countries with higher MC/GDP ratios are also the countries with better VT/GDP ratios. Turnover ratio is consistently higher for the nations of Bulgaria, Hungary, the Czech Republic, and Poland over the three years 2005-2008 which suggests that these markets are highly active. Hungary alone stands out as a country which has a relatively large VT/GDP ratio at19.8% and also a relatively active Turnover ratio of 157.3% in 200,8 followed by the Czech Republic with a VT/GDP of 23%, and a Turnover ratio of 115.4%).

2.6.08 Bond Markets

To understand fully the development of stock markets in transition economies, we also need to understand the forces that shaped development of the bond markets in these countries. Herring and Chatusripitak (2001) argue that there are several general reasons for developing debt markets as part of a process of stock market development. They argue that the most fundamental reason is to make financial markets more complete by generating market interest rates that reflect the opportunity cost of funds in each maturity and risk category. This is essential for efficient investment and financing decisions. Moreover, the existence of tradable instruments aids risk management. If borrowers have available to them only a narrow range of instruments (eg in terms of maturity, currency, etc), they can be exposed to significant mismatches between their assets and their liabilities. If bond markets do not exist, for instance, firms may have to finance the acquisition of long-term assets by incurring short term debt (or raising equity). As a result, their investment policies may be biased in favour of short-term projects and away from entrepreneurial ventures. If firms attempt to compensate for the lack of a domestic bond market by borrowing in international bond markets, they may expose themselves to excessive foreign exchange risk.

The risks entailed by such mismatches can only be minimised by the use of appropriate hedging mechanisms, the availability of which depends on the range of financial instruments actively traded on the stock markets. Liquid markets help financial market participants to hedge their exposures. As risks are spread across many participants and not concentrated on a few, and as risks can be transferred to entities best placed to bear them, the costs of intermediation are reduced and the financial system, along with the corporate bodies that use the financial system, are, other things equal, likely to become more stable.

A second general reason for developing bond markets is to avoid concentrating intermediation uniquely on banks. As seen in the recent financial crisis, highly leveraged banks make the economy more vulnerable to crises as the recovery process is lengthy and the damage caused to the real economy can last for years.

A third general reason for fostering debt markets is that such markets can help the operation of monetary policy which relies heavily on indirect instruments of control like a well functioning money market which is essential for the smooth transmission of policy. In addition, prices in the long term bond market give valuable information about expectations of likely macroeconomic developments and about market reactions to monetary policy moves.

The CEE region has well established government securities markets with all countries heavily dependent on public sector financial requirements of local governments. The same cannot be said of corporate securities markets which remain thin throughout most of the CEE region, even as late as 2008 when the outstanding stock of non-financial corporate debt securities as a percentage of GDP accounted for less in all countries of the region than the average Latin American and Asian Emerging markets - and these markets remain relatively small compared to developed economies. (Tovar, 2005, Yoshitomi and Shirai, 2001) Furthermore, secondary corporate bond market activity is limited and even in countries where primary corporate issues have increased at faster rates in the past few years, growth has been concentrated in a handful of sectors such real estate, energy and the financial sector. The market for securities issued by financial institutions is somewhat deeper and expanding more rapidly than the nonfinancial corporate securities segment.

Table 2.5 provides a summary of the listed bonds in the major CEE stock exchanges. It highlights an increase in the number of listed bonds. These bonds are mostly of domestic origin and international bonds play a relatively minor role except on the Prague Stock Exchange.

Table 2.5 Listed Bonds-Domestic

	Domestic Public Sector			Domestic Non-Public Sector			International		
	Year			Year			Year		
Exchange	**2006**	**2007**	**2008**	**2006**	**2007**	**2008**	**2006**	**2007**	**2008**
Bratislava	5	3	1	8	7	11	-	-	-
Bucharest	1	4	4	-	-	-	-	-	-
Budapest	2	3	2	8	0	1	-	-	-
Sofia	-	-	-	5	4	5	-	-	-
Ljubljana	9	7	5	7	2	4	-	-	-
Prague	7	9	9	4	6	7	7	7	5
Warsaw	8	1	7	-	-	-	-	-	-

Source: FESE, European Exchange Report, 2009

2.6.09 Development of Local Markets in CEE Countries

Governments play a key role in providing the necessary infrastructure to support the development of efficient and competitive capital markets, the core of which is providing and enforcing a strong legal framework to protect the rights of creditors and shareholders, and ensuring sufficiently high disclosure standards and quality of information, good governance of institutional investors, and support for private and public institutions (Claessens, Djankov and Klingebiel, 2000; Levine, Loayza and Beck, 2000). This section describes government debt management policy which is very important for the development of a liquid and complete benchmark yield curve, the implementation of efficient and reliable trading, and payments and settlement systems, enforcement of law and regulations and the role of investors.

Governments also play a crucial role in providing the infrastructure needed to facilitate the flow of information and the price discovery process in order to support the development of efficient and competitive capital markets. Most of the countries in the CEE region now (2008) have adequate infrastructure for the trading of stocks. Namely, electronic trading systems, delivery versus payment (DvP), clearing and settlement systems. (Iorgova and Ong, 2008)

Regarding the bond market, firm government commitment to a set of issuance policies, ensuring predictable supply of government securities led to the establishment of a liquid government benchmark yield curve. This in turn facilitates the pricing of corporate securities which is the case in the Czech Republic. (IMF, 2003) The lack of sophistication in pricing credit risk was a major constraint on the growth of local bond markets in CEE. As late as 2005, benchmark yield curves remained largely incomplete and illiquid in many CEE countries (Iorgova and Ong, 2008). At this time, government bond issues were largely clustered around the 3 – 5 year tenure. A handful of countries, such as Bulgaria and Romania had issued bonds up to the 15 year mark, but in CEE only the Czech Republic and Poland had issued 30-year bonds by the end of 2005. In late 2007, the Czech Republic became the first country in the region to issue a 50 year bond. The issuance strategy in Poland had been designed to increase liquidity while also extending the maturity of the government debt market. The Hungarian Government on the other hand had focused its issuance strategy to bring its market practices more in line with the eurozone. This has now changed and, from 2012 onwards, the maturity of bonds issued in most CEE countries was broadly in line with maturities in more developed European markets.

Lack of a credible credit rating system represents another barrier to the development of corporate bond markets in the region. Moreover, even in countries where rating agencies exist, the credit rating culture for private bond issues remains weak. In Bulgaria, for instance, corporate bond issuers have not felt the need to acquire a credit rating thus far (as at 2006) partly due to the lack of corporate defaults. (Arvai and Herderschee, 2007) Thus, it is unclear to what extent regulations could induce the use of rating agencies, or whether their credit assessments would be useful in pricing or allocation decisions. (See also IMF, 2003)

Decisions that are particularly relevant to the development of a primary market such as choice of auction techniques and set-up of primary dealer systems can define the operating efficiency of both the primary and the secondary markets which in turn impact on the price discovery process. By enhancing market credibility and ensuring liquidity in the secondary market, these decisions impact crucially on the implementation and continuous enhancement of efficient and reliable trading, and payments and settlement systems.

2.6.10 Institutional and Foreign Investors

Institutional investors were defined earlier on page 39 as “Specialised financial institutions which manage savings collectively on behalf of small investors towards a specific objective in terms of acceptable risk, return maximisation and maturity of claims. (Davis, 1996: pp. 64) Their importance for stock market development has been supported by theoretical reasons and empirical evidence, which clearly implies that institutional investors have a nontrivial impact on the process of stock market development. Bodie (1990), Davis (1996) and Vittas (1998) suggest that institutional investors may promote stock market development through functions such as clearing and settling payments, pooling of funds, transferring economic resources, managing uncertainty, controlling risk, introducing financial innovation, using price information, and dealing with incentive problems. These activities will encourage increased liquidity and market capitalisation and, through this, will encourage decreased price volatility and more efficient asset pricing. It is also possible that increased international stock market integration will also be promoted thus improving institutional indicators of stock market development. This direction of causality from institutional investors to stock market development is referred to as the supply-led causality relationship. (Muslumov and Aras, 2005)

The decade up to 2003 saw a significant increase in trading of securities both in domestic and international markets, and as a result more transactions needed to be settled. However, increasingly more of these transactions needed international settlement. (Van Cayseele and Wuyts, 2005) Generally the associated transactions costs are passed on to investors and according to NERA (2004) it was euro 0.10 per transaction in the United States while it ranged from euro 0.35 to 0.80 in CEE. By adhering to the European code of conduct for clearing and settlement, institutional investors can help reduce these transaction costs. (Schaper, 2007)

Vittas (1998) finds that this causality is bidirectional since stock market development leads to the diversification of financial instruments, more financial stability and increased efficiency. These improvements increase demand for instruments of risk management, financial innovation, and portfolio management functions of institutional investors while institutional investors may support stock market development in the earlier stages. However, stock market development feeds the development of institutional investors in the later stages of development

As an investor class, foreign investors are also playing an increasingly important role in shaping capital market development in the region. Investment by foreigners in the stock markets of CEE has generally been significantly low in the region when compared to the mature markets of Western Europe. As at 2007, the exceptions are Hungary and the Slovak Republic as Table 2.6 shows. One reason for this might be their relatively low market capitalisation when compared to the more mature markets of Western Europe.

Table 2.6: Foreign Investor Involvement (In Million $), 2007

Country	**Portfolio Investment (PI)**	**Market Capitalisation (MC)**	**Percentage of Foreign Investment (PIMC)**
Bulgaria	4000	21793	18.35
Czech Republic	26158	73420	35.63
Estonia	4965	6037	82.24
Hungary	66811	47651	140.21
Latvia	1517	3111	48.76
Lithuania	5694	10134	56.19
Poland	91812	207322	44.28
Romania	8654	44952	19.26
Slovak Republic	8258	6971	118.46
Slovenia	5638	28963	19.47

Source: World Development Indicators 2008-2009, IMF World Economic Outlook Database 2009, IMF-Portfolio Investment: Coordinated Portfolio Investment Survey (CPIS) Data

Note that Portfolio Equity includes net inflows to equity securities other than those recorded as direct investment and includes shares, stocks, depository receipts, and direct purchases of shares in local stock markets by foreign investors. FDI is net inflows of investment to acquire a lasting interest in, or management control over, an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvested earnings, other long-term capital, and short-term capital, as shown in the balance of payments accounts.

Even as late as 2013, FDI inflows into the countries investigated in this theseis was relatively low

Table 2.7: Foreign Direct Investment (In Million €), 2013

Country	**Inflow**	**FDI Net**
Bulgaria	1092	957
Czech Republic	3760	1278
Estonia	715	447
Hungary	2317	615
Latvia	609	349
Lithuania	400	324
Poland	728	-890
Romania	2725	2635
Slovak Republic	445	763
Slovenia	-511	-555

Tables 2.6 and 2.7 are not srtictly comparable because they give a different data set in a different currency. However, they do reveal a consistent pattern in that FDI remains low in CEE compared with more developed economies in the EU. In 2013 for example, net FDI into Germany was over $26bn and negative €149bn in Luxemburg. Nevertheless, foreign investors have become an important source of demand for local securities and are perceived to play a key role in local market development by, for example, acting as a catalyst in the development of robust market infrastructure and improvements in governance and transparency (Mathieson and Roldos, 2004). As of end-2005, foreign investors held close to 78 percent of equity market capitalisation in Hungary and 51 percent of equity holdings in Bulgaria as of end-2006.

Similarly, foreign investors play a significant role in the bond markets with a third of all government bonds in Hungary held by foreigners. In Poland and the Czech Republic, foreign investors hold around a quarter of outstanding government bonds. (Iorgova and Ong, 2008) Given that investments by foreign institutional investors is quite a significant proportion of the total local market capitalisation, any adjustment in foreign holdings of the region's assets could lead to large price movements and any collective action by these investors could have a potentially profound impact on local markets. On the other hand, foreign investors have also been credited with supporting market development and growth in emerging market regions by enforcing discipline on the corporations that they have invested in. (IMF, 2003)

2.6.11 Corporate Governance and Transparency

Strong corporate governance and financial transparency which entail the adoption and implementation of well-developed securities and bankruptcy laws, credible accounting and auditing standards, enhanced regulation and supervision and stronger enforcement of private contracts are crucial for the development of local capital markets. La Porta, Lopez-de-Silanes, Shleifer and Vishny (2000) show that countries with less protection for minority shareholders have less developed markets, while Pajuste (2002) and Klapper and Love (2004) find that better corporate governance is highly correlated with higher market valuation. Proper financial disclosure has become even more important in a globalised environment with increasing cross-border activity because information needs to be made available to, and understood by, investors, shareholders, firms and financial analysts globally. (Dowers and Lorenzo, 2004)

Many emerging European markets still suffer from inadequate reporting standards, reporting histories, lack of credible corporate ratings and ownership disclosure structures. Carvajal and Elliott (2007) observe that a combination of factors, such as insufficient legal authority, lack of resources, political will and skills tend to undermine regulators' capacity to effectively execute regulation. Zoli (2007) discusses areas where there is still scope for strengthening institutional reform in emerging CEE markets. In some cases, judicial bottlenecks and lack of capacity prevent effective enforcement. For example, Berglof and Pajuste (2005) note that while the Baltic countries and Romania implemented strict securities market regulations relatively early on in the transition process, enforcement has been limited due to the lack of well-defined legal responsibilities, resources and expertise.

According to Berglof and Pajuste (2005), rules relating to mandatory disclosure in annual reports are still not sufficiently enforced and they highlight the case of Poland where there is less corporate disclose in annual reports than companies are legally obliged to disclose. This is in sharp contrast to the Czech Republic, where corporations are now said to disclose more in their annual reports that they are legally required to disclose. However, the enforcement of regulation *per se* may not be sufficient for encouraging capital market development. The regulatory process must also be efficient: market timing is of utmost importance to both issuers and investors, since any regulatory delay would be tantamount to prohibitive regulation (Luengnaruemitchai and Ong, 2005). By taking corporate bond market development in emerging Europe as an example, it can be observed that lack of sufficient corporate procedures and regulations in some cases, and the existence of restrictive regulations in others, has held back the progress of this market in the CEE region generally. (Iorgova and Ong, 2008)

2.7 Conclusion

The emergence of stock markets in transition economies is crucial to the progress of transition and no developed market economy could function optimally without a developed and efficiently functioning stock market. The demand for stock markets, like the demand for financial institutions arises from the creation of markets for goods and services generally, but the supply of institutions like stock markets depends, on among other things, on the emergence of trust the dissemination of accurate information and laws that protect investors. This chapter reviews the emergence of stock markets in the first two decades of transition in CEE with the empahasis on the first decade of transition when embryonic stock markets were established There are positive signs, and market capitlisation, though low by international standards, is clearly rising. However, it is clear that even after a decade of transition, progress has been slow. Nevertheless, reform has continued and privatisation, as well as liberalising markets, the very cornerstones of transition to market economy, have provided both the impetus and the pressing need for stock market development.

In the transition economies of CEE, privatisation preceded the development of stock markets but, once privatisation proceeded, the need for a market to transfer ownership rights in newly privatized companies quickly emerged. One consistent feature across the economies of CEE is the remorselessly continued trend in privatisation. Initially stock listings rose rapidly but as ever more reliable standards of corporate governance emerged, de-listings became more common as those companies which failed to comply with stock exchange regulations, the design features of which were imported from developed Western stock markets, were de-listed. The raw numbers might create the impression that this was somehow a set-back to the development of stock markets in CEE. However, it is a positive sign that quality listings were becoming the norm in the newly created stock markets of CEE.

Inevitably the early stages of transition were characterised by instability as structural changes took place in the economy and new institutions gradually replaced the institutions associated with Soviet economic planning. As stability and growth became established features of the CEE region, this encouraged the development of stock markets by providing companies with access to the savings of individuals and especially institutional investors, which enabled them to grow by exploiting profitable investment opportunities. The flow of savings to the corporate sector was also encouraged by the enactment of laws aimed at shareholder protection which particularly opened up opportunities for institutional investors and spurred the growth of these. The development of bank markets similarly provided opportunities for private sector oganisations to access funding from investors not wishing to be equity holders. Without the emergence and growth of institutional investors, transition could never have taken place on the scale it has. Markets have also been opened up to foreign investors and the implied increase in competition on stock markets will have encouraged more efficient performance and increased the confidence of domestic investors. All in all, from lowly beginnings, stock markets in CEE slowly began to resemble those in developed Western economies.

CHAPTER 3
MARKET EFFIEICNY AND STOCK MARKET COMOVEMENT

3.1 Introduction to Market Efficiency

A stock market performs much the same functions as any other market for goods, services, financial assets and so on. It brings buyers and sellers of stock and bonds of various classes into contact with other buyers and sellers of stock and bonds. A stock market thus relieves each party of the need for a long and potentially expensive search for a counterparty with exactly equal and opposite needs. In performing this basic function, stock markets enable assets to be valued, risks to be spread, capital to be raised and the efficiency levels of management monitored and enhanced.

The inventor of a new product can form a company to raise capital by selling stock in that company. This provides both funding for the project and the pooling of risks involved in investing in a company. When there is transparency and appropriate governance mechanisms are in place, the market will value the company taking into consideration the expected returns it is thought will materialse. These will be commensurate with an assessment of the risk involved from the projects the company is undertaking and/or plans to undertake. If the market undervalues a company it will raise less capital than otherwise and/or capital raised will be more expensive than otherwise. Company development will therefore be hampered. Exactly the opposite will happen if the market overvalues a company. Over time, perceptions will adjust and, if markets perform their role efficiently, information will be fully processed and company valuation will reflect this. This will encourage competition among companies and will promote efficiency in the use of resources. When this happens, company valuation also provides an impartial assessment of managerial performance and is used in assessing managerial remuneration.

It seems reasonable to assume that the risk of loss will encourage investors to make use of every piece of information relevant to the performance of the company they have invested in and the performance of other companies to assess their returns relative to the risks they undertake. However, a fair return on investment is one that offers the investor just the right level of compensation for the expected risk of the investment (in addition to the time preference rate and an adjustment for expected inflation). This raises the obvious question of why it matters whether market prices for investments in fact offer fair returns? It could be argued that the pricing of stock is a zero-sum game in which one player's loss is another's gain? For every investor who loses by buying at the top end of the market and selling at the bottom end, there must be another who, by definition, profits by doing the opposite. So can we argue that if a particular investment offers either an excessive or an inadequate return, total income and wealth are neither increased nor reduced, but merely redistributed among market participants?

On the other hand, if it could be shown that markets *do* price investments fairly, this would have far reaching and quite radical implications. It would imply that all the time and effort expended by investors on trying to 'pick winners' (that is, identify investments that pay excess returns) would be so much time and effort wasted. The converse argument would apply to organisations' efforts to spot windows of opportunity to finance their operations when funds appear to be relatively cheap because stock prices are relatively high since this will, in fact, be illusory. The rate demanded by the market would be a fair one in relation to the risks involved and the expected returns and would therefore be neither 'expensive' nor 'cheap'.

This takes us naturally to the question of whether it is it possible through the exercise of skill or experience, to predict the movement of share prices in such a way that excess returns can be earned not just occasionally, but consistently? This is impossible in an efficient market where the prices of securities reflect all relevant information, react quickly to new information about the firm's products, its costs, its management, its dividend policy, its prospects as the economy changes and so on.

In an efficient market, then, prices act as valid signals for resource allocation, both to investors investing in stock and to corporate managers engaged in capital formation. So, for example, an investor choosing among alternative stocks can have confidence that stock prices fairly reflect their relative values. At the same time, the corporate manager considering alternative investments can have confidence that funds will be available for those that are profitable since the market will recognize and value those profitable investments. As Baumol (1965) puts it, "rewards and punishments would be meted out by the market and management's collective nose kept to the grindstone by anticipated future capital needs" (p67).

3.2 Types of Market Efficiency

An all embracing definition of market efficiency is a market which instantaneously processes new information and generates a constantly updated set of prices such that prices in the market are without systematic tendencies leaving investors no opportunity for arbitrage. To the extent that markets are efficient therefore, it is impossible for investors to earn above average returns, or, as Fama (1998) puts it "The expected value of abnormal returns is zero but chance generates deviations (anomalies) in both directions" (p284). Of course whether potentially profitable trading opportunities exist depends on trading costs and the magnitude of risk adjusted returns. Notwithstanding this, if returns above the market return are consistently recorded, the market is clearly not efficient. The implication is that in an efficient market, competition among participants leads to a situation where, at any point in time, actual prices of individual securities already reflect the effects of information based both on events that have already occurred and on events which, as of now, the market expects to take place in the future. In other words, in an efficient market at any point in time the actual price of a security will be a reliable estimate of its intrinsic value. This having been said, the concept of market efficiency has three dimesions and each is considered below.

3.2.1 Strong-form Efficient Market Hypothesis

In its strongest form, the efficient market hypothesis says a stock market is efficient if all information relevant to the value of a share, whether or not generally available to existing or potential investors, is quickly and accurately reflected in the market price of that share. For example, if the current market price is lower than the value justified by some piece of privately held information, holders of that information will exploit the pricing anomaly by buying the equity. They will continue doing so until this excess demand for the share has driven the price up to the level supported by their private information. At this point they will have no incentive to continue buying, so they will withdraw from the market and the price will stabilise at this new equilibrium level. This is strong form market efficiency. It is the most satisfying and compelling form of the efficient market hypothesis in a theoretical sense, but it suffers from a major drawback in practice: It is virtually impossible to confirm empirically as those with the ability to provide the information necessary to test the proposition (insider dealers) have every incentive to withhold that very information.

Despite this, if a market is strong-form efficient the current market price is the best available unbiased predictor of a fair price, having regard to all relevant information, whether the information is in the public domain or not. As noted above, this implies that excess returns cannot consistently be achieved even by trading on inside information. This does prompt the interesting observation that *somebody* must be the first to trade on the inside information and hence make an excess return. Unfortunately as noted above, this observation, though very attractive in theory, is impossible to test in practice with any degree of academic rigour.

3.2.2 Semi-strong-form Efficient Market Hypothesis

In its semi-strong form, the Efficient Market Hypothesis says a market is efficient if all relevant publicly available information is quickly reflected in the market price. This is the semi-strong form of the Efficient Market Hypothesis. If the strong form is theoretically the most compelling Efficient Market Hypothesis, the the semi-strong form perhaps appeals most to common sense. It implies that the market will quickly digest the dissemination of relevant new information by moving the price to a new equilibrium level that reflects the change in supply and demand caused by the emergence of that information. What it may lack in intellectual rigour, the semi-strong form of the Efficient Market Hypothesis certainly gains in empirical strength being far less difficult to test than the strong form.

If a market is semi-strong efficient, the current market price is the best available unbiased predictor of a fair price, having regard to all publicly available information about the risk and return of an investment. The study of *any* public information (and not just past prices) cannot yield consistent excess returns. We note in passing that this is a somewhat more controversial conclusion than that of the weak-form Efficient Market Hypothesis discussed below because it implies that *fundamental* analysis – the systematic study of companies, sectors and the economy at large – cannot produce consistently higher returns than are justified by the risks involved. Such a finding calls into question the relevance and value of a large sector of the financial services industry devoted to investment research and analysis.

We also note in passing that one problem with the notion of semi-strong form efficiency lies with the identification of all ‘relevant publicly available information’. The phrase sounds relatively tight, but the reality is less clear-cut because information does not arrive with a convenient label saying which shares this information will or will not impact upon.

3.2.3 Weak-form Efficient Market Hypothesis

In its third and least rigorous form (known as weak form efficiency) the Efficient Market Hypothesis confines itself to just one subset of public information: historical information about the share price itself or an index of share prices. The argument is simple. Since ‘new’ information cannot be related to previous information otherwise it would not be new, it follows that every movement in the share price (or index of share prices) in response to new information cannot be predicted from the last movement in price. The behaviour of past prices gives no guide to future price movements and all information in past prices is incorporated into current prices. The development of the price (or price index) assumes the characteristics of a random walk and future prices cannot therefore be predicted from a study of historic prices.

If a market is weak-form efficient, there is no correlation between successive prices so that excess returns cannot consistently be achieved through the study of past price movements. Studying the behaviour of past prices in an attempt to indentify recurring patterns of a predictable nature in the behaviour of prices is referred to as technical analysis or chartist analysis because it is based on the study of past price patterns without regard to any further background information.

3.3 The Importance of Market Efficiency

Each of the three forms of the Efficient Market Hypothesis has different implications in the context of the search for excess returns, that is, returns in excess of what is justified by the risks incurred in holding particular investments. It is therefore difficult to make precise observations on the importance of market efficiency since observations will depend on the type of market efficiency referred to. However, some general observations are possible and these are elaborated here to provide some insight into the motivation for this thesis.

An immediate and direct implication of stock market efficiency is that no investor, nor group of investors, can constantly achieve excess returns by following a defined investment strategy. Equity research with the intent of achieving accurate valuation would be a costly business since it would offer no benefit. The probability of indentifying an undervalued stock would always be 50:50 reflecting the randomness of pricing errors. Furthermore, in an efficient stock market, a strategy of randomly diversifying across stocks or indexing to the market, carrying little or no information cost and minimal execution cost, would be superior to any other strategy that involved larger information and execution costs. Clearly no value added could be gained by employing portfolio managers and/or investment strategists. The final implication for portfolio management of market efficiency is that a strategy of minimising trading, that is, creating a portfolio and not trading unless cash is needed, would be superior to a strategy that required frequent trading or even minimal trading over and above that required to convert assets to cash.

However, the implications of stock market efficiency are more far reaching and are not simply confined to the area of portfolio management. Stock market efficiency is important because unless a stock market is informationally efficient, it will be unable to fully discharge its role in a functioning market economy and this will inhibit economic progress. Stock market efficiency therefore has clear implications for transition and economic development generally. In this context there is evidence that establishing appropriate financial and economic institutions is an important feature of successful transition from a centrally planned economy, to a market economy (Young and Reynolds, 1995; EBRD 1998; Ibrahim and Galt, 2002). Furthermore, 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 established, the sooner there will be sound benchmarks for enterprises to be privatised. The clear implication is that an efficient capital market is essential in establishing the conditions necessary for a functioning market economy.

There are other issues and in a capitalist economy, prices for goods and services play the central role in resource allocation. For any good or service, prices adjust to reflect relative scarcities and, as they do so, buying and selling decisions are revised and alter the allocation of resources. The strength of capitalism therefore lies in its ability to enable market prices to reflect sufficient information so that resources are allocated efficiently. However, the markets for assets, such as the stock market, are different from the markets for goods and services. In particular, if a company's share price goes up, it is not clear that its access to equity capital will be altered. This is because stock prices differ from the prices of goods and services in three ways:

a) The price of equity is not a marginal value but an average value. Stock market prices are secondary market prices which value an entire firm rather than a marginal investment. The role played by the stock market is analogous to the role played by conventional markets for goods and services only in the single case where a newly created firm issues equity for the first time to fund its investment. In this special case, if investors believe that the capital sought can be more effectively deployed elsewhere, or if the expected returns on the project are insufficient to induce enough saving, the price of equity will be insufficient for investment in the company to be undertaken. However, in reality an insignificant amount of capital is raised in this way and therefore this latter possibility is of no concern to us here.

b) Decisions about the allocation of investment funds are usually delegated to managers who sometimes have little or no ownership stake in the firm. Managers make decisions over dividend policy, leverage, the timing of new issues of equity and other securities and therefore have discretion over the amount of funding available for investing in new assets. The principal-agent problem and that of designing appropriate incentives is well known, but is complicated by the fact that decisions managers take might have implications for the long term performance of the company stretching well beyond the time they leave the company.

c) The flow of information in a stock market might be bi-directional: The market might want to learn about the quality of the manager's decisions, but the manager might also want to learn the market's valuation of prospective investments. The stock price, although intrinsically irrelevant to the investment decision, might be useful indirectly because it conveys information about prospective investment projects and cash flows. For example, a relatively high stock price might signal to a manager that the market believes the firm has profitable investment opportunities. The fact that managers seek to infer information from the price of equity implies that the price of stock differs from the price of goods and services since the buyers of goods and services have no interest in whether the market price of what they buy reflects the marginal utilities of other consumers or the marginal cost of making these goods and services available. In these cases they need only compare the price of the product to their own marginal valuation. In the stock market, managers (acting on behalf of shareholders) are concerned with other agents' information as reflected in price, but the stock price is not the marginal cost of investment funds.

These special features of the stock market raise questions about whether 'efficient' stock prices are related to the efficient allocation of resources. However, Fama (1976) is in no doubt about this: "An efficient capital market is an important component of a capitalist system …. If the capital market is to function smoothly in allocating resources, prices of securities must be good indicators of value" (p133). This view is further 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" (pp 101). Dickinson and Muragu (1994) provide evidence of this in the case of Nigeria.

The implication is that in an efficient market, prices act as valid signals for resource allocation, both to investors investing in securities and to corporate managers engaged in capital formation. So, for example, an investor choosing among alternative stocks can have confidence that their prices fairly reflect their relative values. At the same time, the corporate manager considering alternative investments can have confidence that funds will be available for those invstments that offer appropriate expected returns since the market will recognise and value those potentially profitable investments.

Furthermore, efficient capital markets enable manager compensation to be tied to stock performance thus aligning the interests of principals and agents and, through this, promoting efficiency in the allocation of resources. Market inefficiency removes the incentive for managers to maximise a firm's stock price and evade hostile take overs by corporate raiders seeking short term gains. Bekeart and Harvey extend this notion to the economy and argue that "An efficient stock market can enhance growth by mitigating moral hazard and consequently increasing productivity" (p38)

Typically underdeveloped capital markets are illiquid with relatively high transactions costs which hinder the efforts of firms to raise capital thus negatively impacting on growth. (This is also likely to encourage larger enterprises to raise capital in overseas markets thus perpetuating thin trading and impeding stock market development.) Recent theoretical literature on financial development and growth identifies three fundamental channels through which capital markets and economic growth might be linked (Pagano, 1993). One channel occurs because capital market development increases the proportion of savings that can be mobilised as investments. A second channel occurs because capital market development is likely to increase the rate of savings and through this facilitate higher levels of investment. A third channel occurs because capital market development, as noted above, increases the efficiency of capital allocation. Of course, a developed market is not necessarily an efficient capital market, but the literature overwhelmingly finds that developed capital markets are efficient and these channels operate because an efficient capital market gathers and processes information in a way that projects the content of that information accurately and through this provides investors with better opportunities for risk diversification.

More generally, economic growth in a modern economy hinges on an efficient financial sector that pools domestic savings and encourages foreign capital to the domestic economy. According to Ewah et al. (2009), the rate of economic growth of any nation is inseparably linked to the sophistication of its financial markets and specifically to capital market efficiency. Filer, Hanousek and Campos (1999) survey 70 countries and report evidence of a positive and significant relationship going from stock market development to economic growth, particularly in emerging economies. Rajan and Zingales (1996) have argued that in economies where inside finance is available, the contribution of financial intermediaries to economic development and growth may be relatively small. However, they further argue that financial sector development may play a particularly beneficial role in the rise of new firms. If these firms are disproportionately the source of new ideas, financial development can enhance innovation and thus enhance economic growth in indirect ways. This condition is likely to apply in transition economies which are the subject of this thesis because of the mass privatisation of industrial organisations and the creation of new commercial organisations as markets emerged and developed.

3.4 Stock Market Comovement

Many of the world's stock markets are likely to be related and exhibit comovement, that is, simultaneous movement in stock prices with a common cause. One obvious reason for such comovement is that many stocks are cross listed on different exchanges and any factor impacting on a stock's price in one market will immediately impact on its price in other markets, otherwise arbirtrage would take place and force price adjustments to restore cross market equilibrium. Moreover recent technological progress in the financial sector has enabled information and funds to be rapidly transmitted between financial sectors thereby providing investors with opportunities in world stock markets rather than just in a local stock market. Also, economic activities of firms have become more international mostly due to falling transportation costs stemming from technological progress.

This might have clear implications for stock market efficiency which, as Fama (1970) noted, implies zero unexploited excess profit given the information available to the public. To understand this more fully, consider the case where one country's stock market is not efficient but that that stock market is jointly efficient with another country's stock market. This clearly implies that investors can invest in both markets to create portfolio diversification and arbitrage riskless gains. Because of this, it is possible that 'joint efficiency' among several markets occurs when these markets are cointegrated.

Since stock price data are mostly non-stationary, a stable relationship between stock price data in two (or more) markets implies that these markets are cointegrated. As MacDonald and Taylor (1988 and 1989) point out, if stock prices in any two markets are cointegrated then a linear combination of stock prices must exist and this will help investors to predict future stock prices in one of the cointegrated markets and therefore at least one of the markets is not efficient.

Thus far our analysis suggests stock market efficiency and stock market comovement are linked because efficient markets process all available relevant information and reflect this in stock prices which, by definition, should therefore always reflect the underlying 'fundamentals'. If information impacts on foreign markets and this information is relevant to stock prices in the domestic economy, domestic stock prices should adjust instantaneously or as soon as markets open if markets are separated by time and the domestic market is closed when relevant information reaches the foreign market.

However, if one market affects the other market and the harmonisation process does not take place instantaneously, investors might be able to earn excess returns which runs counter to the efficient market hypothesis. In this context, Crochi (2003) suggests that comovement and information transmission between markets can be used in tests of market efficiency. Furthermore, to the extent that comovement is a measure of stock market efficiency and, through this, stock market development, the speed of adjustment in market comovement is the crucial measure of stock market development in the former transition economies of Central and Eastern Europe. If adjustment between markets is instantaneous, comovement is consistent with an efficient market. However, if one market leads another market and synchronisation of prices is not instantaneous, there is clear evidence of inefficiency.

3.5 Importance of This Research

The discussion above sets the importance of stock market efficiency and the advantages to be gained from an efficient stock market into clear relief. The focus of this research is the development of stock markets in the former transition economies of Central and Eastern Europe. As former Communist countries, stock markets were extinguished because they had no place in a centrally planned economy where private ownership of assets was almost non-existent and large scale enterprises were all state owned. Establishing functioning stock markets from scratch, though an enormous task in itself, was simply a building block in the creation of a functioning market economy since a functioning market economy cannot exist in the absence of a functioning stock market.

In the years of Communism, new generations, unaccustomed to the operation of capital markets, had grown up and viewed the newly created stock markets with suspicion and caution. One of the major challenges in the transition economies was therefore to educate investors and to explain to them the nature of risk capital. However, efforts to educate investors were somewhat confounded because, coupled with the absence of understanding, there was an absence of reliable information about the companies traded on the stock market. The information disclosed by companies was often inaccurate or incomplete and was frequently based on different accounting standards and reliable auditing practices were non-existent. In other words, reliable corporate governance structures of the type common in developed market economies were not in place and companies were subject to few, if any, mandatory disclosure requirements.

Encompassing all of these issues was the absence of a regulatory framework to establish rules within which a market economy could develop. The legal systems of the different transition countries had to be changed substantially so as to incorporate rights to the ownership of private assets, to provide guarantees for investors over the proper use of invested funds, to create a legal base for the existence of the stock market, to define legally the different financial instruments traded on the stock market, to provide a consistent set of accounting standards, to reform laws concerning the tax system and so on. All of these are taken for granted in developed market economies and these economies therefore provided the blue print suitable for market realities to function. However, the process of change was far from easy since it had to adapt to national peculiarities and in some formerly centrally planned economies, it remains unfinished even to this day. Nevertheless, several economies have now completed the process of transition and provide examples of a functioning market economy including those countries investigated in this thesis, all of which have long since been admitted to the EU.

The following chapters of this thesis investigate stock market efficiency and stock market comovement with developed Western markets in Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia. These countries are selected for investigation because progression towards the status of developed stock market in these countries that are part of Central and Eastern Europe has been more rapid in this group than in other transition economies. There is therefore far more to investigate by way of exploring stock market efficiency and stock market comovement with developed Western markets from early and ambitious beginnings to their current state, than in exploring stock market development in any one individual country. Moreover, as implied above, stock markets in these countries of Central and Eastern Europe are more developed than in any other part of the former Soviet Union.

The literature on stock market efficiency has mainly focussed on developed economies where stock markets have been functioning in some cases for over 300 years. As more data has become available, a literature has developed on stock markets in transition economies. I aim to contribute to this literature by focussing on market efficiency and stock market comovement with the more developed economies of Western Europe in the former transition economies of CEE identidfied above.

The papers that make up the following chapters investigate stock market efficiency and stock market comovement in several of the former transition economies of Central and Eastern Europe rather than targeting the stock market of a single country. This wider study will be more revealing because, as previously noted, although stock markets faced similar problems in their development, they progressed at different speeds partly reflecting the extent of the internal problems different economies faced and the different mechanism used to address these problems. Whilst it is true that stock markets in the transition economies could import stock market systems (electronic trading systems etc) from the developed countries, they still needed to develop a basic infrastructure for the financial sector including stronger legal rights for creditors and shareholders, better information, greater disclosure, well-governed institutional investors and supporting public and private institutions. In these respects, many transition economies still have far to go, but those of Central and Eastern Europe have now completed their transition from Communism to functioning market economy.

Following the collapse of Communism, transition countries attempted to put in place adequate corporate governance structures requiring as part of this, internationally accepted standards of disclosure. Their stock markets have also been opened up to overseas investors and rights of ownership have been established. Investigations of stock market efficiency in CEE countries admitted to the EU overwhelmingly confirm that at the very least they exhibit weak form efficiency (Bohl et al (2006) Rockinger and Urga 2001, and Harrison and Paton 2005). Given these developments, as well as political and economic stability and impressive rates of growth, these economies potentially offer investors attractive opportunities for portfolio diversification. As a result of financial globalisation, interest has grown in the extent of stock market integration between different countries. As noted above, stock markets can be considered integrated if their prices have a tendency to move together, or if one market leads another market and we investigate this in chapters 6-8. We note in passing that an understanding of the determinants of stock market comovement might aid understanding of the home country bias that investors exhibit (Lewis 1999), that is, the preference of investors for domestic investments over foreign investments.

3.6 Research Questions

Against this background, we investigate the emergence, growth, development and performance of stock markets in what are now, the former transition economies of Central and Eastern Europe. It is clear from Mendelson and Peake (1993) and the EBRD (1998) that functioning stock markets are an important corner stone of a functioning market economy. But a 'functioning stock market' implies more than simply the existence of a stock market which provides a trading platform for the purchase and sale of equity. In the fullest sense of the term, a 'functioning stock market' implies an informationally efficient stock market that is integrated into the global trading platform with equity cross listed on several exchanges. This thesis seeks to assess:

1. The extent to which stock markets in our target group of countries in Central and Eastern Europe are developed as measured by whether they are informationally efficient. We investigate this by testing for weak form efficiency using a battery of different statistical tests.
2. The extent to which our target stock markets in Central and Eastern Europe are cointegrated with the developed stock markets in the EU as a further test of their efficiency and development. We test this by investigating comovement between the developed stock markets of London and Frankfurt with the stock markets of Central and Eastern Europe.

CHAPTER 4

RANDOM WALKS AND MARKET EFFICIENCY IN CENTRAL AND EAST EUROPEAN EQUITY MARKETS

4.1 Introduction

In an efficient stock market, arbitrage ensures that, on average, the full effects of new information on the intrinsic value of stock prices will be instantaneously reflected in actual prices. However, the implications of new information will not always be perfectly understood instantaneously and so stock prices might over-react to new information as often as they under-react. Moreover, the lag in the complete adjustment of actual prices to successive new intrinsic values which reflect informationally fair value prices, will itself be a random variable. When an event is anticipated, these changes will occur before the event which is the underlying cause of the change in intrinsic values; whilst with other events which are unexpected, stock prices will adjust following the event. This tells us that the ‘instantaneous price adjustment’ component of an efficient stock market implies that successive price changes in individual securities will be independent. This is important because where successive price changes are independent, the market follows a random walk.

The random walk model implies that all information contained in previous stock prices is incorporated into the current price of the stock and therefore previous stock prices cannot be used to predict the future price of stock. The future path of a stock market index is no more predictable than the path of a series of cumulative random numbers and therefore knowledge of the past behaviour of the index cannot be used to make profits from any short or long trading strategy. More specifically, if successive price changes for a stock market index are independent, there is synchronisation between the timing of sales and purchases of securities traded on that market. One way to assess whether stock markets are efficient is therefore to test whether their returns follow a random walk.

As well as being of crucial importance to investors, stock return processes have important implications for traders, fund managers and, in a wider sense, for asset pricing models and financial and economic development as a whole. Worthington and

Higgs (2004) have argued that trading strategies differ when returns are characterised by random walks or by positive autocorrelations (or persistence) over short horizons and negative autocorrelations (or mean reversion) over long horizons. This implies that as the investment horizon lengthens, an investor would invest more (less) in stocks if the relative risk aversion is greater (less) than unity than if the returns were serially independent. In the absence of a random walk, stock returns can be predicted from the historical sequence of returns. In general, an efficient market, characterised by the existence of a random walk with respect to stock prices, implies that equity is at its equilibrium level where capital and risk are appropriately priced. This is likely to increase confidence among investors favourably impacting on domestic savings and increasing the ability of stock markets to attract both domestic and foreign investment. All of this has serious implications for the allocation of capital within an economy and hence overall economic development. (Worthington and Higgs, 2004)

A number of studies have been carried out testing for random walks in the world's stock markets. Fama (1970) and later Fama (1991) survey stock returns for early departures from random walks. More recently, the focus has been on individual markets and these include studies of random walks in Korea (Ayadi and Pyun, 1994; Ryoo and Smith, 2002), China (Lee et al., 2001), Hong Kong (Cheung and Coutts, 2001), Slovenia (Dezlan, 2000), Spain (Regulez and Zarraga, 2002), the Czech Republic (Hajek, 2002), Portugal (Manuel et al. 2002), the United Kingdom (Poon, 1996) and Turkey (Zychowicz et al., 1995; Buguk and Brorsen, 2003). Quite a few studies have been carried out on markets in Asia (Huang, 1995; Groenewold and Ariff, 1998), Latin America (Urrutia, 1995; Ojah and Karemera, 1999; Grieb and Reyes, 1999; Karemera et al., 1999), Africa (Smith et al. 2002; Appiah-Kusi and Menyah, 2003) the Middle East (Abraham et al., 2002) and Harrison and Moore (2012).

However, comparatively very little attention has been paid to European equity markets and especially Central and East European (CEE) markets in investigating the presence of random walks in these stock markets. Apart from the more usual benefits resulting from the understanding of random walk behaviour and market efficiency, Worthington and Higgs (2004) note that this is an important omission for two critical reasons. First, capital provision in Europe in general, and in the newly expanded

European Union in particular, relies upon a relatively large number of smaller developed markets and an increasing proportion of emerging markets. Knowledge of random walks and market efficiency in this instance yields valuable insights into the ability of these markets to provide appropriately priced and efficiently allocated equity capital, especially for the purposes of national (regional) development in the smaller EU Member States. Secondly, there has been increasing pressure for the consolidation of European equity markets over the past decade or so. Given that market liquidity, breadth and depth are thought to be closely associated with market efficiency, the failure to attain some nominal level of efficiency in a given market provides a strong rationale for technological and regulatory reform and the creation of institutional linkages in the form of collaborative partnerships, even mergers of stock markets in different countries.

This chapter tests for the presence of random walks in stock returns of the ten CEE countries identified. We test for a random walk over the entire sample period, but we also test for a random walk after EU enlargement in 2004 to explore the possibility that this might have impacted on market efficiency. There are reasons to believe that closer economic integration might promote, or at least encourage, stock market efficiency not least because stocks will be cross listed, standards of governance will converge to Western standards and foreign investors will enhance liquidity and market capitalisation, all of which impact on market efficiency (Amihud and Mendelson, 1986; and Jacoby, Fowler and Gottesman, 2000).

4.2 Description and Properties of Data

The data used in this chapter consist of market value-weighted equity indices for ten CEE equity markets, comprising of Bulgaria (SOFIX), the Czech Republic (PX), Estonia (OMX Tallinn), Hungary (BUX), Latvia (OMX Riga), Lithuania (OMX Vilnius), Poland (WIG), Romania (BET), the Slovak Republic (SAX) and Slovenia (SBI20). All the data are obtained from Thompson Reuters Datasteam and each series starts from the time that daily data become available for the target markets. Because of this, the series' encompass dissimilar sampling periods given the varying times these indexes have started to operate (Table 4.1). The end data for all the series will be the last working day of the respective stock markets in the CEE region as at December 2008. Closing prices at the end of trading on 2009 for Bulgaria and Romania are December 23rd, for the Czech Republic, Estonia, Latvia, Lithuania, Poland and the Slovak Republic closing prices as at December 30th, are used and for Hungary and Slovenia closing prices as at December 31st are used. The closing dates are used because they represent the latest date available at the time our tests were carried out. Omitting the years of the financial crisis had little impact on mean returns implying that the stock markets investigated here were not, at the time, major players on the global stage.

Daily closing prices of each stock exchange index are used to calculate the natural log of the relative price for the daily intervals. This is done to produce a time series of continuously compounded returns, such that:

$$r_t = \log(\frac{p_t}{p_{t-1}}),$$

Where: p_t and p_{t-1} represent the stock index closing price at time t and t-1, respectively. Table 4.1 provides a descriptive summary of statistics of the daily returns of the ten markets in the CEE region. Sample means, standard deviations, skewness, kurtosis and Jarque-Bera statistics and p-values are listed. The lowest mean returns are in Lithuania (0.00021), the Czech Republic (0.00025) and Estonia (0.00027), while the highest mean returns are in the Slovak Republic (0.0030), Poland (0.00076) and Bulgaria (0.00062) with the remainder falling in between these outer values. The standard deviations of the returns range from 0.0098 for Lithuania to 0.1615 for the Slovak Republic. On this basis, of the ten markets in CEE region, the Slovak Republic, Poland, Bulgaria and Hungary are the most volatile; while Lithuania, Slovenia and Latvia are the least volatile. It is important to note that higher mean returns in one market compared to another market does not necessarily imply that the market with higher mean returns offers more profitable investment opportunities. Return must be counter-balanced with the risk involved and so on.

Table 4.1: Descriptive Statistics of CEE Stock Market Returns.

Market	Start	End	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	JB p-Value	Observations
Bulgaria	Oct-20-2000	JUL-31-2009	0.000585	0.019187	-0.617222	24.8903	5.28E+04	0.001	2172
Czech Republic	Sep-07-1993	JUL-31-2009	0.000302	0.015655	0.3633939	14.90357	3.48E+04	0.001	3825
Estonia	June-3-1996	JUL-31-2009	0.000282	0.015891	-1.306206	25.71097	1.07E+05	0.001	3867
Hungary	Dec-31-1990	JUL-31-2009	0.000615	0.017441	-0.647351	11.79577	3.20E+04	0.001	4633
Latvia	Jan-1-2000	JUL-31-2009	0.000323	0.014442	-0.975795	19.65032	4.66E+04	0.001	2942
Lithuania	Jan-4-2000	JUL-31-2009	0.000226	0.010078	-0.826355	18.83834	4.20E+04	0.001	2921
Poland	Apr-16-1991	JUL-31-2009	0.000796	0.020655	-0.645522	13.67241	3.51E+04	0.001	4476
Romania	Sep-19-1997	JUL-31-2009	0.000462	0.019043	-0.333651	5.43083	3.67E+03	0.001	2954
Slovak Republic	Jul-03-1995	JUL-31-2009	0.000155	0.013063	-0.308070	9.259049	1.22E+04	0.001	3417
Slovenia	Jan-11-1993	JUL-31-2009	0.000453	0.013258	0.1627322	20.10598	6.95E+04	0.001	4138

By and large, the distributional properties of all ten return series appear non-normal. All markets except the Czech-Republic, the Slovak-Republic and Slovenia are negatively skewed indicating greater probability of large decreases in returns than increases, while the remaining stock markets in the sample are positively skewed implying a greater likelihood of increases in returns than decreases - especially in the Slovak Republic (56.68). The kurtosis in all market returns is also relatively large, ranging from 5.602 (Romania) to 3233.162 (the Slovak Republic) implying leptokurtic distributions. Finally, the Jarque-Bera statistic and corresponding p-values in Table 4.1 are used to test the null hypotheses that the daily distribution of CEE market returns is normally distributed. All p-values are smaller than the 0.05 level of significance implying rejection of the null hypothesis of normality in all of the return series'. The overall implication of the descriptive statistics is that none of the returns are well approximated by the normal distribution.

4.3 Empirical Methodology

4.3.1 Random walk hypothesis

Consider the following random walk with drift process:

$$P_t = P_{t-1} + \boldsymbol{\beta} + \varepsilon_t \qquad (1)$$

or

$$r_t = \Delta P_t = \boldsymbol{\beta} + \varepsilon_t \qquad (2)$$

(where p_t is the price of the index observed at time t, $\boldsymbol{\beta}$ is an arbitrary drift parameter, r_t is the change in the index and ε_t is a random disturbance term satisfying $E(\varepsilon_t) = 0$, $\sigma^2_{\varepsilon_t}$ is constant and $E(\varepsilon_{t,}\ \varepsilon_{t-g}) = 0$, $g \neq 0$, for all t. Under the random walk hypothesis, a market is weak form efficient if the most recent price contains all available information about past prices such that the best predictor of future prices is the current price.

Within the random walk hypothesis, there exist three successively ever more restrictive sub-hypotheses with sequentially stronger tests for random walks (Campbell et al., 1997). The least restrictive of these is where the returns in a market conforming to this standard of random walk are serially uncorrelated, thus corresponding to a random walk hypothesis with dependent, but uncorrelated, increments.

Next we have a market where returns are serially uncorrelated, in line with the random walk hypothesis, but with increments that are independent and not identically distributed. This is possible if information on the variance of past prices can be used to predict the future volatility of the market. Finally, if it is not possible to predict either future price movements or volatility on the basis of information from past prices, such a market then complies with the most restrictive notion of a random walk. In this market, returns are serially uncorrelated and conform to a random walk hypothesis with independent and identically distributed increments.

Given this, a number of complementary testing procedures for random walks can be used as a way of testing for weak-form market efficiency. To start with, a serial correlation test of independence and the non-parametric runs test can be used to test for serial independence in the series. Further, the trend non-stationary condition for the series to follow random walk can be tested with unit root tests. Finally, multiple variance ratio tests can be carried out to focus on the uncorrelated residuals in the series under the assumption of both homoskedastic and heteroskedastic random walks.

4.3.2 Tests of serial independence

Testing for serial independence in the returns, which correspond to the test that $E(\varepsilon_{t,} \varepsilon_{t-g}) = 0$ in Equations (1) and (2) is done by two approaches. First, the serial correlation coefficient test that is employed to test the relationship between returns in the current period and those in the previous period, is employed. If no significant autocorrelations are found, the series are assumed to follow a random walk. Second, the non parametric runs test is used to determine whether successive price changes are independent. Observing the number of 'runs', that is, the sequence of successive price changes with the same sign, in a sequence of price changes tests the null hypothesis that the series is random. In this approach, each return is classified according to its position with respect to the mean return. In this test a positive change implies that the return is greater than the mean, a negative change implies that the return is less than the mean and zero change implies that the return equals the mean.

To perform this test, a value *A* is assigned to each return that equals or exceeds the mean value and a value *B* is assigned to those items that are below the mean. Let n_A and n_B be the sample sizes of items *A* and *B* respectively. The test statistic is *U*, the total number of runs in the test. For a relatively large sample size, that is where both n_A and n_B are greater than twenty, the test statistic is approximately normally distributed (Berenson et al., 2002). The results of these tests are discussed in the following section.

$$Z = \frac{U-\mu_U}{\sigma_U} \tag{3}$$

(Where $\mu_U = \frac{2n_A n_B}{n} + 1$, $\sigma_U = \sqrt{\frac{2n_A n_B(2n_A n_B - n)}{n^2(n-1)}}$ *and* $n = n_A + n_B$

4.3.3 Unit root tests

Two different procedures are used to test the null hypothesis of a unit root. These correspond to the test that E ($\varepsilon_t\varepsilon_{t-g}$) = 0, but $\sigma^2(\varepsilon_t\varepsilon_{t-g})$ is not constant in Equations (1) and (2). They are the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. To start with, the well-known ADF unit root test of the null hypothesis of non-stationarity is conducted in the form of the following regression equation:

$$\Delta p_u = \alpha_0 + \alpha_1 t + \rho_0 p_{u-1} + \sum_{i=1}^{q} \rho_i \Delta p_{it-1} + \varepsilon_{it} \tag{4}$$

where *it p* denotes the price for the *i*-th market at time *t*, $\Delta p_{it} = p_{it} - p_{it-1}$, $\boldsymbol{\rho}$ are coefficients to be estimated, *q* is the number of lagged terms, *t* is the trend term, $\boldsymbol{\alpha}_1$ is the estimated coefficient for the trend, $\boldsymbol{\alpha}_0$ is the constant, and $\boldsymbol{\varepsilon}$ is white noise. MacKinnon's critical values are used in order to determine the significance of the test statistic associated with $\boldsymbol{\rho}_0$. The Phillips Peron test incorporates an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root, by estimating the non-augmented Dickey-Fuller test equation and modifying the test statistic so that its asymptotic distribution is unaffected by serial correlation.

4.3.4 Multiple variance ratio tests

The multiple variance ratio (MVR) test proposed by Chow and Denning (1993) is used to detect autocorrelation and heteroskedasticity in the returns. This corresponds to the test that E ($\varepsilon_t\varepsilon_{t-g}$) = 0 and $\sigma^2(\varepsilon_t\varepsilon_{t-g})$ is constant or ε_t~ iid in Equations (1) and (2). Based on Lo and MacKinlay's (1988) earlier single variance ratio (VR) test, Chow and

Denning (1993) adjust the focus of the tests from the individual variance ratio for a specific interval to one more consistent with the random walk hypothesis by covering all possible intervals. As shown by Lo and MacKinlay (1988), the variance ratio statistic is derived from the assumption of linear relations in an observation interval with respect to the variance of increments. If a return series follows a random walk process, the variance of a q[th]-differenced variable is q times as large as the first-differenced variable. For a series partitioned into equally spaced intervals and characterised by random walks, one qth of the variance of $(\mathrm{p_t} - \mathrm{p_{t-q}})$ is expected to be the same as the variance *of* $(\mathrm{p_t} - \mathrm{p_{t-1}})$:

$$Var\,(p_t - p_{t-q}) = q\;Var(p_t - p_{t-1}) \qquad (6)$$

Where q is any positive integer. The variance ratio is then divided by:

$$VR(q) = \frac{\frac{1}{q}Var(p_t - p_{t-q})}{Var(p_t - p_{t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)} \qquad (7)$$

such that under the null hypothesis $VR(q) = 1$. For a sample size of $nq + 1$ observations ($p_0, p_1 \ldots p_{nq}$), Lo and Mackinlay's (1998) unbiased estimates of $\sigma^2(1)$ and $\sigma^2(q)$ are computationally denoted by:

$$\hat{\sigma}^2(1) = \frac{\sum_{k=1}^{nq}(p_k - p_{k-1} - \hat{\mu})^2}{(nq-1)} \qquad (8)$$

and

$$\hat{\sigma}^2(q) = \frac{\sum_{k=q}^{nq}(p_k - p_{k-q} - q\hat{\mu})^2}{h} \qquad (9)$$

Where $\hat{\mu} = sample\ mean\ of\ (p_t - p_{t-1})\ and$:

$$h = q(nq + 1 - q)(1 - \frac{q}{nq}) \qquad 10)$$

Lo and Mackinlay (1988) produce two test statistics, *Z(q)* and *Z*(q)*, under the null hypothesis of homoskedastic increments random walk and heteroskedastic increments random walk respectively. If the null hypothesis is true, the associated test statistic has an asymptotic standard normal distribution. With a sample size of $nq + 1$ observations

($p_0, p_1, \ldots, p_{nq}$) and under the null hypothesis of homoskedastic increments random walk, the standard normal test statistic *Z(q)* is:

$$Z(q) = \frac{\widehat{VR}(q) - 1}{\widehat{\sigma_0}(q)} \tag{11}$$

where

$$\widehat{\sigma_0}(q) = \left[\frac{2(2q-1)(q-1)}{3q(nq)}\right]^{\frac{1}{2}} \tag{12}$$

The test statistic for a heteroskedastic increments random walk, *Z*(q)* is:

$$Z^*(q) = \frac{\widehat{VR}(q) - 1}{\widehat{\sigma_e}(q)} \tag{13}$$

where

$$\widehat{\sigma_e}\,(q) = \left[4\sum_{k=1}^{q-1} \langle 1 - \frac{k}{q} \rangle^2 \ \widehat{\delta_k}\right]^{\frac{1}{2}} \tag{14}$$

and

$$\hat{\delta}_k = \frac{\sum_{j=(k+1)}^{nq} (p_j - p_{j-1} - \hat{\mu})^2}{\left[\sum_{j=1}^{nq} (p_j - p_{j-1} - \hat{\mu})^2\right]^2} \tag{15}$$

In tests of the random walk hypothesis, the serial correlation and runs tests are used to determine if the return series are uncorrelated; the unit root tests are used to detect if the return series are identically distributed; and the multiple variance ratio tests are employed to determine if the return series are both independent and identically distributed. Since the multiple variance ratio tests encompass both conditions, they are regarded as being more powerful and more useful in testing the random walk hypothesis (Smith et al., 2002).

4.4 Empirical Results

Table 4.2 provides two sets of test statistics. The first set includes the statistics and *p*-values for the tests of serial independence, namely, the parametric serial correlation coefficient and the nonparametric one sample runs test. The null hypothesis in the former is for no serial correlation while in the latter it is the random distribution of returns. The second set of tests is unit root tests and comprises the ADF and PP *t*-statistics and *p*-values where the null hypothesis of a unit root is tested against the alternative of no unit root (stationarity).

Turning first to the tests of independence, the null hypotheses of no serial correlation for all of the CEE markets are rejected at the 0.05 level except for the Slovak Republic where the null hypothesis of no serial correlation cannot be rejected. The significance of the autocorrelation coefficient indicates that the null hypothesis of weak-form market efficiency may be rejected for all other markets in the sample, with stock prices failing to follow a random walk.

In terms of serial correlation, the coefficient is negative only for Bulgaria (-0.029), indicating mean reversion in returns. For the remaining markets the positive serial correlation coefficients are indicative of return persistence, with persistence being higher in Poland (0.2493), Romania (0.2343), the Czech Republic (0.2188) and Estonia (0.2083). Only for Bulgaria therefore do we have any evidence of weak form efficiency in terms of serial correlation tests.

For the runs tests, the estimated *z*-values are significant at the 0.05 level for all markets except Latvia and the Slovak Republic. The negative *z*-values for all the markets implies that the actual number of runs falls short of the expected number of runs under the null hypothesis of return independence, which therefore implies the existence of positive serial correlation. The Slovak Republic is then weak form efficient under both tests, while Latvia is efficient under the runs test. All remaining markets do not follow random walks and therefore cannot be presumed to be weak form efficient.

Table 4.2: Serial Correlation Runs and Unit Root Tests for CEE Equity Markets.

Notes: 95 % confidence interval considered for all the tests. For Augmented Dickey-Fuller (ADF) tests hypotheses are H0: unit root, H1: Notes: 95 %

Market	Coefficient	p-value	Cases < Mean	Cases >= Mean	Total Cases	Number of Runs	Runs Z Value	p-value	ADF t-Statistic	ADF p-value	PP t-statistic	PP p-value
Bulgaria	-0.0113	5.77E-15	1071	1101	2172	972	-4.9068	9.05E-07	-47.3261	1.00E-03	-47.3255	1.00E-03
Czech-Republic	0.218	0	1906	1919	3825	1656	-8.3114	8.52E-17	-49.4964	1.00E-03	-49.4599	1.00E-03
Estonia	0.2072	0	2138	1729	3867	1618	-9.5759	9.21E-22	-50.3767	1.00E-03	-50.4005	1.00E-03
Hungary	0.0862	1.23E-13	2337	2296	4633	2125	-5.6373	1.70E-08	-62.4137	1.00E-03	-62.4139	1.00E-03
Latvia	0.0359	0	1741	1201	2942	1378	-1.6771	0.0935	-52.4068	1.00E-03	-52.4051	1.00E-03
Lithuania	0.1504	0	1669	1252	2921	1176	-9.6433	4.96E-22	-46.4325	1.00E-03	-46.4093	1.00E-03
Poland	0.25910	0	2178	2038	4216	1962	-4.4463	8.68E-06	-49.8713	1.00E-03	-50.4846	1.00E-03
Romania	0.2141	0	1480	1474	2954	1279	-7.3055	2.55E-13	-43.6932	1.00E-03	-43.7191	1.00E-03
Slovak Republic	-0.00440	0.1329	1816	1601	3417	1697	-0.1799	0.8573	-58.689	1.00E-03	-59.1346	1.00E-03
Slovenia	0.1901	0	2091	2047	4138	1657	-15.6196	1.57E-55	-53.0784	1.00E-03	-53.0799	1.00E-03

confidence interval considered for all the tests. For Augmented Dickey-Fuller (ADF) tests hypotheses are H0: unit root, H1: no unit root (stationary). The lag orders in the ADF equations are determined by the significance of the coefficient for the lagged terms. The Phillips-Peron (PP) unit root test hypotheses are H0: unit root, H1: no unit root (stationary). Intercepts only in the series

The unit root tests in Table 4.2 also s to support the hypothesis that most Central and Eastern European equity markets are weak form efficient in 2009. The ADF and PP *t*-statistics reject the null hypotheses of a unit root at the 0.05 level implying that all of the return series examined are stationary. As a necessary condition for a random walk, the ADF and PP unit root tests reject the requisite null hypothesis in the case of all ten CEE markets. There is therefore no conclusive support for the hypotheses of weak form efficiency for any of the CEE markets examined from the unit root tests.

Table 4.3 presents the results of the multiple variance ratio tests of returns in the ten CEE equity markets investigated. The sampling intervals for all markets are 2, 5, 10 and 20 days, corresponding to one-day, one week, one fortnight and one month periods. For each interval, Table 4.3 presents the estimates of the variance ratio *VR(q)* and the test statistics for the null hypotheses of homoskedastic, *Z(q)* and heteroskedastic, *Z*(q)* increments random walk. Under the multiple variance ratio procedure, only the maximum absolute values of the test statistics are examined and the critical value for these test statistics is 2.49 at the 0.05 level of significance. For each set of multiple variance ratio tests, an asterisk denotes the maximum absolute value of the test statistic that exceeds this critical value, and thereby indicates whether the null hypothesis of a random walk is rejected.

Table 4.3: Multiple Variance Ratio Tests for CEE Equity Markets.

Market	Statistics	q=2	q=5	q=10	q=20
Bulgaria	*VR(q)*	0.98951153	1.113114536	1.239887085	1.561466026
	Z(q)	-0.488812229	2.406177772	*3.311191908	5.265079291
	Z(q)*	-0.172144218	1.036004389	1.680732884	*2.888678701
Czech Republic	*VR(q)*	1.217866662	1.511502048	1.627557879	1.84200519
	Z(q)	*13.47430889	14.43917824	11.49521452	10.47808727
	Z(q)*	*4.373391409	4.962486564	4.333563669	4.367168189
Estonia	*VR(q)*	1.207709999	1.407591764	1.570637153	1.981665696

	Z(q)	*12.91648936	11.56889469	10.50980612	12.28293701
	Z(q)*	*5.704158102	4.383415514	4.169379654	4.979144395
Hungary	*VR(q)*	1.08660693	1.133489171	1.177856216	1.382599757
	Z(q)	*5.894999765	4.147215161	3.585483869	5.239952664
	Z(q)*	2.474828878	1.925445782	1.804751654	*2.769325161
Latvia	*VR(q)*	1.036591039	1.164449666	1.282313938	1.410366077
	Z(q)	1.984705497	*4.071305684	4.535249957	4.478620981
	Z(q)*	0.669439309	1.5171801	1.752482644	1.799460772
Lithuania	*VR(q)*	1.150954193	1.376010003	1.706787908	2.358933247
	Z(q)	*8.158512031	9.275654391	11.31364282	14.77799195
	Z(q)*	2.389291707	*2.823239707	3.735410238	5.494184894
Poland	*VR(q)*	1.259386054	1.453138634	1.61824767	1.826843179
	Z(q)	*16.84212647	13.42952877	11.88941163	10.80251736
	Z(q)*	*7.613485655	6.288212311	5.790436575	5.574493211
Romania	*VR(q)*	1.214702923	1.374641802	1.504515335	1.699593671
	Z(q)	*11.66925694	9.29396132	8.12133063	7.650725866
	Z(q)*	*6.310472338	5.289822046	5.057661636	5.126685306
Slovak Republic	*VR(q)*	0.996167853	0.996446177	1.077972399	1.266490274
			-		
	Z(q)	-0.224008553	0.094819496	1.349929108	*3.134406915
			-		
	Z(q)*	-0.182153672	0.07357888	1.04104731	*2.493899977
Slovenia	*VR(q)*	1.190520344	1.364730679	1.570947602	1.936664892
	Z(q)	*12.25565708	10.70895072	10.87774994	12.12358353
	Z(q)*	*4.033688156	4.18998172	4.995000745	6.358809495

Notes: VR(q) – variance ratio estimate, Z(q) - test statistic for null hypothesis of homoskedastic increments random walk, Z* (q) - test statistic for null hypothesis of heteroskedastic increments random walk; the critical value for Z(q) and Z*(q) at the 5 percent level of significance is 2.49, asterisk indicates significance at this level; Sampling intervals (q) are in days.

For example, if we consider the Czech Republic, the null hypothesis that daily equity returns follow a homoskedastic random walk is rejected at Z(2)=13.294. Rejection of the null hypothesis of a random walk under homoskedasticity for a 2-day period is also a test of the null hypothesis of a homoskedastic random walk under the alternative sampling periods and we may therefore conclude that the equity returns in the Czech Republic do not follow a random walk. However, rejection of the null hypothesis under homoskedasticity could result from heteroskedasticity and/or autocorrelation in the return series. After a heteroskedastic-consistent statistic is calculated, the null hypothesis is also rejected at Z*(2) = 4.108. The heteroskedastic random walk hypothesis is thus rejected because of autocorrelation in the daily increments in returns on the Czech Republic stock market. We may conclude that the Czech Republic equity market is unambiguously weak form inefficient, along with Estonia, Poland, Romania and Slovenia, which display similar results to the Czech Republic.

Further, Lo and MacKinlay (1988) show that for *q*=2, estimates of the variance ratio minus one and the first-order autocorrelation coefficient estimator of daily price changes are asymptotically equal (the Czech Republic serial correlation coefficient in Table 4.2 is 0.2188). On this basis, the estimated first order autocorrelation coefficient is 0.2192 corresponding to the estimated variance ratio $\widehat{VR}(2)$ of 1.2192 (i.e. 1.2192 - 1.0000). Further, where $\widehat{VR}(2)$ <1 a mean reverting process is implied, whereas when $\widehat{VR}(2)$ >1 persistence is suggested. This indicates that there is positive autocorrelation (or persistence) in the Czech Republic equity returns over the long horizon.

By observing the results for the Slovak Republic, the hypothesis that it is weak form efficient as at none of the sampling intervals are the test statistics for the null hypotheses of homoskedastic, *Z (q*) and heteroskedastic*, Z*(q)* random walks greater than the critical value of 2.49. Alternatively in the case of Latvia, the null hypothesis of a homoskedastic random walk is rejected [Z *(5)* =4.657], but the null hypotheses of heteroskedastic random walk is not [*Z*(q) =0.765*]. This is also true for Bulgaria and this rejection of the null hypotheses of a homoskedastic random walk could at least in part be due to heteroskedasticity in the returns and not exclusively due to autocorrelation in returns. The null hypotheses of homoskedastic and heteroskedastic random walks in stock market returns for Hungary and Lithuania are rejected and these markets can be classified as inefficientat at the end of the period investigated. This result for Hungary contrasts with both Rockinger and Urga (2004), and Worthington and Higgs (2004) who find weak form efficiency in this market. From the evidence so far from our serial correlation test, runs test and multiple variance ratio test, the Slovak Republic appears strongly to have achieved weak form efficiency in its stock market, followed by Latvia which derives evidence from our runs tests and heteroskedastic random walk in its stock returns.

4.5 Tests for Random Walk after the European Union Enlargement in 2004

After establishing ever closer trading links with the EU, the Czech Republic, Estonia Hungary, Latvia, Lithuania Poland, the Slovak Republic and Slovenia joined the EU in 2004. In its World Economic Outlook of 2004, the IMF noted that progress towards EU Membership has caused a strong stimulus for financial integration for CEE economies through convergence. In addition, Lane (2001) notes that the entire process has also been supported by foreign direct investment inflows that followed corresponding trade linkages, and that convergence in the real economy also caused convergence of corporate cash flows, financial market risk premia and the overall cost of capital, resulting in increased integration of financial markets.

Lane (2001) also argues that joining the EU will make the region substantially less risky from the point of view of domestic and foreign investors. EU membership greatly constrains arbitrary trade and indirect tax policy changes. It also locks in well-defined property rights, competition policy and State-aid policy. By securing open capital markets and rights of establishment, membership assures investors that they can invest and withdraw funds without difficulty. Finally, EU membership guarantees that regional products have full access to the EU28 markets. On the macro side, membership put the region on a possible path to eventual monetary union and thus provides a solid hedge against inflation spurts. These two aspects of membership are mutually reinforcing and will raise investor confidence in the region. Given these observations, it seems natural to break our data and test the CEE stock markets for weak form efficiency after 2004 following the 2003 Treaty of Accession which came into force on 1st May 2004.

Descriptive statistics for the data, starting on 1st May 2004 and running until 31st July 2009, the latest date for which data was available at the time the tests were conducted, are given in Table 4.4 The null hypothesis of no serial correlation (Table 4.5) for all ten markets in the CEE region is rejected at the 0.05 level of significance, implying that all markets are inefficient over the sample period. Results for the ADF and PP t-statistics are also reported in Table 4.5 and reject the null hypotheses of a unit root at the 0.05 level since all of the return series examined are stationary thus implying that all the CEE markets investigated are inefficient. Similar results are reported for the serial correlation tests, which reinforces this conclusion

For the runs tests, the estimated z-values reported in Table 4.5 are significant at 0.05 level for all markets with the exception of the Czech Republic, Hungary, Latvia and Poland, implying that these markets are weak-form efficient. Table 6 presents our results for the multiple variance ratio tests of returns in the ten CEE equity markets at sampling intervals 2,5,10 and 20 days, corresponding to one-day, one week, one fortnight and one month periods respectively. As indicated in the earlier test, an asterisk denotes the maximum absolute value of the test statistic that exceeds the critical value of 2.49 at the 0.05 level of significance and thereby indicates whether the null hypothesis of a random walk is rejected. The results show that we can reject the hypothesis that the ten CEE markets investigated here are weak form efficient under homoskedastic conditions. However, both the Czech Republic and Hungary fail to reject the null hypothesis of heteroskedastic random walk, implying that these markets are weak-form efficient under heteroskedastic conditions for the sample period.

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Table 4.4: Descriptive Statistics of CEE Stock Market Returns.

Market	Start	End	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	JB p-value	Observations
Bulgaria	MAY-01-2004	JUL-31-2009	-0.00017	0.014886	-1.23156	8.870848	6.97E+01	0.001	1388
Czech Republic	MAY-01-2004	JUL-31-2009	0.000339	0.017516	-0.6352	14.45047	1.22E+04	0.001	1404
Estonia	MAY-01-2004	JUL-31-2009	2.8E-05	0.011083	-0.67662	7.807993	3.88E+03	0.001	1494
Hungary	MAY-01-2004	JUL-31-2009	0.000424	0.018117	-0.20849	7.033073	2.87E+03	0.001	1401
Latvia	MAY-01-2004	JUL-31-2009	-7.3E-05	0.012656	-0.19426	6.549172	2.64E+03	0.001	1481
Lithuania	MAY-01-2004	JUL-31-2009	7.16E-05	0.012037	-0.59418	13.74381	1.15E+04	0.001	1460
Poland	MAY-01-2004	JUL-31-2009	0.000348	0.014116	-0.45042	3.396849	7.39E+02	0.001	1449
Romania	MAY-01-2004	JUL-31-2009	0.000395	0.019818	-0.6773	5.41962	1.80E+03	0.001	1394
Slovak Republic	MAY-01-2004	JUL-31-2009	0.000374	0.01119	-0.0242	17.37101	1.70E+04	0.001	1359
Slovenia	MAY-01-2004	JUL-31-2009	4.42E-05	0.011603	-0.77721	10.55315	6.55E+03	0.001	1392

Table 4.5: Serial Correlation Runs and Unit Root Tests for CEE Equity Markets.

Market	Coefficient	p-value	Cases < Mean	Cases >= Mean	Total Cases	Number of Runs	Runs Z Value	p-value	ADF t-statistic	ADF p-value	PP t-statistic	PP p-value
Bulgaria	0.1758	0	644	744	1388	586	-5.6626	1.421E-08	-31.5017	1.00E-03	-34.543	1.00E-03
Czech Republic	0.0837	7.687E-07	655	749	1404	671	-1.5207	0.1283	-34.4462	1.00E-03	-34.3609	1.00E-03
Estonia	0.1916	0	749	745	1494	617	-6.7545	1.274E-11	-32.1614	1.00E-03	-34.3538	1.00E-03
Hungary	0.1054	2.0373E-09	681	720	1401	685	-0.8269	0.4083	-33.6911	1.00E-03	-33.5336	1.00E-03
Latvia	0.0109	0.00016985	689	792	1481	739	-0.0304	0.9759	-38.3609	1.00E-03	-38.9494	1.00E-03
Lithuania	0.1684	0	727	733	1460	643	-4.581	4.513E-06	-32.557	1.00E-03	-35.3701	1.00E-03
Poland	0.0917	0.0125	725	724	1449	727	0.0526	0.9581	-34.7994	1.00E-03	-35.0495	1.00E-03
Romania	0.1342	3.9248E-07	674	720	1394	623	-3.9558	7.525E-05	-32.7277	1.00E-03	-33.1295	1.00E-03
Slovak Republic	0.0431	2.82E-07	785	574	1359	604	-3.3157	0.0009192	-35.637	1.00E-03	-36.6371	1.00E-03
Slovenia	0.2427	0	665	727	1392	535	-8.6035	5.637E-18	-29.2085	1.00E-03	-29.5101	1.00E-03

Notes: 95 % confidence interval considered for all the tests. For Augmented Dickey-Fuller (ADF) tests hypotheses are H0: unit root, H1: no unit root (stationary). The lag orders in the ADF equations are determined by the significance of the coefficient for the lagged terms. The Phillips-Peron (PP) unit root test hypotheses are H0: unit root, H1: no unit root (stationary). Intercepts only in the series.

Table 4.6: Multiple Variance Ratio Tests for CEE Equity Markets.

Market	Statistics	q=2	q=5	q=10	q=20
Bulgaria	*VR(q)*	1.17724212	1.587756	1.98746	2.782865
	Z(q)	*6.60330991	9.994737	10.89586	13.36487
	Z(q)*	*2.88511408	4.339357	4.957701	6.588574
Czech-Republic	*VR(q)*	1.08377602	1.006937	1.029689	1.12809
	Z(q)	*3.13908656	0.118645	0.329474	0.96572
	Z(q)*	1.17771126	0.044955	0.130779	0.400053
Estonia	*VR(q)*	1.19224144	1.539981	1.90315	2.524745
	Z(q)	*7.43057294	9.526496	10.3391	11.85834
	Z(q)*	*3.50863949	4.724967	5.57152	6.794994
Hungary	*VR(q)*	1.10682558	1.080678	1.121713	1.121255
	Z(q)	*3.9984743	1.378336	1.349289	0.913207
	Z(q)*	1.91739458	0.704463	0.714611	0.492217
Latvia	*VR(q)*	1.01219381	1.059149	1.25772	1.607382
	Z(q)	0.4692638	1.038968	*2.937464	4.703177
	Z(q)*	0.21511206	0.491368	1.466763	*2.512325
Lithuania	*VR(q)*	1.16959589	1.424333	1.820271	2.631245
	Z(q)	*6.48024977	7.400528	9.282853	12.54143
	Z(q)*	1.95416526	2.311076	*3.14441	4.792931
Poland	*VR(q)*	1.09131388	1.188214	1.280897	1.3686
	Z(q)	*3.47592957	3.270129	3.166863	2.823199
	Z(q)*	*2.87803773	2.538517	2.326037	2.054033
Romania	*VR(q)*	1.13552544	1.181719	1.289537	1.590488
	Z(q)	*5.06001983	3.096782	3.201715	4.436025
	Z(q)*	*2.81866093	1.781474	1.976496	2.893782
Slovak Republic	*VR(q)*	1.04448722	1.188613	1.397955	1.777141
	Z(q)	1.6400045	*3.173665	4.345011	5.764496
	Z(q)*	1.42924729	*2.685982	3.731174	5.000563

Slovenia	*VR(q)*	1.24448628	1.35266	1.411285	1.807777
	Z(q)	*9.12166478	6.005587	4.544748	6.064046
	Z(q)*	*3.57332966	2.392543	1.974851	2.90443

Notes: VR(q) – variance ratio estimate, Z(q) - test statistic for null hypothesis of homoskedastic increments random walk, Z* (q) - test statistic for null hypothesis of heteroskedastic increments random walk; the critical value for Z(q) and Z*(q) at the 5 percent level of significance is 2.49, asterisk indicates significance at this level; Sampling intervals (q) are in days.

The Slovak Republic, which showed signs of weak-form market efficiency (runs test and serial correlation test) in the longer sampling period, fails to replicate this finding after EU enlargement in 2004 on the multiple variance ratio test shown in Table 4.6. One reason for this somewhat surprising result might be the unprecedented situation caused by the financial turmoil beginning in 2008 and the coordinated response of the individual central banks caused the target group of stock markets to move together (comovement of stock markets). Further testing would be necessary to assess whether the Slovak Republic stock market is indeed efficient, as the earlier test results imply, and that the later result simply arises because of unusual circumstances. On the other hand, this begs the question of why the stock markets of the Czech Republic and Hungary showed signs of weak form efficiency after accession (runs test and serial correlation test), despite the financial crisis. One possibility is that these markets are characterised by relatively high market capitalisation and turnover compared to the market in the Slovak Republic and other markets in the region as shown. (See Table 4.7.)

Table 4.7 Market Capitalisation and Turnover as a Percentage of GDP in Selected CEE Countries in 2005.

Country	Market Capitalisation (% GDP in 2005)	Market Turnover (% GDP in 2005)
Bulgaria	8	26
Czech Rep	39	96
Estonia	41	49
Hungary	46	102
Latvia	12	41
Lithuania	13	20
Poland	38	79
Romania	15	78
Slovak Rep	17	71
Slovenia	24	64

Source: Stock Market websites

4.6 Conclusions

This chapter tests for weak form market efficiency in ten CEE equity markets by employing three different tests on daily returns from these stock markets. These tests are (i) the parametric serial correlation coefficient and nonparametric runs test which tests for the presence of serial correlation; (ii) the Augmented Dickey-Fuller and Phillips-Perron unit root tests to test for non-stationarity as a necessary condition for a random walk and (iii) multiple variance test statistics to test for random walks under distributional assumptions of homoskedasticity and heteroskedasticity. These tests are carried out on the historical data of all the indices.

The results of our tests for serial correlation conclusively reject the presence of random walks in daily returns for all markets except the Slovak Republic for the entire sample period considered, while the presence of random walks for all ten CEE markets is rejected for the data following EU accession of the countries in our sample. Similarly, the unit root tests conclude that unit roots, as a necessary but not sufficient condition for a random walk, are absent from all the markets under both the time periods considered. Finally, the multiple variance ratio procedure also rejects the presence of random walks in all the CEE countries except for the Slovak Republic and Latvia for the longer duration, and the Czech Republic and Hungary for the period after EU enlargement in 2004. Our analysis implies that there are only limited grounds for suggesting that any of the markets in the CEE region were efficient by the end of 2008. Our tests for a random walk provides the most encouraging results for the Slovak Republic with our serial correlation test and our variance ratio procedure both implying that security prices follow a random walk on the Bratislava stock market. However, these findings are not confirmed by our runs test and no firm conclusions can therefore be drawn about market efficiency in the Slovak Stock Market. Even less encouraging results are reported for the other stock markets in our investigation and the implication is that potentially profitable trading opportunities exist in these markets over and above the market return. Of course, whether potentially profitable trading opportunities exist depends on trading costs and the magnitude of risk adjusted returns. Notwithstanding this, if returns above the market return are recorded, the market is clearly not efficient.

CHAPTER 5
TESTING MARKET EFFICIENCY IN CENTRAL AND EAST EUROPEAN EQUITY MARKETS: A PANEL DATA APPROACH

5.1 Introduction

Ever since Fama (1970) there has been a growing body of literature investigating stock market efficiency. An efficient market instantaneously processes new information and generates a constantly updated set of prices such that prices in the market are without systematic tendencies leaving investors no opportunity for arbitrage. To the extent that markets are efficient therefore, it is impossible for investors to earn above average returns, or, as Fama (1998) puts it, "the expected value of abnormal returns is zero but chance generates deviations from zero (anomalies) in both directions" (p284). Of course, whether potentially profitable trading opportunities exist depends on trading costs and the magnitude of risk adjusted returns. Notwithstanding this, if returns above the market return are consistently recorded, the market is clearly not efficient.

Most investigations into stock market efficiency have tested the weak form hypotheses where past information on asset prices is contained in the current price of the asset. Until the late seventies, studies overwhelmingly confirmed that in developed markets at least, stock markets were informationally efficient. Subsequent evidence began to question this finding and a growing number of studies indicated that anomalies sometimes exist offering investors the prospect of abnormal returns by adopting a trading strategy based on historical data and publicly available information.

Stock market efficiency is important for a variety of reasons. Fair pricing of equity is essential if investors are to be encouraged to trade and hold equity. If equity is not fairly priced, investors might feel no confidence that the resale value of equity at the time of sale would reflect the fundamental value of the firm. To the extent that this is the case, equity would fail to offer a return commensurate with the risk investors are exposed to by supplying risk capital to the private sector. The implication is that the private sector would find it difficult to raise risk capital and this would impede economic growth. To encourage savings to be diverted into equity, investors need to know that the market is a 'fair game'. Market efficiency is also important to company managers aiming to maximise shareholder wealth. In an efficient market, equity prices will accurately reflect wealth generating decisions by managers who will see their success signalled to shareholders through rising equity prices. In this way, an efficient market provides feedback (positive or negative) on managerial decisions and encourages the pursuit of wealth creating strategies. Harrison and Moore (2012) have argued, there are also wider implications for the economy as a whole and this implies that stock market efficiency also matters to policy makers. Accurate and reliable price signals from the stock market are crucial in promoting allocative efficiency as noted by the EBRD - "Markets tend to provide for an efficient allocation of resources when information about the goods and 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." (pp. 101)

5.2 Methodology

Weak form of information efficiency of a financial market implies that the behaviour of its index (the market portfolio) is described by a random-walk model of the following kind:

$$P_t = 1 \cdot P_{t-1} + \varepsilon_t, \tag{1}$$

where $t = 1 \dots T$, implying that the current value of the market index P_t depends only on its previous value P_{t-1} (the 1st lag) and a non-systematic stochastic term ε_t - a white-noise stochastic process with zero mean and constant variance).

To test the hypothesis of the weak form of information efficiency of a market, we need first to estimate the following econometric specification:

$$P_t = \alpha + \beta \cdot P_{t-1} + \varepsilon_t, \tag{2}$$

After estimating Eq.(2), we then test the joint null hypothesis $H_0: \alpha = 0, \beta = 1$.

Two principal points are emphasised here. First, it is usually the case that market index time-series are non-stationary, which implies that market index returns should be calculated in order to avoid inference problems (see Granger and Newbold (1974)). We run the appropriate non-stationarity tests in the following section.

Secondly, since the focus of this research is on the newly emerged stock markets Central and Eastern Europe (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia) all of which have followed a similar transition to market economy stsus, it is reasonable to study the extent to which these stock markets are weak form efficient as part of a wider issue of stock market development in these countries. To assess this, we adopt a panel model approach.

We begin by taking logarithms of the market indices and transforming Eq.(2) into the following basic panel model specification:

$$r_{it} = \alpha_{it} + \varepsilon_{it}, \tag{3}$$

where $i = 1 \dots N$ is the country index; $r_{it} = [\ln(P_{it}) - \ln(P_{i,t-1})] \cdot 100\% = \Delta\ln(P_{it}) \cdot 100\%$ is the time-series of returns of the i-th market portfolio. By introducing th subscripts it to the intercept term α, we explicitly show that this parameter is (potentially) allowed to change both over the objects (countries) and the time-moments.

Numerous studies in the field have confirmed that market returns are often autocorrelated and if neglected, this might introduce inference problems. For this reason and following, for example, from Dockery and Kavussanos (1996), we amend Eq.(3) by including an autoregressive term to obtain the final specification:

$$r_{it} = \alpha_{it} + \phi_1 \cdot r_{i,t-1} + \varepsilon_{it}. \tag{4}$$

which we test later.

We have the following observations on the parameters of Eq. (4). With respect to panel data, if the parameter α is only allowed to change across countries (denoted as α_i), but ϕ_1 remains constant, then the corresponding model is the so called **fixed effects panel model** (or FE-model). If the parameter α varies both over countries and time (denoted as α_{it}), but ϕ_1 remains constant, then the corresponding model is the so called **random effects panel model** (or RE-model). If parameter α is constant across countries and time (no subscripts specified), then the corresponding naive panel model is the so called the **pooled model** and basically represents the idea that all of the observations are homogeneous and there is no need to consider the panel structure in its entirety.

In the context of Eq.(4), the implication is that both of the parameters $\alpha_{[it]}$ and ϕ_1 should be zero (technically, the corresponding estimates should not be statistically significant) if the market is weak form efficient. To facilitate this, we first identify the appropriate panel specification (pooled, FE-, or RE-model) for our dataset by running the usual tests (the F-test, the Breusch-Pagan test and the Hausman test). If our tests of the model's parameters are statistically significant, there is evidence of weak form inefficiency in the corresponding markets. Before we do this, we outline the dataset used in this chapter.

5.3 Data

In this chapter we consider 10 Central and East European markets (the codes for their market indices are given in parentheses after the country names): Bulgaria (bulx), the Czech Republic (czex), Estonia (estx), Hungary (hunx), Latvia (latx), Lithuania (litx), Poland (polx), Romania (romx), the Slovak Republic (slvax), and Slovenia (slvex).

Daily values of the corresponding market indices were collected from Datastream for the period from 6^{th} January 2012 – 29^{th} July 2015. The choice of sample is a little arbitrary but we wanted to allow sufficient time for our target markets to settle after the financial crash of 2007-2009 (post 2012) and yet still have a meaningful dataset of 9290 observations.

5.3.1 Descriptive analysis of the index levels

Figure 5.1 shows the graphs of the index levels of the financial market indices investigated in this chapter. This allows a first visual identification of the non-stationary behaviour of the indices. However, behaviour of the idicies must be interpreted with caution since it is stationarity of the returns which indicates market efficiency or its absence.

Figure 5.1 Daily index levels of Central and East European Markets

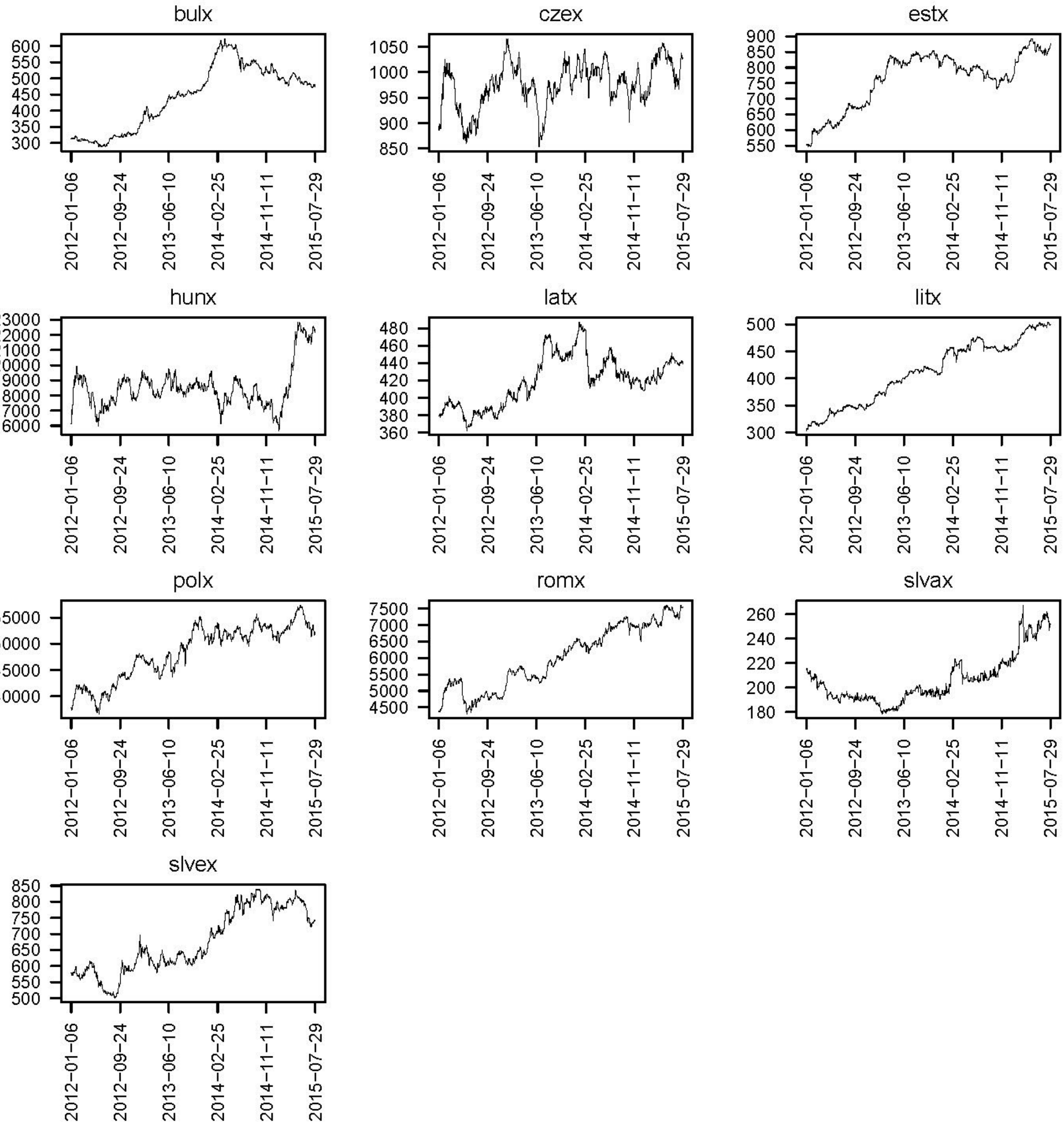


Table 5.1 Descriptive statistics of the different index levels

	Mean	Median	Max.	Min.	SD	Skew	Kurtosis
Bulx	442.636	457.590	622.850	287.650	97.634	-0.107	-1.262
Czex	976.996	982.140	1066.140	852.900	43.918	-0.598	-0.049
Estx	764.222	792.880	892.970	545.250	87.816	-0.830	-0.482
Hunx	18534.622	18387.990	22850.530	15686.690	1373.116	1.248	1.901
Latx	420.036	420.830	487.090	362.530	28.440	0.106	-0.805
Litx	412.057	414.920	504.290	303.670	57.666	-0.198	-1.243
Polx	48446.592	50338.710	57379.450	36653.280	5157.532	-0.455	-0.993
Romx	6018.467	6036.040	7608.020	4303.570	936.890	-0.037	-1.322
Slvax	206.831	200.420	267.510	178.650	20.144	1.114	0.476
Slvex	675.626	643.510	839.400	501.270	98.158	0.137	-1.349

Table 5.2 Normality and non-stationarity test results for the different index levels

	Jarque-Bera test	ADF-test (w/o trend)	ADF-test (w/trend)
	Ho: Yt ~ N	Ho: Yt ~ I(1)	Ho: Yt ~ I(1)
Bulx	63.036**	-1.309	-0.283
Czex	55.652**	-3.074**	-3.388
Estx	115.716**	-2.181	-1.990
Hunx	383.203**	-1.437	-1.866
Latx	26.537**	-1.755	-1.912
Litx	65.553**	-0.902	-2.514
Polx	70.013**	-1.810	-2.871
romx	67.539**	-0.946	-2.974
Slvax	201.823**	-0.512	-2.669
Slvex	73.016**	-1.220	-2.317

Table 5.1 shows the descriptive statistics of the index levels used in this investigation, while Table 5.2 provides the results of the Jarque-Bera normality test (with the null of

normality of the tested data; see Jarque, Bera(1981)) and the non-stationarity Augmented Dickey-Fuller test (with and without the linear trend component in the test equation; see Dickey, Fuller (1979)). The null hypothesis of the ADF-test is that the time series tested is non-stationary.

Non-zero skewness and kurtoses of the time-series give a clear indication of non-normality in the distribution of the observations. The formal results suggest that the null hypothesis of normality of the index levels is rejected in all cases, a finding typical of data on stock market returns. The results of the ADF-test show that all the time-series are non-stationary with one technical exception of *czex* index (test specification is without trend) which may be considered as a statistical aberration since the graph of *czex* clearly indicates a random walk, that is non-stationary, behaviour.

5.3.2 Descriptive analysis of the index returns

Fig. 5.2 presents the graphs of the index returns. The visual analysis of the graphs tentatively suggests that the time-series displayed are expected to be stationary since in all cases they appear to fluctuate around constant means.

Table 5.3 Descriptive statistics of the index returns

	Mean	Median	Max.	Min.	SD	Skew	Kurtosis
r.bulx	0.044	0.000	5.638	-4.737	0.839	-0.044	5.186
r.czex	0.014	0.007	3.358	-3.964	0.915	-0.149	0.896
r.estx	0.050	0.001	5.298	-2.179	0.636	0.723	6.659
r.hunx	0.034	0.000	4.969	-4.918	1.095	0.173	1.509
r.latx	0.016	0.000	3.293	-5.880	0.778	-0.623	5.061
r.litx	0.054	0.006	2.910	-3.844	0.499	-0.153	7.203
r.polx	0.035	0.000	2.882	-5.354	0.867	-0.514	3.371
r.romx	0.060	0.022	3.413	-4.297	0.820	-0.416	3.779
r.slvax	0.017	0.000	9.118	-9.329	1.094	0.023	13.047
r.slvex	0.024	0.000	3.420	-5.314	0.975	-0.218	2.104

Figure 5.2 Daily Index Returns of the Central and East European Markets

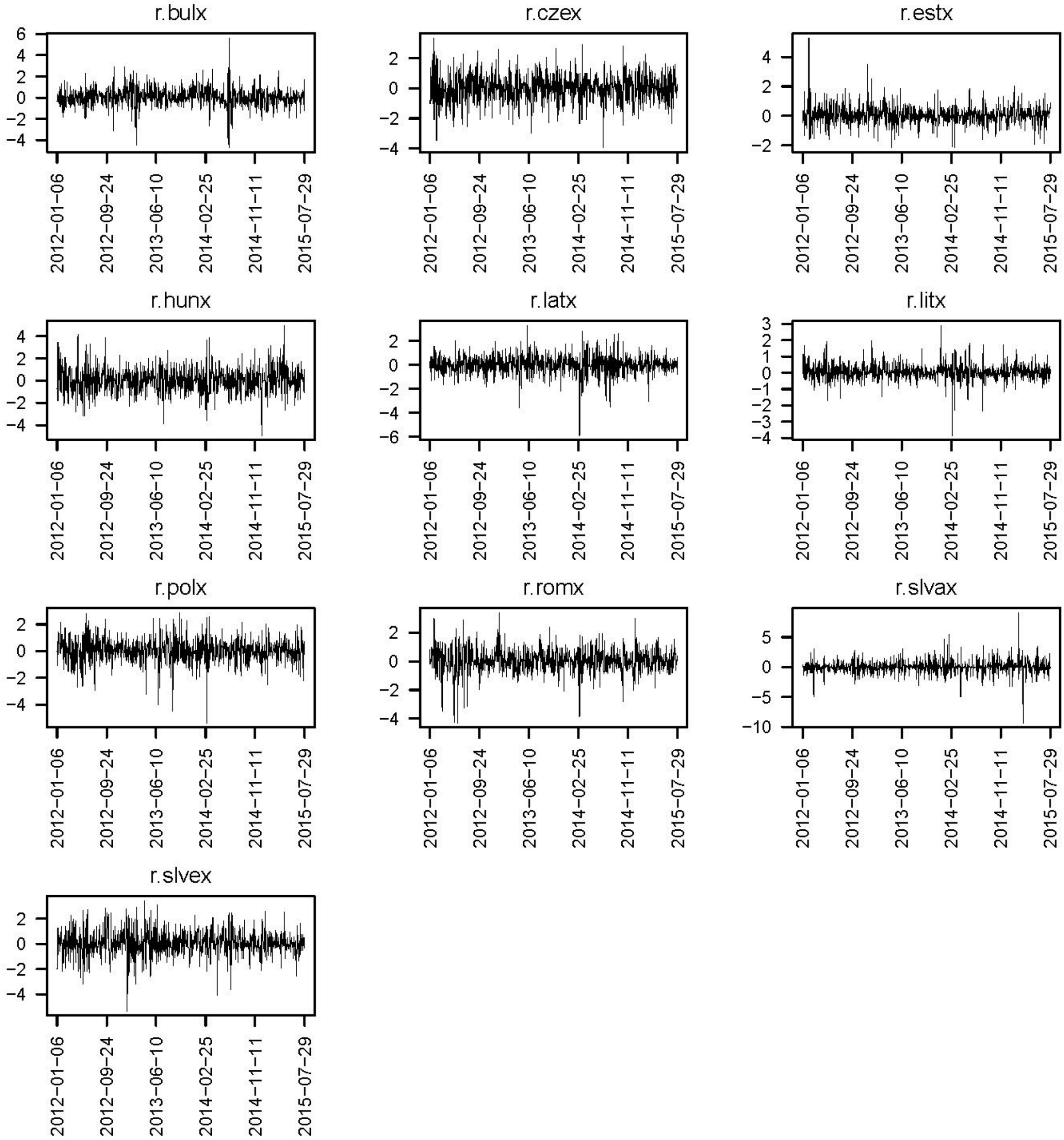


Table 5.4 Normality and non-stationarity test results for the index returns

	Jarque-Bera test	ADF-test (w/o trend)	ADF-test (w/trend)
	Ho: Yt ~ N	Ho: Yt ~ I(1)	Ho: Yt ~ I(1)
r.bulx	1048.301**	-21.517**	-21.588**
r.czex	35.110**	-22.104**	-22.091**
r.estx	1808.608**	-20.969**	-21.042**
r.hunx	93.869**	-20.909**	-20.937**
r.latx	1058.412**	-24.573**	-24.567**
r.litx	2024.313**	-23.399**	-23.412**
r.polx	484.538**	-21.455**	-21.464**
r.romx	584.016**	-18.763**	-18.756**
r.slvax	6623.765**	-25.516**	-25.587**
r.slvex	180.603**	-21.097**	-21.087**

Tables 5.3 and 5.4 provide summary statistics and normality and non-stationarity test results for the returns of the indices. The reported values for skewness and kurtosis again suggest non-normality of the return distributions, a finding supported by the formal Jarque-Bera test which rejects the null of normality in all cases. However, the ADF-test now shows that all the time-series of returns are stationary (both with and without a linear trend in the test equations) which allows us to continue working with the returns without potential inference problems in the panel regression models.

5.4 Panel regression results

In this section we consider the results of choosing and interpreting an appropriate panel specification (as described by Eq.(4)) for our dataset. In this chapter, we follow a two step approach.

1. From our specifications above (pooled, FE-model and RE-model) we select an appropriate model based on the F-test, the Breusch-Pagan test, and the Hausman test.

2. We then test the validity and interpret the estimates of the model selected in order to assess whether the markets investigated are consistent with weak form efficiency.

To select the appropriate model, we estimate Eq.(4) using the three specifications.

Table 5.5 Pooled model coefficient estimates

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	0.03493	0.009031	3.868	0.0001106
ret.1	-0.001632	0.01037	-0.1574	0.8749

Table 5.6 FE-model coefficient estimates

	Estimate	Std. Error	t-value	Pr(>|t|)
ret.1	-0.001969	0.01037	-0.1899	0.8494

Table 5.7 RE-model coefficient estimates

	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	0.02796	0.0004953	56.44	0
ret.1	0.203	0.0101	20.11	4.542e-88

Tables 5.5-5.7 provide the formal estimates of our panel specifications. These are interpreted so as to select the most appropriate model for testing our panel dataset.

5.5 Choosing the appropriate panel specification

To select the appropriate panel specification, we make three comparisons:

1. Compare the pooled model to the FE-model using the standard F-test for panel data.
2. Compare the pooled model to the RE-model using the Breusch-Pagan test (see Breusch and Pagan (1980)).
3. Compare the RE-model to the FE-model using the Hausman test (see Hausman, Taylor (1981)).

5.5.1 Pooled vs. FE-model: the F-test

The null hypothesis of the F-test is that the pooled model is adequate, while the alternative hypothesis is that the FE-model (with fixed individual effects) is the best choice.

Table 5.8 Results of the F-test for the panel model choice

Test statistic	df1	df2	P value	Alternative hypothesis
0.3408	9	9279	0.9615	significant effects

Table 5.8 above reports the results of this test. Since the p-value of 0.9615 is greater than the 5% level of significance, we cannot reject the null hypothesis and preliminarily choose the pooled model.

5.5.2 Pooled vs. RE-model: the Breusch-Pagan test

The null hypothesis of the Breusch-Pagan test is that the pooled model is adequate, while the alternative hypothesis is that the RE-model (with random individual effects) is the best option.

Table 5.9. Results of the Breusch-Pagan test for the panel model choice

Test statistic	df	P value	Alternative hypothesis
2.405	1	0.121	significant effects

Table 5.9 above reports the results of this test. Since the p-value of 0.121 is greater than the 5% level of significance, again we cannot reject the null hypothesis and once again preliminarily choose the pooled model.

5.5.3 RE- vs. FE-model: the Hausman test

Finally, we run the Hausman test which null hypothesis is about the adequacy of the RE-model, while the alternative hypothesis is about the adequacy of the FE-model.

Table 5.10. Results of the Hausman test for the FE- and RE-models

Test statistic	df	P value	Alternative hypothesis
7504	1	0 * * *	RE-model is inconsistent

Table 5.10 above summarises the results of this test. Since the p-value of 0 is less than the 5% level of significance, we reject the null hypothesis in favour of the alternative thus concluding that out of these two models the FE-model is the better choice.

5.6 Selecting the final model

Our results might seem somewhat surprising and formally suggest that we have to work with the pooled model. As noted earlier, both $\alpha_{[it]}$ and ϕ_1 (in Eq.(4)) should be zero (the corresponding estimates should not be statistically significant) for the market to be weak form efficient. This implies that if our suggestion is true and the true parameters are actually zeroes, then the results of both the F-test and the Breusch-Pagan test are as expected because in this specific case the FE- and RE-models (with zero 'true' values of the parameters) look exactly the same as the pooled model with these parameters. In other words, neither of our tests is able to distinguish between the pooled model and the panel models. We should, nevertheless, expect the presence of individual effects in the data because of differences in each of the markets that make up our panel of markets. Thus, we continue working with a panel model and the results of the Hausman test clearly suggest that the preferred choice in our case is the FE-model.

5.7 The FE-model: adequacy testing and coefficient interpretation

Since in our dataset we have as many as 929 daily observations for each market in our sample, but only 10 markets, it is crucially important for the estimated FE model to test for serial correlation in the residuals. To do this, we use the Breusch-Godfrey/Wooldridge test for serial correlation in panel data (see Breusch (1978); Godfrey (1978) and Wooldridge (2002)).

Table 5.11. Results of the panel Breusch-Godfrey/Wooldridge serial correlation test for the FE-model

Test statistic	df1	df2	P value	Alternative hypothesis
1.737	1	9288	0.1876	serial correlation in idiosyncratic errors

Table 5.11 above summarises the results of this test. Since the p-value of 0.1876 is greater than the 5% level of significance, we cannot reject the null hypothesis of no serial correlation in the FE-model which implies that the model is correctly specified. Having estimated (Table 5.6) and appropriately tested the FE-model, we now focus on testing

information efficiency in those markets investigated in this chapter. To assess this, we again test whether both α_i and ϕ_1 in Eq.(4) are zero in which case the estimates are statistically insignificant.

Our estimate of ϕ_1 is -0.0019689 with the p-value 0.8494. Since the p-value is less than the 5% level of significance, we conclude that the estimate of ϕ_1 is statistically insignificant which preliminarily supports the hypothesis of weak market efficiency.

We turn now to the intercept terms α_i reported in Table 5.12.

Table 5.12 Intercept term estimates in the FE-model

	Estimate	Std. Error	t-value	Pr(>|t|)
r.bulx	0.04439	0.02855	1.555	0.1200
r.czex	0.01397	0.02854	0.4894	0.6246
r.estx	0.04967	0.02855	1.74	0.0819
r.hunx	0.0344	0.02855	1.205	0.2282
r.latx	0.01648	0.02855	0.5774	0.5637
r.litx	0.05416	0.02855	1.897	0.0579
r.polx	0.03516	0.02855	1.232	0.2181
r.romx	0.05971	0.02855	2.091	0.0365
r.slvax	0.01715	0.02855	0.6009	0.5479
r.slvex	0.02429	0.02855	0.851	0.3948

In all cases, except the Romanian stock market, the coefficients are *statistically insignificant* (the corresponding p-values are greater than the 5% level of significance). Thus, for all stock markets investigated except Romania, we find support for these markets being weak from informationally efficient. However, in other research not included in this thesis, Harrison and Paton (2005 and 2007) find evidence that the Romanian Stock Market is informationally efficient.

5.8 Conclusions

In this chapter we investigate weak form efficiency in a group CEE markets using daily data from 6th January 2012 – 29th July 2015. The choice of dates is somewhat arbitrary but the period selected allows markets to settle down after the global financial crisis of 2007-2009 whilst still allowing for the creation of a meaning dataset.

There is strong evidence that well-functioning and efficient markets are important in promoting growth and development within an economy. However, efficient markets also ensure that investors engage in a fair gamble when buying equity in companies with nothing to enable other investors to make gains by strategic decision based knowledge of regular patterns in return indices. This is likely to encourage the development and growth of markets.

We apply a panel data model and from the range of models available and on the basis of the usual test we select the fixed effect panel model. The panel data model is a considerably more sophisticated approach than that adopted in chapter 4 and is therefore likely to yield more reliable results. We also use a longer data set to test whether market efficiency has evolved since the earlier tests were carried out. Our results from testing our panel data model show that for the period investigated, most markets in our target group are weak form efficient. The exception is Romania which still shows signs of market inefficiency. However, other studies find the Romanian Stock Market weak form efficient and there is therefore, at the very least, some ambiguity about this result which suggests the need for further testing using a different methodology. We take our findings as providing supportive evidence that CEE markets are well-developed – a theme we explore more fully in chapters 6-8 using a different approach to stock market development.

CHAPTER 6

SPILLOVER EFFECTS FROM LONDON AND FRANKFURT TO CENTRAL AND EAST EUROPEAN STOCK MARKETS

6.1 Introduction

One approach to testing for stock market development is to test for stock market comovement. The literature overwhelmingly confirms that the stock markets of developed economies are cointegrated. (See for example, Aggarwal, Lucey, and Muckley, 2003 Ben Zion et al 1996, Dickinson 2000, Floros 2005, Koch and Koch 1991, Longin and Solnik 2001, Meric and Meric 1989 and Bessler and Yang 2003). There have been fewer investigations into stock market linkages among emerging economies with most focussing on Asia and Latin America. (See for example, Koutmos and Booth 1995, Chen, Firth, and Rui 2002, Manning, 2002, Ng, 2002 and Fujii 2005). Only a few studies have investigated comovement between the emerging economies of Central and Eastern Europe (CEE) and the developed markets of Western Europe. In contrast linkages between developed markets and emerging markets appears to be relatively weak. Bekeart and Harvey (1997) and Wong et al (2004). It is therefore legitimate to test for stock market development in the CEE markets investigated here with developed Western markets. By implication, the greater the degree of comovement CEE markets and developed Western markets the greater the evidence of stock market development in CEE countries.

All of the former planned economies of CEE have now completed their transition to market economy status and all have functioning stock markets organised along conventional lines with electronic trading systems and the usual stock exchange departments (trading, registry, clearing and settlement etc). Studies have generally shown that stock markets in the CEE countries are efficient (see for example Harrison and Paton 2005, Ajayi, Mehdian and Perry 2004, and Rockinger and Urga 2001) and the recent enlargement of the EU to include ten countries from CEE (Bulgaria, the Czech Republic, Estonia, Hungary, Poland, Latvia, Lithuania, Romania, the Slovak Republic, Slovenia) therefore provides a unique opportunity to investigate the extent of stock market comovement in the enlarged EU.

An accurate assessment of the degree of comovement between international stock markets is important for several reasons. For investors there are benefits from international portfolio diversification only if returns from international stock markets are not significantly correlated. If returns are highly correlated, diversifying a portfolio internationally offers no significant advantages over a well diversified domestic portfolio. Stock market comovement is also of considerable interest to policy makers because, to the extent that investors hold internationally diversified portfolios, highly correlated international returns have a different impact on wealth than returns that are either uncorrelated or only weakly correlated. Through the wealth channel, the impact on expectations and the dissemination of equity market shocks, the differing levels of stock market comovement imply different effects on the macro economy and this has important implications for the planning of monetary policy and the timing of monetary intervention. Such policy makers are also interested in whether stock markets exhibit comovement because in a world of increasingly liberalised capital flows, the degree of stock market comovement can impact on the stability of the international monetary system. For example, if comovement is weak a downturn in one stock market might lead to capital flight from that country to other countries and this could impact on exchange rates.

There are good reasons for believing that stock markets in CEE might be increasingly integrated with the developed stock markets of Western Europe and, if these linkages do exist, they are likely to be strongest between those countries from CEE which have been granted EU Membership, especially with those that have adopted the euro (the Czech Republic, Estonia, Hungary, Poland, Latvia, Lithuania, the Slovak Republic, Slovenia, Bulgaria and Romania) and Frankfurt and London, the latter being the dominant exchanges in the area. As full members of the EU, these CEE countries are establishing stronger economic ties with other EU Members through trade, cross-border investments and policy coordination. The Maastricht Criteria establishes rules for entry into EMU which are designed to promote economic convergence. Studies by Asprem (1989), Bodurtha et al (1989) and Canonova and de Nicolo (1995) have shown the relevance of common factors in international stock market linkages. Nasseh and Strauss (2000) demonstrate that stock prices in European countries are determined by domestic economic variables and by German economic variables for the period 1962-1995. Fratzscher (2002) has shown that increasing integration in European equity markets in the 1990s was due mainly to the drive towards EMU.

More recently, Phengpis et al (2004) have investigated the impact of economic convergence on stock market returns in four stock markets in the Eurozone (France, Germany, Italy and the Netherlands) and one stock market in the EU (the UK). They find that economic convergence is an important factor contributing to returns in the countries investigated with the exception of Germany implying that Germany plays some role as policy leader in relation to the other countries. Kim et al. (2005) find that the introduction of the euro caused a regime switch among participating country stock markets and deepened stock market linkages both within the EU and between the EU and Japan and the US.

Of more relevance for our purposes in this chapter is the study by Chelley-Steeley (2005). The study, comparing the periods 1994-96 and 1996-98, finds comovement between the stock markets of Hungary and Poland and, to a lesser extent, the market in the Czech Republic, with the markets in Germany and the UK, as well as other developed markets. Importantly, using a variance decomposition methodology, this study shows that nearly 40 per cent of the variation in equity market returns in Hungary and Poland are explained by non-domestic factors in the latter period compared with about 10 per cent in the earlier period. Little difference was reported for the Czech Republic between the two periods.

Since the study by Chelley-Steely (2005), the economies of CEE have become increasingly more integrated with Western European economies. Ten are now full EU Members and five countries (Estonia, Latvia, Lithuania, the Slovak Republic and Slovenia) one country (Slovenia) have adopted the euro. Membership of the EU comes with a commitment to adopt the euro when the necessary conditions are fulfilled. The ten countries in this study are therefore, by implication, committed to the Maastricht Criteria and to this extent share certain macroeconomic aims. In this chapter we extend the work of Chelley-Steely (2005) by including an increased number of countries in our sample and by providing a time-varying assessment of comovement between the exchanges. In addition, estimates of mean and variance spillover effects are provided.

The remainder of this chapter is structured as follows. Section 2 analyses the observations on stock market returns for CEE countries and Section 3 outlines the three approaches employed to evaluate stock market comovement. In Section 4 we detail our empirical results and Section 5 provides a summary and conclusions.

6.2 Data and Summary Statistics

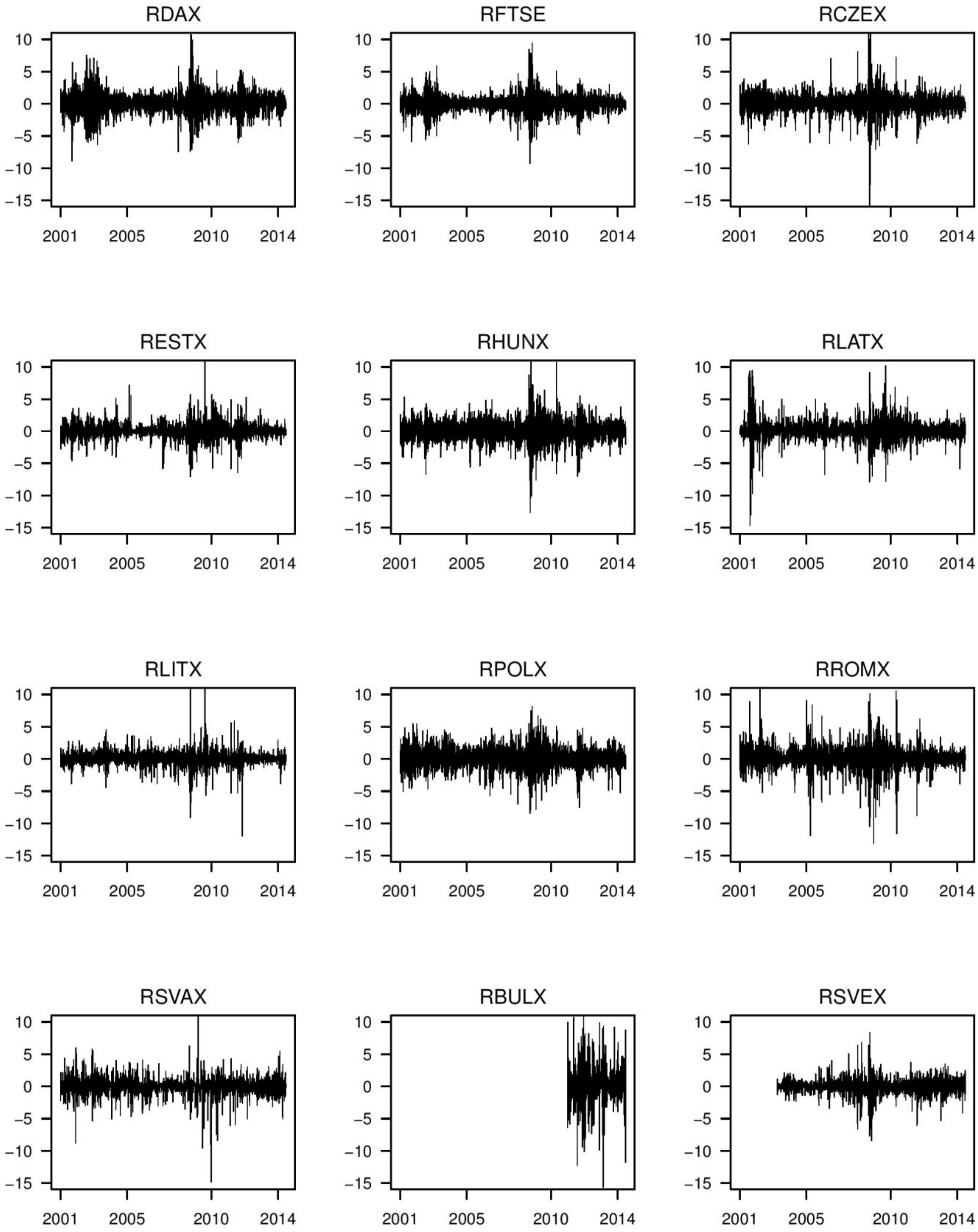
In this chapter we use daily data on the stock market indices for 10 CEE countries (Slovenia, the Slovak Republic, Estonia, Latvia, Lithuania, Bulgaria, the Czech Republic, Romania, Hungary and Poland) and the two biggest European stock exchanges (Frankfurt and London). The data were obtained from Datastream. Table 6.1 provides summary statistics for the daily returns between 2001 and 2014. Daily returns are calculated as $r^i_{t,d} = ln(p^i_{t,d} / p^i_{t,d-1})*100$, where $p^i_{t,d}$ is the stock market index of *i-th* country, in year t on trading day d. The highest mean returns were in Romania (0.069 percent) and Estonia (0.049 percent). In addition, mean daily returns are generally higher across the stock markets for the CEE countries than for either the DAX or the FTSE; the average daily returns for CEE countries is 0.032 percent compared to 0.012 and 0.002 for the DAX and FTSE, respectively.

Table 6.1: Summary Statistics of Daily Returns of CEE and European Stock Exchanges

	Mean	Median	Max.	Min.	Std. Dev.	Skew	Kurt.	Jarque–Bera	p-value
Germany (DAX)	0.012	0.047	10.797	-8.875	1.549	-0.016	4.858	3463.547	0.000
United Kingdom (FTSE)	0.002	0.000	9.384	-9.266	1.234	-0.153	6.830	6856.565	0.000
Czech Rep. (CZEX)	0.021	0.017	12.364	-16.185	1.437	-0.521	13.840	28252.562	0.000
Estonia (ESTX)	0.049	0.030	12.094	-7.046	1.135	0.144	8.746	11231.459	0.000
Hungary (HUNX)	0.024	0.000	13.178	-12.649	1.561	-0.092	6.613	6420.903	0.000
Latvia (LATX)	0.030	0.000	10.180	-14.705	1.456	-0.724	16.793	41665.534	0.000
Lithuania (LITX)	0.046	0.012	11.001	-11.938	1.083	-0.334	18.255	48937.361	0.000
Poland (POLX)	0.008	0.000	8.155	-8.443	1.519	-0.150	2.664	1055.302	0.000
Romania (ROMX)	0.069	0.014	14.576	-13.117	1.643	-0.228	9.467	13177.778	0.000
The Slovak Republic (SVAX)	0.023	0.000	11.880	-14.810	1.161	-0.936	18.570	51085.770	0.000
Bulgaria (BULX)	0.034	0.000	10.935	-15.620	2.517	-0.103	6.279	1499.493	0.000
Slovenia (SVEX)	0.013	0.000	8.358	-8.431	1.087	-0.500	8.529	9021.357	0.000

Despite the larger daily returns available on CEE exchanges, volatility was not significantly higher on these equity markets than in London and Frankfurt. The average volatility across the CEE countries (measured by the standard deviation of daily returns) is 1.460 compared to 1.549 for the DAX and 1.234 for the FTSE. Of the CEE countries investigated, returns in Estonia, Lithuania and Slovenia are the least volatile possibly implying that being part of the eurozone impacts on stability in the stock markets of these countries. Corroborating evidence regarding the volatility of CEE exchanges can also be obtained by examining Figure 6.1 which provides a plot of the daily returns.

Figure 6.1: Daily Returns of CEE and European Stock Exchanges



Although stock exchanges in CEE countries have been created in different ways, they have generally experienced similar problems during development. (See Claessens et al., 2000.) Initially, liquidity of newly established stock markets was relatively low and trading was thin with the result that in the early days at least, markets tended to be open for only a few hours a day and only one or two days a week. Consequently stock prices were volatile compared with developed stock markets and it seems likely that this inhibited the growth of trading activity because of the increased risk. In addition, in the early days there was an absence of reliable information about the companies traded on these emerging stock markets. The information disclosed by companies was often inaccurate or incomplete, and was frequently based on different accounting standards and practices. In other words, reliable corporate governance structures of the type common in developed market economies were not in place and companies were subject to few, if any, mandatory disclosure requirements. (See, for example, Kawalec and Kluza, 2001.)

In addition to the relatively higher level of volatility in CEE countries, the distribution of returns also seems to be non-normal. With the exception of the equity market in Estonia, most of the returns (including the DAX and the FTSE) are negatively skewed. The measure of excess kurtosis for all the exchanges deviates significantly from that expected from returns drawn from a normal distribution. In particular, the Czech Republic, Latvia, Lithuania and the Slovak Republic all displayed kurtosis significantly above 3. The non-normality of the data is confirmed by the significance of the Jarque-Bera statistic.

6.3. Methodology

This chapter uses three approaches to evaluate stock market comovement in the daily returns of the European stock exchanges investigated: (1) time-varying realised correlation ratios; (2) time-varying cointegration statistics, and; (3) a multivariate GARCH model. The first two approaches utilise a two step technique. The first step consists of estimating a common factor model of stock markets in CEE countries. Let y_{it} denote a vector of stock market indicators for country $i = 1...10$ for period $t = 1...T$. The common factor (f_t) approach assumes that there is an unobservable variable (the factor) that accounts for the correlations among the stock exchanges:

$$y_{it} = \sum_{j=1}^{r} \lambda_{ij} f_{jt} + \varepsilon_{it} \tag{1}$$

where λ_{ij} are the factor loading coefficients associated with each of the z common factors and ε_{it} is a well-behaved error term. The common factors are obtained using principal component analysis and therefore account for the maximum portion of the variance present in the stock exchanges in CEE countries. (See Johnson and Wichern, 2002, for more details on principal component analysis.)

Following Andersen, et al. (2003), the authors define daily returns as: $r^i_{t,d} = ln(p^i_{t,d} / p^i_{t,d-1})*100$, where $p^i_{t,d}$ is the stock market index of *i-th* country, in year t on trading day d . A consistent estimate of annual index volatility is obtained using the sum of the squared returns, $\sigma^2_{t,i} = \sum_{d=1}^{D_t} (r^i_{t,d})^2$, and a measure of realised covariance between the annual stock returns of country i and country j:

$$\rho_t^{i,j} = \frac{\sigma_t^{i,j}}{\sigma_t^i \bullet \sigma_t^j} \tag{2}$$

where $\rho^{i,j}$ is the realised correlation ratio. Compared to standard coefficients of correlations, the realised correlation approach improves the accuracy of the measure of association between the two exchanges under consideration (Andersen et al., 1999). Pairwise realised correlations are estimated for each of the ten countries investigated relative to the DAX and the FTSE (All Shares) and for 13 years of data (2001 to 2014).

The realised correlation coefficients are only able to evaluate co-movements in the returns of CEE countries and Europe, but can provide misleading inferences during periods of significant volatility (Forbes and Rigobon, 2002). To address this shortcoming, we use the Hansen and Johansen (1992) recursive cointegration method with a rolling window. The recursive approach is adopted since traditional cointegration tests over the entire sample period would tend to reject the hypothesis that the series are cointegrated if equity prices are in the process of converging. The time-varying cointegration technique allows for changes in the relationship between the variables in a system. To obtain time-varying measures of convergence, the step size is set at $k = 20$ with rolling daily 3 year sub-samples and the number of observations employed to calculate each unit root statistic is therefore $3D + k = 3(262) + 20 = 806$, where D is the number of trading days in a year. The eigenvalue statistics are scaled by the critical values at the 5 percent significance level and plotted in the next section.

The third, and final, approach employs a multivariate GARCH model to assess comovements in CEE countries and European Stock Exchanges. Similar to Liao and Williams (2004), and the Baba *et al.* (1990) model formulation, commonly referred to as the BEKK GARCH, is used in this study. This approach is chosen since it provides estimates of informational spillover effects in the mean and variance.

Assume that the conditional expected return equation can be written as:

$$R_t = \omega + AR_{t-1} + \upsilon_t \tag{3}$$

where R_t is an $n \times 1$ vector of daily returns for each market and $\upsilon_t \mid I_{t-1} \sim N(0, H_t)$. The elements of the A matrix provide measures of the own and cross-mean spillovers. The BEKK approach assumes that H_t depends on the squares and cross products of the innovations, υ_t and the lagged volatility for each market:

$$H_t = B'B + C'\upsilon_t\upsilon_{t-1}C + G'H_{t-1}G \tag{4}$$

where B is a matrix of constants, C is a matrix of the degree of innovation from market i to j, and G provides estimates of the persistence in conditional volatility from market i to j. The model is estimated using the BHHH algorithms and the econometric programme Eviews 6.

6.4 Results

6.4.1 Rolling Realised Correlation Ratios and Cointegration Statistics

In this section, we apply the principal components approach to a dataset of daily closing values for the stock exchanges for 10 CEE countries over the period 2001 to 2014. Table 6.2 summarises the eigenvalues and the proportion of total variance explained. Two factors are generated: the first uses data on the eight countries (group 1) that have observations for the entire sample period (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic), while the other factor employs observations on all the countries investigated. Table 6.2 shows that the first principal component for group 1 countries accounts for 88.23 percent of the total variance, while for the group containing all countries the first principal components account for 54.81 percent of the total variation. To further evaluate the goodness-of-fit of the factors, Table 6.3 presents the bivariate correlation ratios (between the stock market for country i and the first principal component) with associated test statistics, while Figure 6.2 plots the evolution of the common factor and stock price indices for each country. Table 6.3 shows that most of the correlation ratios in Group 1 are at least 0.90 and are significant at standard levels of testing.

Table 6.2: Principal Component Analysis

	Group 1		All countries	
Value	Eigenvalue	% of total variance	Eigenvalue	% of total variance
1	7.058	88.23	5.481	54.81
2	0.572	7.15	2.800	28.00
3	0.181	2.26	0.851	8.51
4	0.104	1.29	0.366	3.66
5	0.029	0.36	0.168	1.68
6	0.028	0.35	0.114	1.14
7	0.017	0.21	0.084	0.84
8	0.011	0.14	0.064	0.64
9	--	--	0.044	0.44
10	--	--	0.026	0.26

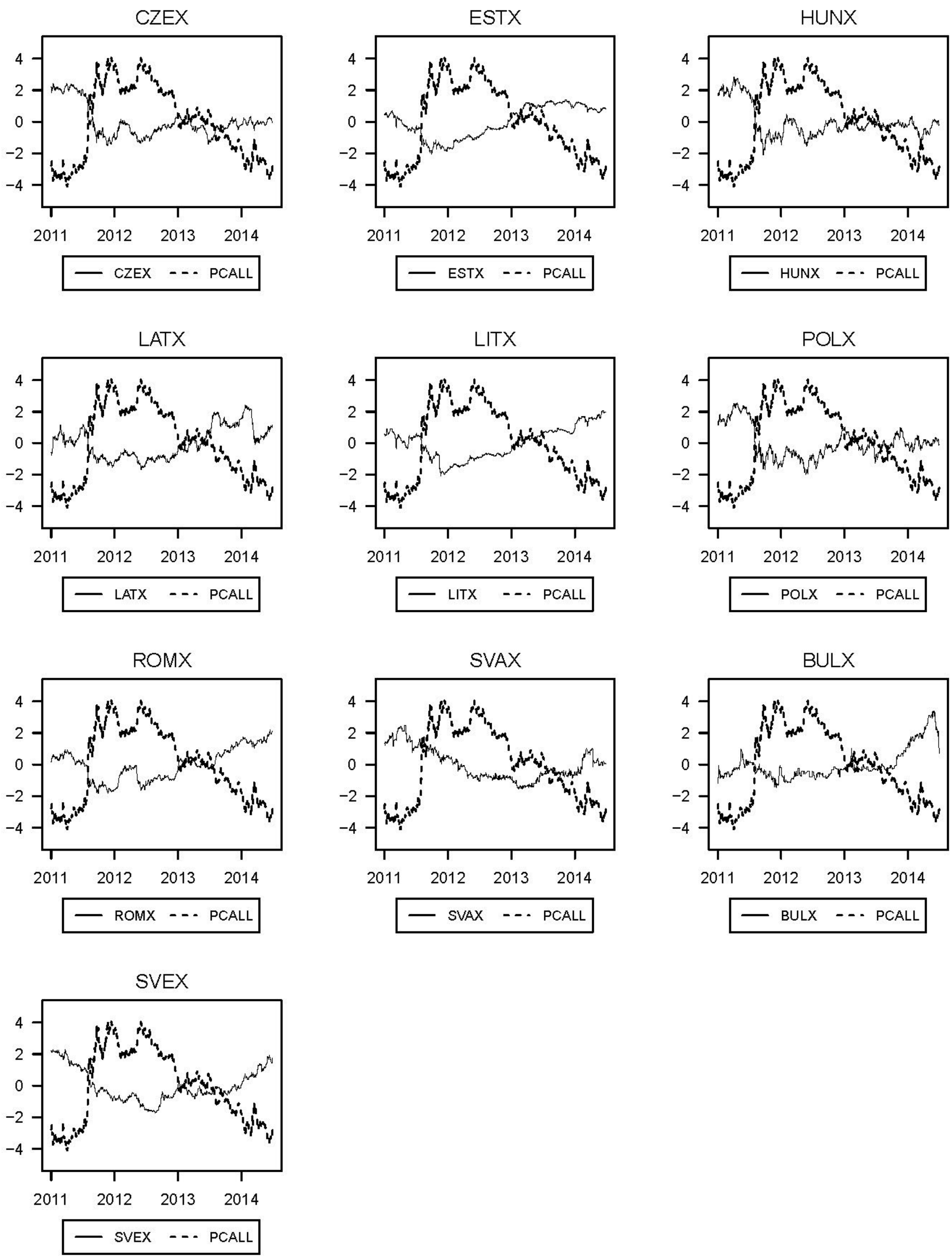
Table 6.3: Correlation with Principal Component

Country	**Group 1**	**All countries**
Czech Republic	0.974	-0.763
	(256.732)	(-35.472)
	[0.000]	[0.000]
Estonia	0.910	-0.661
	(130.334)	(-26.513)
	[0.000]	[0.000]
Hungary	0.957	-0.690
	(194.852)	(-28.701)
	[0.000]	[0.000]
Latvia	0.954	-0.766
	(189.227)	(-35.881)
	[0.000]	[0.000]
Lithuania	0.971	-0.843
	(241.230)	(-47.073)
	[0.000]	[0.000]
Poland	0.965	-0.806
	(217.543)	(-40.897)
	[0.000]	[0.000]
Romania	0.987	-0.857
	(357.076)	(-49.999)
	[0.000]	[0.000]

Slovak Republic	0.779	-0.443
	(73.701)	(-14.883)
	[0.000]	[0.000]
Slovenia	--	-0.587
	--	(-21.815)
	--	[0.000]
Bulgaria	--	-0.874
	--	(-54.193)
	--	[0.000]

Note: (1) t-statistics are given in parentheses below correlation ratio.
(2) p-values are provided in square brackets below t-statistics.

Figure 6.2: Evolution of Common Factor and Stock Markets in CEE Countries



Given that the common factors provide an adequate representation of stock market fluctuations in CEE countries, Figure 6.3 plots the rolling realised correlation ratios between group 1 countries and two European stock exchange indexes: the DAX and the FTSE. Figure 6.3 shows that the realised correlation ratio fluctuated around 0.05 for most of the sample period. There was, however, a rise in the realised correlation ratio from the middle of 2007 until the end of 2008 (during the period of the global financial crisis of 2007-2009). The results from using the common factor generated from the full sample of CEE countries are somewhat similar (Figure 6.4). The implication is that although there is correlation between CEE and Western European exchanges, the degree of comovement remains quite weak.

Figure 6.3: Comovement between Group 1 CEE Countries and European Exchanges (Rolling Realised Correlation Coefficients)

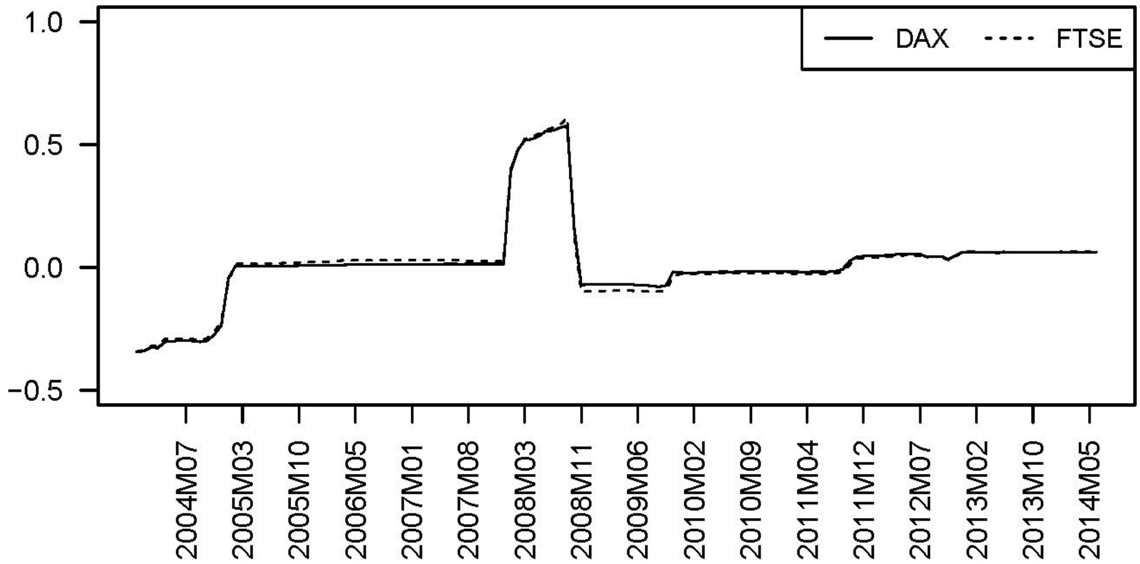
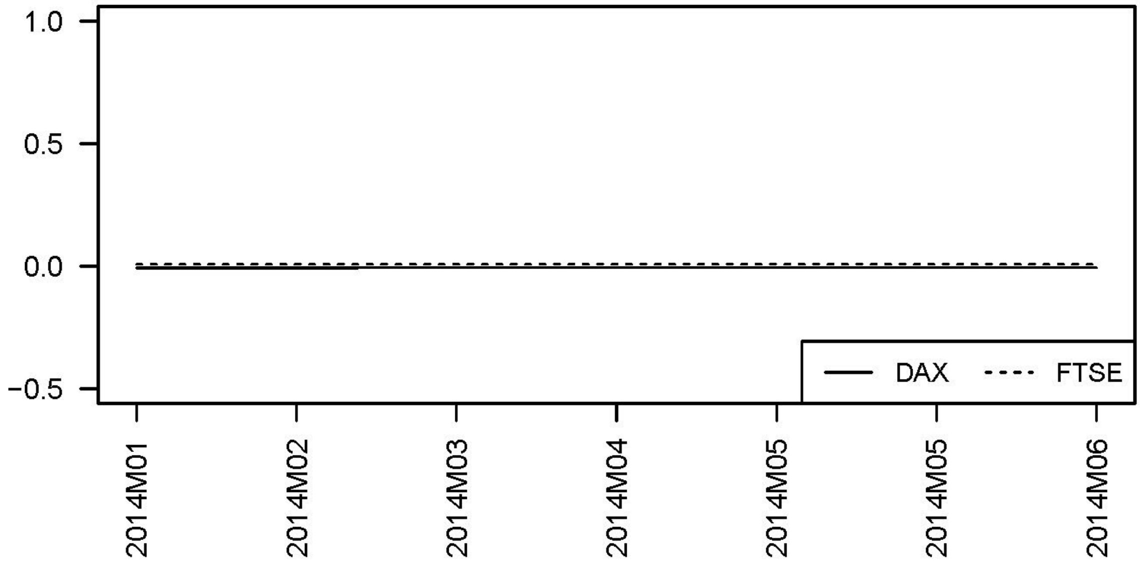
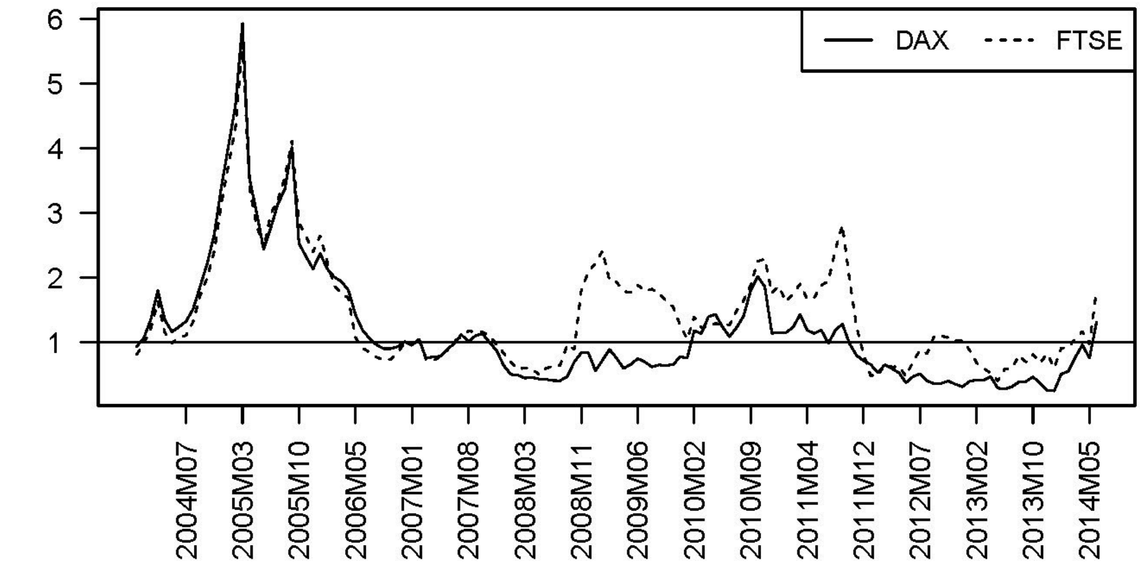


Figure 6.4: Comovement between All CEE and European Exchanges (Rolling Realised Correlation Coefficients)



To evaluate equity price comovement, Figure 6.5 presents the rolling cointegration tests for the selected group of CEE countries and the two European exchanges. The eigenvalue statistics are standardised at the 5 percent critical value, so that values above 1 suggest that the null hypothesis of no cointegration cannot be accepted.

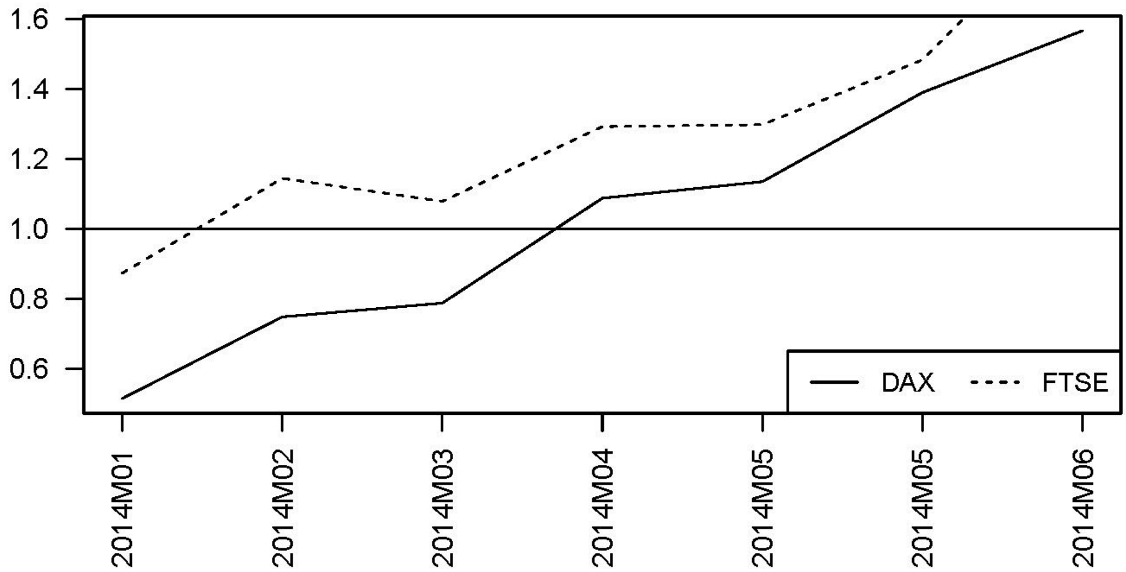
Figure 6.5: Convergence between Group 1 CEE Countries and European Exchanges (Rolling Eigenvalue Statistic)



Looking first at the results for the DAX, Figure 5.5 shows that the null hypothesis of no cointegration could not be rejected for the period of the world financial crisis of 2007-2009 and later from 2012 to 2014. From 2004 to 2007 and from 2010 to the end of 2011, the standardised eigenvalue statistic was generally significant at the 5 percent level of testing. This suggests that there was a common stochastic trend between CEE countries and the Frankfurt exchanges. When the FTSE is employed in the bivariate cointegrating equation, the null hypothesis of no cointegration was rejected for the periods of 2004-2006 and 2009-2011.

When the full sample of countries is employed, the rolling eigenvalue statistic is only available from the beginning of 2011 onwards. However, Figure 6.6 shows that the findings are quite similar. The common factor for CEE countries is generally cointegrated with the FTSE and DAX for most of the restricted sample period. This is especially true for the FTSE However, there seems to have been a break in the relationship with the DAX since April, 2014.

Figure 6.6: Convergence between All CEE and European Exchanges (Rolling Eigenvalue Statistic)



6.4.2 Multivariate GARCH

One of the drawbacks of the rolling cointegration approach is that it does not allow one to consider both mean and variance transmission across exchanges. As a result, it cannot inform investors whether investing in CEE countries provides avenues for mean or volatility diversification. To test this, we estimate the MGARCH model outlined in Section 3 using observations on stock market returns for three of the larger CEE countries (the Czech Republic, Hungary and Poland) as well as the DAX and FTSE. The restricted sample of CEE countries was chosen since observations on these exchanges are readily available for the entire sample period and daily returns for these three countries are highly correlated with those on other CEE exchanges.

The estimated coefficients and standard errors for the conditional mean return equations are provided in Table 6.4. The results suggest that there are mean spillover effects that is, events in one stock market impact on other markets, between European equity markets impact on CEE markets and vice versa between European and CEE equity markets,. In the Czech Republic, lagged returns on the DAX significantly influence current returns while the FTSE had an insignificant impact on returns in this country. In contrast, there were no statistically significant mean spillover effects from the FTSE and the DAX on the Hungarian Exchange. The results also suggest that Poland experiences positive mean spillover effects from the DAX exchange. The mean spillover effects are not homogenous for CEE countries. For example, while a 1 percent increase in the DAX would increase daily returns on the Czech Republic Exchange by 0.067 percent, in Poland market returns would only rise by 0.058 percent. In general, the DAX seems to have larger mean effects on the Czech Exchange, while the FTSE has a relatively stronger (though, statistically insignificant) impact on the exchange in Poland. The leading role that the DAX exchange plays in CEE countries is consistent with our findings that its own mean spillover effects are insignificant. This is not generally true for the FTSE index and the implication is that the FTSE has no significant influence on CEE stock exchanges.

Table 6.4: Estimated Coefficients for Conditional Mean Return Equations

	Coefficient	Standard Error	Coefficient	Standard Error
	DAX (i = 1)		FTSE (i =2)	
ω	0.091	0.017**	0.055	0.014**
a_{i1}	0.042	0.026	0.057	0.019**
a_{i2}	-0.115	0.030**	-0.158	0.025**
a_{i3}	-0.011	0.019	-0.002	0.015
a_{i4}	-0.029	0.015*	-0.009	0.013
a_{i5}	0.038	0.016*	0.029	0.012*
	CZEX (i = 3)		HUNX (i = 4)	
ω	0.083	0.017**	0.088	0.021**
a_{i1}	0.067	0.022**	0.034	0.025
a_{i2}	-0.016	0.029	-0.012	0.032
a_{i3}	-0.040	0.020*	-0.016	0.021
a_{i4}	0.014	0.015	-0.019	0.019
a_{i5}	0.039	0.016*	0.029	0.018
	POLX (i = 5)			
ω	0.071	0.021**		
a_{i1}	0.058	0.025*		
a_{i2}	-0.028	0.032		
a_{i3}	-0.049	0.022*		
a_{i4}	-0.027	0.019		
a_{i5}	0.021	0.019		

Note: ** and * indicates significance at the 5 and 10 percent level of testing.

There is also some evidence of intra-regional spillover effects with lagged returns for the Czech Republic significantly (and negatively) influencing returns in Poland, while the Czech Republic exchange has positive mean spillover effects from Poland. These mean spillover effects are, however, quite small. In the case of Poland, a one percent increase in returns on the stock exchange in the Czech Republic would only lead to a 0.049 decrease in returns on the equity market in Poland.

There is some evidence of mean return feedback effects from CEE countries to European Stock Markets. In the case of the DAX, returns on the stock exchange in Hungary and Poland are statistically significant predictors of performance on this market. The magnitude and directional impact are, however, different; while positive returns on the Polish exchange are associated with higher mean returns for the DAX. The opposite is the case for the Hungarian Exchange. In the case of the FTSE, only the Polish Exchange has statistically significant feedback effects, though the positive sign on the coefficient implies that Poland could not be used as a vehicle for diversification for FTSE investors. The magnitude of these feedback effects however remains quite small: a one percent increase in returns on the Polish Exchange increases returns on the DAX and FTSE by 0.038 and 0.029, respectively.

In addition to mean spillover effects, it is also probable that there could be volatility transmission between European and CEE exchanges. To investigate this possibility, the estimated conditional variance-covariance equations are presented in Table 6.5. The b's are the intercepts in the GARCH equation, the c's provided estimates of the ARCH effects or the degree of innovation transmission, while the g's are the GARCH effects and provide estimates of the persistence in conditional volatility transmission.

Table 6.5: Estimated Coefficients for Variance-Covariance Equations

	DAX (i = 1)		FTSE (i = 2)		CZEX (i = 3)		HUNX (i = 4)		POLX (i = 5)	
	Coefficient	**Standard Error**	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**	**Coefficient**	**Standard Error**
b_{i1}	0.025	0.003**	0.016	0.002**	0.016	0.002**	0.018	0.003**	0.012	0.002**
b_{i2}	0.016	0.002**	0.015	0.002**	0.013	0.002**	0.013	0.002**	0.010	0.001**
b_{i3}	0.016	0.002**	0.013	0.002**	0.049	0.005**	0.024	0.003**	0.018	0.002**
b_{i4}	0.018	0.003**	0.013	0.002**	0.024	0.003**	0.055	0.006**	0.019	0.003**
b_{i5}	0.012	0.002**	0.010	0.001**	0.018	0.002**	0.019	0.003**	0.022	0.003**
c_{i1}	0.060	0.004**	0.055	0.003**	0.035	0.003**	0.036	0.003**	0.028	0.003**
c_{i2}	0.055	0.003**	0.061	0.004**	0.039	0.003**	0.036	0.003**	0.031	0.002**
c_{i3}	0.035	0.003**	0.039	0.003**	0.076	0.005**	0.039	0.004**	0.036	0.003**
c_{i4}	0.036	0.003**	0.036	0.003**	0.039	0.004**	0.057	0.004**	0.031	0.003**
c_{i5}	0.028	0.003**	0.031	0.002**	0.036	0.003**	0.031	0.003**	0.038	0.003**
g_{i1}	0.922	0.004**	0.926	0.004**	0.935	0.005**	0.934	0.006**	0.954	0.004**
g_{i2}	0.926	0.004**	0.922	0.004**	0.931	0.005**	0.934	0.006**	0.949	0.004**
g_{i3}	0.935	0.005**	0.931	0.005**	0.887	0.007**	0.922	0.007**	0.935	0.005**
g_{i4}	0.934	0.006**	0.934	0.006**	0.922	0.007**	0.911	0.007**	0.943	0.005**
g_{i5}	0.954	0.004**	0.949	0.004**	0.935	0.005**	0.943	0.005**	0.948	0.004**

Note: ** and * indicates significance at the 5 and 10 percent level of testing.

Own-volatility spillover effects in all the countries are larger and significant indicating the presence of important ARCH effects. In the CEE countries, the own-volatility spillover effects range from 0.038 in Poland to 0.0076 in the Czech Republic. In terms of the transmission of volatility from Europe to CEE countries, both the DAX and the FTSE are significant and the effects on all three markets are quite similar. However, the own-volatility spillover effects are larger than the cross-volatility spillover effects indicating that past volatility in CEE countries is a more important predictor of future volatility in these markets.

Volatility persistence in the CEE countries is very high. The lagged volatility persistence ranges from 0.887 to 0.948. In the case of the CEE countries, the DAX and the FTSE had relatively similar effects on future volatility persistence, although these effects were somewhat larger for Poland. Overall volatility persistence is highest in Poland with its own-volatility persistence at 0.948 compared to 0.911 in Hungary and 0.887 in the Czech Republic. Most of the volatility persistence in CEE countries therefore seems to emerge from within the foreign markets.

The MGARCH model is only consistent when the standardised residuals are independently and identically distributed. Therefore the Ljung-Box statistic is calculated for each country and the results are provided in Table 6.6. At the 5 percent level of testing, the p-values suggest that the test statistic is insignificant implying that the conditional mean return equation is correctly specified.

Table 6.6: Tests for Randomness of Standardised Residuals

	DAX	FTSE	CZEX	HUNX	POLX
L–B statistic	2.138	2.389	0.001	0.353	0.563
p-value	0.144	0.122	0.993	0.552	0.453

6.5 Conclusions

This study uses daily data on the stock market indices for 10 CEE countries (Slovenia, the Slovak Republic, Estonia, Latvia, Lithuania, Bulgaria, the Czech Republic, Romania, Hungary and Poland) and two European stock exchanges to measure the extent of stock market comovement between these exchanges. The chapter uses three approaches to evaluate stock market comovement in the daily returns of European stock exchanges: (1) time-varying realised correlation ratios; (2) time-varying cointegration statistics, and; (2) a multivariate GARCH model. The first two approaches utilise a two step technique to evaluate the issue of stock market comovement. The first step estimates a common factor model of stock markets in CEE countries, while the second step uses realised correlation and time-varying cointegration analysis to examine the relationship between this common factor for CEE countries and principle stock exchanges in Europe (Germany and the UK).

The rolling realised correlation ratios fluctuated around 0.05 for most of the sample period, with an increase in the ratio in the middle of 2007 until the end of 2008 (during the period of the global financial crisis of 2007-2009). Using the time-varying cointegration approach, the null hypothesis of no cointegration of stock returns could not be rejected for the period of the world financial crisis 2007-2008 and from the beginning of 2012 onwards. However, for the early part of the sample (2001-2007) and during 2010-2011, the standardised eigenvalue statistic was generally significant at the 5 percent level of testing, suggesting that there was a common stochastic trend between CEE countries and those in Europe perhaps influenced by converging rates of inflation. The results presented in this chapter show that there are linkages between stock exchanges in CEE countries and those in Europe, and this relation has been augmented since the period of the world financial crisis 2007-2009. However, the degree of comovement between these exchanges is not, as yet, sufficiently strong to raise issues for monetary policy or international financial stability stemming from symmetrical changes in wealth or inflation that well developed comovement implies. Nevertheless, our results do suggest that policy makers need to continue to monitor evolving developments in this area because, as noted earlier, if comovement becomes apparent this has implications for the conduct of monetary policy in all countries exhibiting comovement.

One of the drawbacks of the rolling cointegration approach is that it does not allow one to consider both mean and variance transmission across exchanges. To take account of this, we also estimate a MGARCH model using observations on stock market returns for three of the larger CEE countries (the Czech Republic, Hungary and Poland) as well as the

DAX and FTSE. The results suggest that there are mean spillover effects between European and CEE equity markets. The mean spillover effects are, however, not homogenous across CEE countries. The DAX seems to have larger mean effects on the Czech Republic, while the FTSE has no statistically significant influence on any of the CEE exchanges investigated. Only relatively small (though, negative) mean spillover effects from one CEE country to another are reported suggesting that investors may diversify their portfolios within the three CEE exchanges only (without considering the DAX and FTSE exchanges).

Own-volatility spillover effects in all the countries are larger and significant indicating the presence of important ARCH effects. In terms of the transmission of volatility from Europe to CEE countries, both the DAX and the FTSE are significant and the effects on all three markets are quite similar. However, the own-volatility spillover effects are larger than the cross-volatility spillover effects indicating that past volatility in CEE countries is a more important predictor of future volatility in these markets. Most of the volatility persistence in CEE countries seems to emerge from within the foreign markets. However, it is important to be aware that these conclusions are partly the result of the methodology used where we have assumed linear causality. This cannot be guaranteed and in the following chapter we run tests using a non-linear methodology to see how our results compare with those reported in this chapter.

As a final remark, our results suggest only limited stock market development on the comovement criteria

CHAPTER 7

NON-LINEAR STOCK MARKET COMOVEMENT IN CENTRAL AND EAST EUROPEAN ECONOMIES

7.1 Introduction

As a result of financial globalisation, interest has grown in the extent of stock market integration between different countries. Stock markets can be considered integrated if their prices have a tendency to move together, or if one market leads another market. The results of such investigations have important implications for portfolio diversification along international lines. In particular, significant comovement of international stock markets increases the exposure of domestic investors to foreign shocks and therefore offers very limited scope for gains from international diversification. Also, an understanding of the determinants of stock market comovement might aid understanding of the home country bias that investors exhibit (Lewis 1999), that is, the preference of investors for domestic investments over foreign investments.

A great number of studies have investigated possible linkages between the world's developed markets and in particular major US and European Stock Markets or major US and Japanese Stock Markets (see for example, Koch and Koch 1991; Kasa, 1992; Georgoustsos and Kouretas, 2001; Aggarwal, Lucey, and Muckley, 2003; Bessler and Yang, 2003; Fraser and Oyefeso, 2005). There have been fewer investigations into stock market linkages among emerging economies, with most focussing on Asia and Latin America (Ghosh et al., 1999; Koutmos and Booth, 1995; Chen, Firth, and Rui, 2002; Johnson and Soenen, 2002; Manning, 2002; Ng, 2002; Fujii, 2005).

Since the collapse of Communism at the end of the 1980s and the beginning of the 1990's, the economies of Central and Eastern Europe (CEE) have established functioning stock markets as part of the transition process. For those economies admitted to the EU (Bulgaria, the Czech Republic, Estonia, Hungary, Poland, Latvia, Lithuania, Romania, the Slovak Republic, Slovenia) these stock markets have been modelled along similar lines to those in developed market economies. These countries have also attempted to put in place adequate corporate governance structures, requiring as part of this internationally accepted standards of disclosure.

Their markets have also been opened up to overseas investors and rights of ownership have been established. Investigations of stock market efficiency in CEE countries admitted to the EU overwhelmingly confirm that at the very least they exhibit weak form efficiency (Bohl et al 2006 Rockinger and Urga 2001, and Harrison and Paton 2005). Given these developments, as well as political and economic stability and impressive rates of growth, these economies potentially offer investors attractive opportunities for portfolio diversification.

Linne (1998) was the first to investigate long run linkages between East European markets (the Czech and Slovak Republics, Hungary Poland and Russia) with the developed economies of France, Germany, Italy, Japan, Switzerland, the US and the UK. For investors seeking to diversify their portfolios this early study provided encouraging results, finding that only the Slovak Republic Stock Market exhibited comovement with all of the developed markets. Similarly Gilmore and McManus (2003) found only weak short run correlations and no long run correlations between the Czech Republic, Hungary and Poland with US Stock Markets. These results are supported by Egert and Kocenda (2007), who report no robust cointegrating relationship between the relatively new markets of the Czech Republic, Hungary and Poland and the developed markets of Frankfurt, London and Paris.

A problem with these studies is that their standard methodology is static cointegration developed by Johansen (1988) and Johansen and Juselius (1990) and, consequently, they give very little information about processes that are time varying. Phylaktis and Ravazzolo (2002) have shown that for Pacific Basin countries, financial integration is accompanied by economic integration at both real and financial levels. This has important implications for financial integration for countries admitted to the EU. Furthermore, in the case of our target countries there are good reasons for believing that stock markets in CEE might be increasingly integrated with the developed stock markets of Western Europe. As full members of the EU, these CEE countries are establishing stronger economic ties with other EU Members through trade, cross-border investments and policy coordination. The Maastricht Criteria establish rules for entry into EMU which are designed to promote economic convergence. Studies by Asprem (1989), Bodurtha et al (1989) and Canonova and De Nicoló (1995) have shown the relevance of common factors in international stock market linkages. Nasseh and Strauss (2000) demonstrate that stock prices in European countries are determined by domestic economic variables and by German economic variables for the period 1962-1995. Fratzscher (2002) has shown that increasing integration in European equity markets in the 1990s was due mainly to the drive towards EMU.

More recently, Phengpis et al (2004) have investigated the impact of economic convergence on stock market returns in four stock markets in EMU (France, Germany, Italy and the Netherlands) and one stock market in the EU (the UK). They find that economic convergence is an important factor contributing to returns in the countries investigated, with the exception of Germany, implying that Germany plays some role as policy leader in relation to the other countries. Phengpis and Apilado (2004) further demonstrate that stock market returns of a group of five non-EMU countries are driven by their own unique stochastic trends and are not cointegrated with each other or with any EMU or US Stock Market. They further showed that stock market returns for a group of five EMU member countries were strongly cointegrated, suggesting that economic interdependence encourages stock market comovement. Kim et al (2005) find that the introduction of the euro caused a regime switch among participating country stock markets and deepened stock market linkages, both within the EU and between the EU and Japan and the US. This finding is contradicted by Syriopoulos (2007) who detects no impact due to EU membership. He suggests that this might be because macroeconomic policies have already been adjusted to support convergence with the EU. Importantly for our purposes, he demonstrates the existence of major linkages between the stock markets of Poland, the Czech Republic, Hungary and the Slovak Republic with Germany and the US. Aggarwal and Kyaw (2005) investigate the impact of the formation of the NAFTA on stock markets within member countries and find that after the formation of NAFTA, stock markets in the NAFTA region became more integrated.

It is now widely acknowledged that a wide range of tests is needed to assess the complex nature of financial integration, especially since this process might be time varying (Kearney and Lucey 2004). An important paper by Gilmore et al (2008) applies various static and dynamic methodologies to examine the comovements of the major CEE equity markets (Hungary, the Czech Republic and Poland) with those of London and Frankfurt for the period 1995–2005. The authors also investigate the time varying properties of comovement using a rolling-window approach. The results of this investigation provide encouraging news for investors seeking to diversify their portfolios along international lines. Static cointegration tests find no evidence of any long run relationship between the CEE markets investigated and Frankfurt or London. Dynamic tests do reveal periods of cointegration as well as instances where short-run behaviour overpowers the long-run equilibrium relationship, but the authors conclude that any relationship is episodic and on the whole there is little evidence of any steady increase in comovement among the markets investigated.

In this chapter we extend the work of Gilmore et al (2008) by providing a time-varying assessment of non-linear comovement using an enhanced database of CEE countries. The non-linear tests for time-varying comovement employed in this study, unlike traditional approaches to testing for cointegration, encompass a number of alternative forms of non-linearity. In addition, because sample dependency can distort results when a series is converging, we test whether our results are robust to data gathered using daily data. Our data set includes the ten CEE countries that have become full EU Members since, as indicated above, there is increasing evidence that economic integration might promote stock market comovement. Investigating this group of countries is timely because five of these countries (Estonia, Latvia, Lithuania and the Slovak Republic and Slovenia) have adopted the euro and the remaining countries remain committed to adopting the euro when they satisfy the entry conditions as in the Maastricht Criteria. To this extent they share certain macroeconomic aims and common goals.

The remainder of this chapter is structured as follows. Section 2 analyses the observations on stock market returns for CEE countries and Section 3 outlines the three approaches employed to evaluate stock market comovement. In Section 4 we detail our empirical results and Section 5 provides a summary and conclusions.

7.2. Data and Summary Statistics

The study uses data on stock market indices for 10 CEE countries (Bulgaria, the Czech Republic, Estonia, Hungary Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia) and two Western European stock exchanges (Frankfurt and London). We express stock price indices in their national currencies, since this restricts any change in index values exclusively to stock price movements and so avoids distortions resulting from the numerous currency devaluations that have taken place in CEE countries (Voronkova, 2003).

The data were obtained from Datastream**.** Following Voronkova (2004) and Lagoarde-Segot and Lucey (2007), we use daily data to incorporate the information on market interactions contained in high-frequency series and Table 7.1 provides summary statistics for daily returns between 2001 and 2014. Daily returns are calculated as $r^i_{t,d} = ln(p^i_{t,d} / p^i_{t,d-1}) * 100$, where $p^i_{t,d}$ is the stock market index of *i-th* country, in year t on trading day d. The highest mean returns are in Romania (0.069 percent) and Estonia (0.049 percent). In addition, mean daily returns are generally higher across the stock exchanges for the CEE countries than for either the DAX or the FTSE; the average daily returns for CEE countries is 0.032, percent compared to 0.012 per cent and 0.002 per cent for the DAX and FTSE, respectively.

Table 7.1: Summary Statistics of Daily Returns of CEE and European Stock Exchanges

	Mean	Median	Std. Dev.	Skew	Kurt.	Jarque–Bera
Germany (DAX)	0.012	0.047	1.549	-0.016	4.858	3463.547
United Kingdom (FTSE)	0.002	0.000	1.234	-0.153	6.830	6856.565
Czech Rep. (CZEX)	0.021	0.017	1.437	-0.521	13.840	28252.562
Estonia (ESTX)	0.049	0.030	1.135	0.144	8.746	11231.459
Hungary (HUNX)	0.024	0.000	1.561	-0.092	6.613	6420.903
Latvia (LATX)	0.030	0.000	1.456	-0.724	16.793	41665.534
Lithuania (LITX)	0.046	0.012	1.083	-0.334	18.255	48937.361
Poland (POLX)	0.008	0.000	1.519	-0.150	2.664	1055.302
Romania (ROMX)	0.069	0.014	1.643	-0.228	9.467	13177.778
The Slovak Republic (SVAX)	0.023	0.000	1.161	-0.936	18.570	51085.770
Bulgaria (BULX)	0.034	0.000	2.517	-0.103	6.279	1499.493
Slovenia (SVEX)	0.013	0.000	1.087	-0.500	8.529	9021.357

Note: All Jarque-Bera statistics are significant at normal levels of testing.

Despite the larger daily returns available on CEE exchanges, volatility was not significantly higher on these equity markets relative to those in London and Frankfurt. The average volatility across the CEE countries (measured by the standard deviation of daily returns) is 1.459 compared to 1.549 for the DAX and 1.234 for the FTSE. Of the CEE countries investigated, Lithuania, Slovenia and Estonia are the least volatile and it is interesting to note that all three have adopted the euro.

As expected the summary statistics shown in Table7.1 show that the distribution of returns also seems to be non-normal. With the exception of the equity market in Estonia, other returns (including the DAX and the FTSE) are negatively skewed. Except for Poland, the measure of excess kurtosis for all other exchanges deviate significantly from that expected from returns drawn from a normal distribution. In particular, the Czech Republic, Latvia, Lithuania and the Slovak Republic all had measured excess kurtosis significantly above 3. The non-normality is confirmed by the significance of the Jarque-Bera statistic.

7.3. Methodology

Let P_t represent the stock market index in a given CEE country and P_t^* the stock market index of the benchmark exchange, in this case London (FTSE) or Frankfurt (DAX). If the two series are integrated of order one, $I(1)$, then in the model:

$$P_t = P_t^* + u_t \tag{1}$$

where u_t is normally assumed to be $I(1)$. If $u_t \sim I(0)$, however, there exists a bivariate cointegrating relationship between the variables and therefore some linkage between the CEE country index and benchmark index.

Tests for a linear cointegrating relationship of the type given in Equation (1) have been developed by Johansen and Juselius (1990). The maximum eigenvalue statistic tests the null hypothesis that there exists at most *r* cointegrating vectors. The test statistic is computed as:

$$LR_{\max}(r_0) = -T\log(1-\lambda_{r_0+1})$$

for $r = 0,1,\ldots,k-1$ where λ are the eigenvalue statistics and asymptotic critical values can be found in Johansen and Juselius (1990).

In fact, the relationship between the two series may not always be linear. Li (2006) shows that the cointegrating relationship between two exchanges may be log-linear and deterministic, log-linear and stochastic or non-linear in the price indices, depending on whether the risk premium is a linear or non-linear function of domestic and foreign risks. Equation (1) may therefore be rewritten as:

$$g(P_t) = f(P_t^*) + e_t \qquad (2)$$

where $g(.)$ and $f(.)$ are monotonically increasing functions. If $e_t \sim I(0)$, then there exists a non-linear cointegrating relationship between the two exchanges.

The functions $g(.)$ and $f(.)$ are not observed, but Breitung (2001) has developed tests of non-linear cointegration based on the ranks of the observed series, $R_T[g(P_t)] = R_T(P_t)$ and $R_T[f(P_t^*)] = R_T(P_t^*)$. Breitung (2001) computes two test statistics:

$$\kappa_T = T^{-1} \sup_t |d_t| \qquad (3)$$

and

$$\varepsilon_t = T^{-3} \sum_{i=1}^{T} d_t^2 \qquad (4)$$

where $d_t = R_T(P_t) - R_T(P_t^*)$ and $\sup_t |d_t|$ is the maximum value of $|d_t|$ over $t = 1, 2, ..., T$. The null hypothesis tested is that of no (non-linear) cointegration and is rejected if the test statistics are too small. Breitung (2001) provides critical values for the test statistics in Table 7.2. One of the main advantages of Breitung's (2001) tests is that they encompass a number of other alternative forms of non-linearity. Therefore, rather than testing one type of non-linearity, which might not necessarily be the correct form, the statistics are able to evaluate whether or not there exists some long-run association between two or more variables.

Because cointegration tests are usually sample dependent (Stephon and Larsen, 1991) the authors employ time-varying cointegration tests with a rolling window. To obtain time-varying measures of the cointegration statistics, the step size, k, is set at 20 for daily series. Rolling 3-year sub-samples are therefore generated using $3D + k$ observations, where D is the number of trading periods. The test statistics in each case are then scaled by the critical values at the 5 percent level. To overcome the problem of non-synchronous trading days, some authors employ weekly or monthly data which sidesteps the problem, but at the expense of lost information (see Miller et al 1994). Testing for cointegration at each frequency of observation allows the authors to investigate the possible implications this might have on stock market integration. Despite this, we do not test at these frequency levels here and thus overcome the problem posed by non-synchronous trading days.

Breitung's (2001) test, although able to detect the presence of cointegration, does not indicate whether the relationship is linear or nonlinear. Using the following equation:

$$P_t = \gamma_0 + \gamma_1 P_t^* + f^*(P_t^*) + v_t \tag{5}$$

the null hypothesis of linearity $f^*(P_t^*) = 0$ for all t and $v_t \sim I(0)$ can be tested. Since $f^*(P_t^*)$ is unknown, a multiple of the rank transformation is used instead, that is, $f^*(P_t^*) = \Theta R_T(P_t^*)$. Breitung notes that if P_t^* is exogenous and $v_t \sim N(0, \sigma^2)$ a score statistic TR^2 from the least squares regression:

$$\hat{v}_t = \lambda_0 + \lambda_1 P_t^* + \lambda_3 f^*(P_t^*) + \xi_t \tag{6}$$

where $\hat{v}_t$ are the residuals under the null hypothesis. The test statistic is distributed as χ^2 with one degree of freedom.

7.4. Results

7.4.1 Full Sample

Before testing for cointegration, unit root tests are conducted for all the stock market indices expressed in level terms. The results are given in Table 7.2. The tests were done with and without a trend, as recommended by Engle and Granger (1987) and Breitung and Gouriéroux (1997). The tests suggest the null hypothesis of a unit root in the level series cannot be rejected in all cases.[1]

[1] Lag lengths were chosen using the Schwarz Bayesian criterion.

Table7.2: Summary Statistics of Daily Returns of CEE and European Stock Exchanges

Series tested	ADF		Breitung	
	Without trend	**With trend**	**Without trend**	**With trend**
Levels				
DAX	-0.464	-2.574	0.055	0.005
FTSE	-1.667	-2.776	0.032	0.004
CZEX	-1.488	-1.168	0.031	0.019
ESTX	-1.196	-1.225	0.051	0.010
HUNX	-1.699	-1.572	0.047	0.016
LATX	-1.634	-1.391	0.022	0.015
LITX	-1.095	-1.103	0.042	0.013
POLX	-1.545	-1.669	0.037	0.014
ROMX	-1.509	-1.378	0.035	0.015
SVAX	-1.408	-1.139	0.022	0.021
BULX	-1.705	-2.272	0.050	0.016
SVEX	-1.027	-1.438	0.022	0.015
Returns				
RDAX	-43.002**	-43.033**	0.000**	0.000**
RFTSE	-28.743**	-28.765**	0.000**	0.000**
RCZEX	-42.962**	-42.977**	0.000**	0.000**
RESTX	-37.502**	-37.527**	0.000**	0.000**
RHUNX	-28.277**	-28.289**	0.000**	0.000**
RLATX	-29.950**	-29.975**	0.000**	0.000**
RLITX	-16.521**	-16.534**	0.000**	0.000**
RPOLX	-42.139**	-42.133**	0.000**	0.000**
RROMX	-40.629**	-40.697**	0.000**	0.000**
RSVAX	-41.752**	-41.892**	0.000**	0.000**
RBULX	-23.595**	-23.580**	0.000**	0.000**
RSVEX	-36.967**	-37.020**	0.000**	0.000**

Note: ** indicates significance at the 1 percent level of testing.

In contrast, the null hypothesis of a unit root in the alternative series is rejected in all cases. The stock market price indices for CEE countries as well as the DAX and FTSE are $I(1)$, stationarity is achieved after first differencing the level series. As a preliminary investigation of stock market linkages in Europe, bivariate tests for cointegration are provided in Table7.3. These tests are conducted using daily observations for the full sample period.

Table7.3: Johansen's Tests for Cointegration (Full Sample)

Country	$H_0\!: rank = p$	Without trend	With trend
DAX			
CZEX	$p = 0$	7.369	11.490
	$p = 1$	1.484	5.767
ESTX	$p = 0$	9.489	12.927
	$p = 1$	6.108	4.225
HUNX	$p = 0$	6.651	10.073
	$p = 1$	2.124	5.109
LATX	$p = 0$	4.748	12.797
	$p = 1$	2.310	2.636
LITX	$p = 0$	6.080	11.526
	$p = 1$	3.573	1.799
POLX	$p = 0$	5.840	9.551
	$p = 1$	1.941	5.687
ROMX	$p = 0$	6.257	12.459
	$p = 1$	2.385	2.462
SVAX	$p = 0$	3.338	13.220
	$p = 1$	0.861	1.929
BULX	$p = 0$	13.182	14.815
	$p = 1$	1.345	5.219
SVEX	$p = 0$	7.145	22.323*
	$p = 1$	0.925	4.285
FTSE			
CZEX	$p = 0$	4.666	12.512
	$p = 1$	3.663	3.626
ESTX	$p = 0$	16.944*	16.857
	$p = 1$	3.673	1.607
HUNX	$p = 0$	7.672	11.569
	$p = 1$	3.591	3.450
LATX	$p = 0$	9.255	16.865
	$p = 1$	2.716	1.963
LITX	$p = 0$	13.827	15.408
	$p = 1$	3.143	1.229
POLX	$p = 0$	6.480	11.030
	$p = 1$	2.840	2.868
ROMX	$p = 0$	12.346	16.061
	$p = 1$	2.771	1.949

SVAX	$p = 0$	3.948	15.133
	$p = 1$	2.293	2.332
BULX	$p = 0$	10.703	13.929
	$p = 1$	1.881	5.877
SVEX	$p = 0$	9.487	25.203*
	$p = 1$	3.294	5.124

Note: * indicates significance at the 5 percent level of testing.

Given that the variables are $I(1)$, we employed the Johansen and Juselius (1990) maximum eigenvalue statistic to test for linear cointegration between each CEE country exchange and the DAX and FTSE. The results are given in Table7.3 and are conducted with and without a trend. Looking first at the results for the DAX, the null hypothesis of no cointegration is only rejected in 1 out of the 10 countries studied: Slovenia. However, these results should be treated with caution, given the lower predictive power of the full-sample maximum eigenvalue statistic when there are structural breaks in the sample period (Andrade et al 2005). Moore and Wang (2007), investigate the volatility of stock exchanges in new EU member States between 1994 and 2005 using a Markov switching model and find that in the early stage of transition, stock returns are usually in the high volatility regime. The authors note that this volatility is primarily due to the spillover effects from crises in Asia in 1997 and Russia in 1998.

The results may also be due to non-linearity in stock price data, as a result of diversity in agents' beliefs, heterogeneity in investors' objectives, herd behaviour and endowment switches between high and low economic growth (Sarantis, 2001). Table 7.4 therefore provides Breitung's non-linear test for cointegration using the full sample of data. Quite similar to Johansen's cointegration tests, there is no evidence of cointegration between stock exchanges in CEE countries and the DAX and FTSE (except for only several statistically significant kappa-statistics for DAX-Estonia, DAX-Poland, DAX-Bulgaria, FTSE-Estonia, and FTSE-Poland, implying that we reject the null hypothesis of no non-linear cointegration. These results are similar to those obtained by Égert and Kocenda (2007) who analyse comovement among three stock markets in Central and Eastern Europe and their interdependence with Western Europe. The authors find no robust cointegration for any of the stock index pairs or for any of the extended specifications. Similarly, Chelley-Steeley (2005), using smooth transition analysis, notes that during the recent history of the CEE countries, their markets were heavily segmented. This segmentation has, however, declined significantly over time. These findings suggest that testing for stock market comovement over the entire sample of data could provide misleading results since the exchanges may have been in the process of converging. This therefore provides important support for the use of time-varying econometric tests.

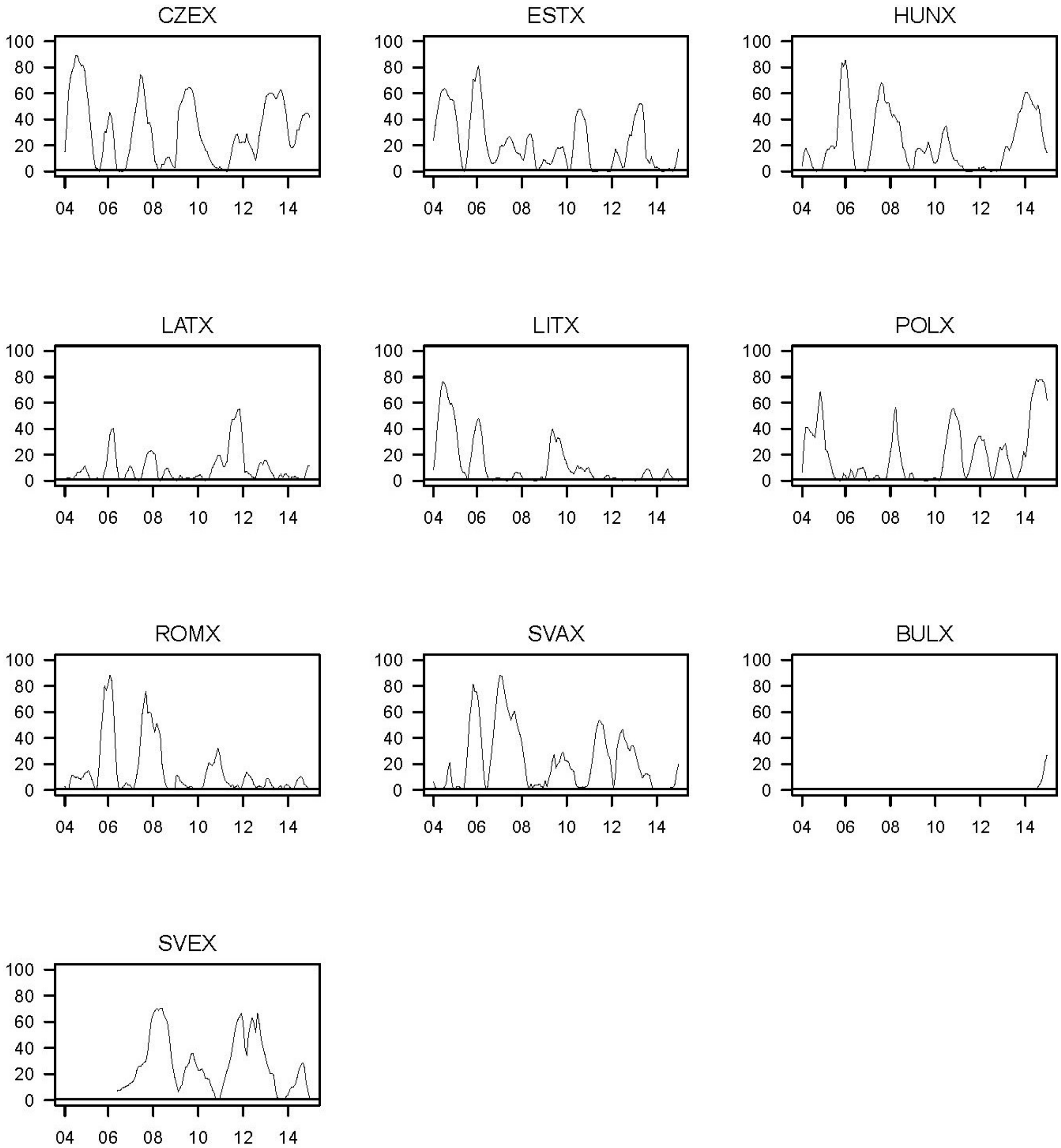
Table7.4: Breintung's Tests for Cointegration (Full Sample)

	κ_T	ξ_T
DAX		
CZEX	0.597	0.079
ESTX	0.663*	0.036
HUNX	0.589	0.062
LATX	0.679	0.070
LITX	0.651	0.052
POLX	0.489*	0.044
ROMX	0.692	0.057
SVAX	0.799	0.130
BULX	0.677*	0.041
SVEX	0.806	0.168
FTSE		
CZEX	0.695	0.073
ESTX	0.803*	0.034
HUNX	0.722	0.061
LATX	0.822	0.056
LITX	0.693	0.045
POLX	0.604*	0.040
ROMX	0.834	0.048
SVAX	0.842	0.127
BULX	0.711	0.051
SVEX	0.857	0.149

Note: * indicates significance at the 5 percent level of testing.

As further evidence of the need to take into account the time-varying properties of stock exchanges in CEE countries, Figure 7.1 plots the scaled tests for non-linearity recommended by Breitung (2001). As a result, values above the unit line indicate that we cannot accept, at normal levels of significance, the null hypothesis of no non-linearity. Indeed, Figure 7.1 suggests that there are periods where linear models of stock market comovement are unlikely to adequately represent the dynamics in CEE countries. The findings presented in this section are therefore instructive and suggest that comovement in Europe is likely to be non-linear and time-varying. As a result, the following section addresses both of these issues.

Figure 7.1: Tests for Non-Linearity



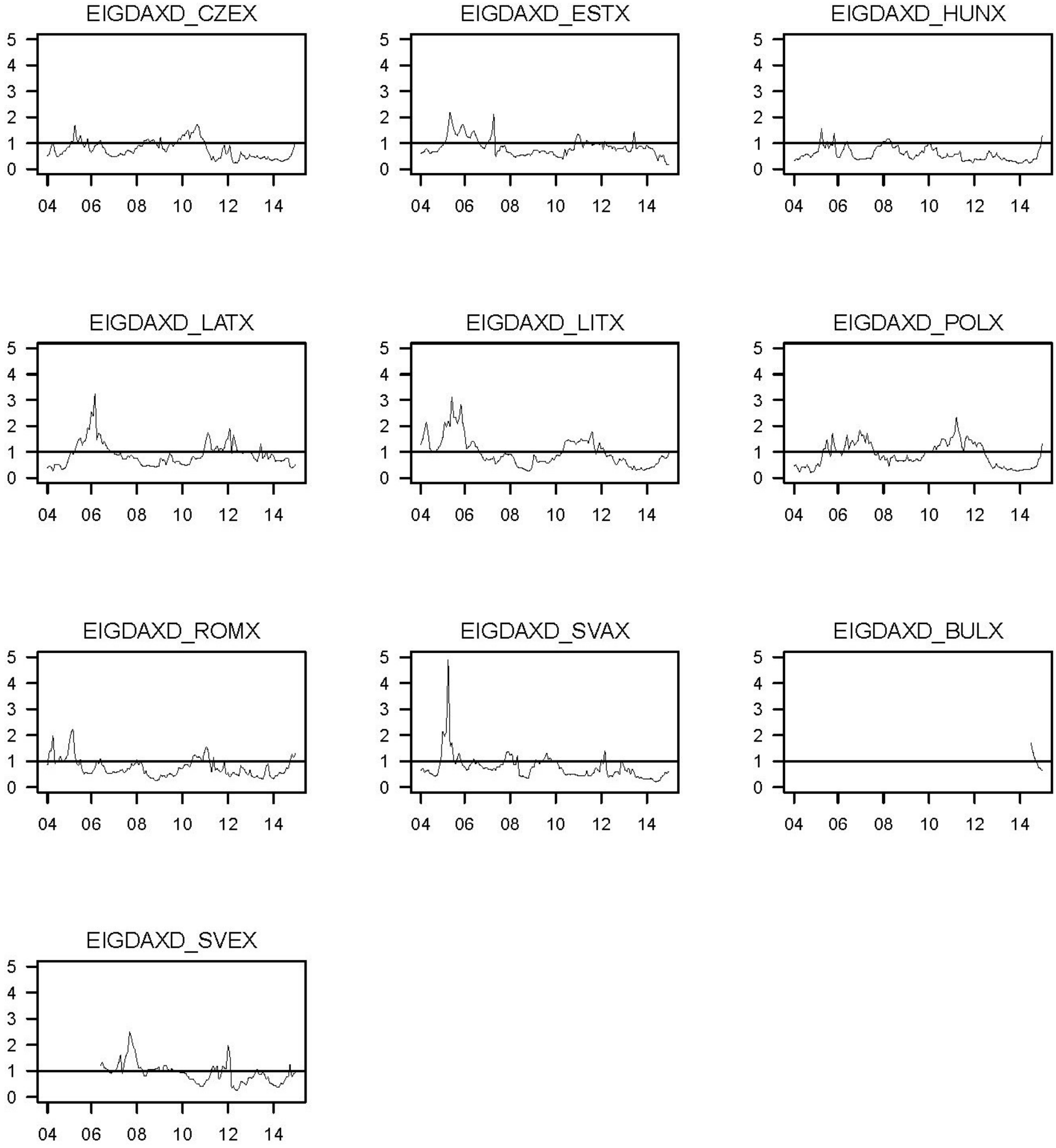
7.4.2 Time-Varying Results

Given that the evidence so far suggests that stock markets in CEE countries are to a large extent segmented from those in the rest of Europe, the authors utilise time-varying cointegration techniques to investigate if this hypothesis holds for various sub-periods. The three cointegration test statistics ($LR_{\max}$ denoted by EIG, κ_T denoted by KAPR, and ε_t denoted by XI) are calculated using rolling three-year sub-samples and the step size is set so that the test statistics are obtained for each month in the sample period. The acronyms for each of the test statistics are affixed at the front of each figure to denote which test is used.

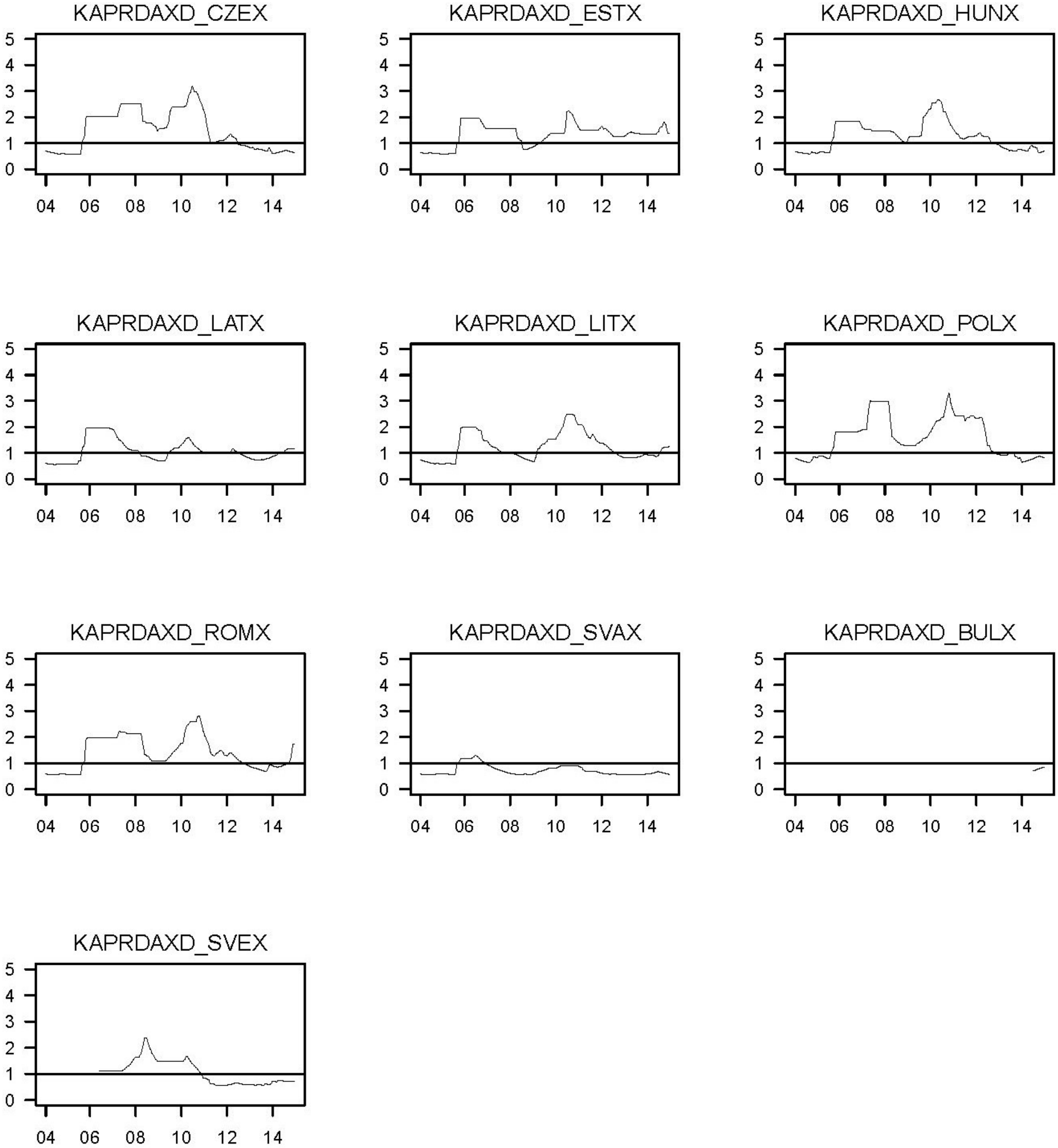
Figure 7.2 presents the results from using the DAX as the benchmark index and therefore tests the null of no cointegration between the given CEE exchange and the DAX. Since the scaled test statistics are plotted, all values above 1 (the horizontal straight line) indicate the null hypothesis is rejected at normal levels of testing. The statistics are obtained using daily observations and the results are provided in Figure 6.2. As suggested by Stephon and Larsen (1991), the maximum eigenvalue statistic is highly dependent on the sample period under investigation. Relative to Breitung's non-linear cointegration statistics, the maximum eigenvalue statistic has a greater degree of volatility. In general, however, all three cointegration statistics suggest that stock market comovement tends to be episodic. However, the maximum eigenvalue statistic tends to over-reject the null, particularly during periods of high volatility.

Figure 7.2: Time Varying Linear and Nonlinear Tests for Cointegration between the DAX and CEE Countries' Exchanges (daily data)

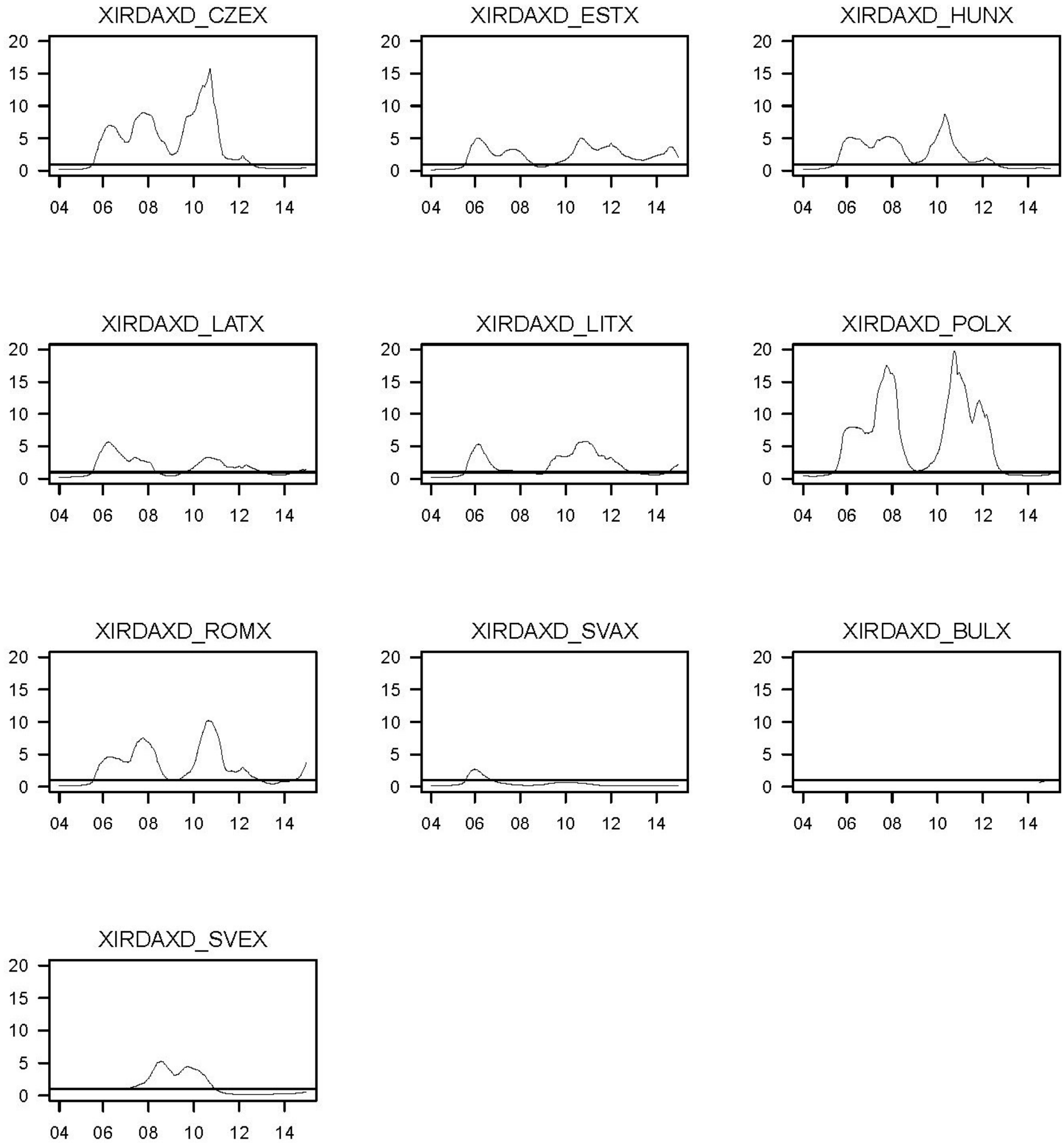
Maximum eigenvalue test



Kappa-test


KAPRDAXD_CZEX
KAPRDAXD_ESTX
KAPRDAXD_HUNX
KAPRDAXD_LATX
KAPRDAXD_LITX
KAPRDAXD_POLX
KAPRDAXD_ROMX
KAPRDAXD_SVAX
KAPRDAXD_BULX
KAPRDAXD_SVEX
0 1 2 3 4 5
04 06 08 10 12 14

Xi-test



The results also indicate that comovement between stock exchanges in CEE countries and those in Western Europe is heterogeneous. In the case of Slovenia, the non-linear cointegration statistics suggest that the null hypothesis of no cointegration could not be rejected for most of the sample period. After 2006, however, the null hypothesis of no cointegration is rejected up until 2008, when there is a slight dip in the cointegration statistics. The increased capital market integration probably reflects the removal of foreign investment restrictions following the enactment of the country's Foreign Exchange Act. This has enhanced portfolio diversity by incorporating foreign securities (Andritzky, 2007). In contrast, the slight dip in the statistic for 2006 could reflect growing investor risk aversion towards emerging markets during the year.

In the Slovak Republic, test statistics suggest that there exists a relationship between the domestic stock exchange and those in Germany and the UK. This result is somewhat surprising since trading activity is mainly done as pre-negotiated trades and the market is fairly small and illiquid. However, Herrmann and Jochem (2003) note that money markets in the Slovak Republic display a high degree of international integration in the euro area. In addition, this association has strengthened since 1999. The findings for Estonia are quite similar, but with a pronounced upward shift in the cointegration test statistics in 2002, 2003 and 2004. Egger and Pfaffermayr (2004) note that the Eastern enlargement was characterised by a substantial, positive anticipation effect in the period prior to the announcement and the formal establishment of each of the integration steps. This anticipation effect could explain the significant jump in the statistics observed between 2002 and 2004.

Given that stock markets in Latvia, Lithuania, and Bulgaria were only recently re-established relative to other CEE countries, the cointegration statistics for these nations are only available from 2002 onwards. The results for the three exchanges are quite similar. The Johansen maximum eigenvalue statistic suggests that the linear comovement between the stock markets in these countries and those in Western Europe was, at best, episodic. However, Breintung's non-linear cointegration statistics suggest that there was some degree of comovement between stock markets in these countries and those in the rest of Europe from 2002. These results suggest that despite their relatively late start, market returns in these countries are fairly integrated (although non-linearly) with the rest of Europe. Encouragingly, our results are in line with those reported by Mateus (2004). Set in an unconditional asset-pricing framework, Mateus attempts to measure the impact that global risk factors have on excess returns in emerging countries. The author finds that global risk factors have high predictive power for Bulgaria, Estonia, Lithuania, Romania and Hungary, while local risk factors were more important in the Czech Republic, Latvia, Poland and Slovenia.

The cointegration statistics suggest that comovement between the stock markets in the Czech Republic and Romania and those in Western Europe seem to be rising over time. These results are similar to those obtained by Schotman and Zalewska (2006), Chelley-Steeley (2005) and Mateus (2004) and seem to be driven by greater financial integration in the Czech Republic (Herrmann and Jochem, 2003). In the case of Hungary and Poland, the cointegration test statistics have been rising over time. However, for most of the sample period until 2002, the null hypothesis of no cointegration could not be rejected. This result could be due to the insignificance of global risk factors on excess returns in Poland (Mateus, 2004) and the greater influence of Mediterranean countries on Hungary relative to Western Europe (Brüggerman and Trenkler, 2007).

The results presented in this section suggest that the Johansen cointegration test statistic can provide misleading inferences if there is non-linearity in the relationship between the variables. Breintung's cointegration test statistic suggests that there is some comovement between stock exchanges in CEE countries and those in Western Europe.

7.5. Conclusions

In this chapter, we have explored the possible comovement of Central and Eastern European stock markets with those of the UK and Germany by testing for the existence of a cointegrating relationship between pairs of stock market indices. Using the full-sample data, the standard cointegration test by Johansen revealed very little evidence of cointegration between either the FTSE or the DAX and a CEE stock market indices. Testing for the possibility of a nonlinear cointegrating relationship using Breintung's (2001) test revealed even less evidence of cointegration.

Mindful of the fact that the CEE stock markets are highly volatile relative to those of the UK and Germany, and the Johansen test is sensitive to data volatility as well as the sample period considered, we proceeded to test for cointegration by using a rolling window approach. Our results suggest that comovement between CEE and developed European exchanges are heterogeneous. In general, we find evidence of comovement with Western exchanges in Slovenia and the Slovak Republic. Using linear cointegration techniques we find limited evidence of comovement between the stock markets in Latvia, Lithuania and Bulgaria with those of Western Europe. However, we find stronger evidence of comovement between these exchanges and Western Europe using Breintung's non-linear cointegration statistic. We also find evidence that while comovement between the Czech Republic, Hungary Poland and Romania with Western Europe is limited, it seems to be increasing over time.

In summary, we find that Johansen's cointegration test statistic can provide misleading inferences if there is non-linearity in the relationship between the relevant stock market indices. Breintung's cointegration test statistic provides more reliable results and suggests that there is some comovement between stock exchanges in CEE countries and those in Western Europe. We find no evidence that the frequency of observations has any effect on our results. Our results affirm the importance of using non-linear tests when investigating stock market comovement. This is hardly surprising given the dynamic nature of transition and the evolution and development of stock markets in CEE countries. In the last two and half decades, these countries have experienced unprecedented economic upheaval and structural change, most recently powered forward by increasing economic integration with Western Europe both before and after EU Accession, and these changes have had far reaching implications for investigations into stock market comovement which linear tests might fail to capture.

In trems of the implications of our results for stock market development, non-linear cointegration techniques are clearl;y superior to standard tests of cointegration and give more encouraging reults that our target group of stock markets are becoming increasingly cointegrated with Europe and, in that sense, are becoming more developed.

CHAPTER 8

DO SPILLOVERS FROM DEVELOPED STOCK MARKETS IMPACT ON THE VOLATILITIES OF CENTRAL AND EASTERN EUROPEAN STOCK MARKETS?

8.1 Introduction

When Lehman Brothers filed for bankruptcy on September 15th 2008, many commentators allege that this was the first major sign that a financial crisis was about to erupt and engulf markets across the globe. Earlier, in 2007, the financial stress experienced by Bear Sterns failed to exert any restraining influence on financial markets which continued their gallop upwards. However, the collapse of Lehman Brothers sent shock waves which reverberated across global markets. Earlier in the year, the Dow Jones had peaked in May 2008 at 13191.49, but on 15th September, it closed at 10917.51. Taking the year as a whole, the Dow Jones opened on January 2nd at 13,043.96, but on the same day a year later it stood at only 9,034.69. Other markets quickly reflected the impact of contagion and the FTSE-100 fell 31 per cent opening the year at 6456.90 and closing at 12.30 on New Year's Eve at 4434.17. In Frankfurt, the Dax-30 ended 2008 down 40% - the index's second-worst annual performance in its 20-year history. Japanese shares also suffered their biggest yearly decline with the Nikkei dropping 42%. The worst performance of all was recorded in China where the Shanghai Stock Index (SEE Composite Index) posted a drop in stock prices on the year of some 65 per cent. This might indicate some degree of comovement between stock markets and if markets exhibit comovement, the benefits of international portfolio diversification disappear at the time they are most needed. It is therefore important to understand the process of contagion and to test for its occurrence across markets.

In recent decades, stock markets have become more integrated as the global economy has become more integrated and this pattern is replicated among countries in the same geographic region. (See for example Harrison and Moore (2009, 2010 and 2011.) One possibility is that spillover effects between markets are amplified by economic shocks that reverberate across markets as contagion spreads. One channel through which this might happen is that a crisis in one country adversely impacts on the liquidity of market participants forcing them to sell their holdings of assets in countries not affected by the crisis so as to meet margin calls etc in the country where the crisis occurs. Be that as it may, this possibility cannot explain the turbulence unleashed on stock markets, both in developed and emerging economies, during the financial of crisis of 2008-09. A more general explanation of this turbulence is that lessons learned when the shock broke in the USA were transferred to other countries with similar financial structures where the balance sheets of banks were strikingly similar and therefore contained the seeds of financial collapse.

8.2 A Review of the Related Literature

The time-varying behaviour of comovements in stock markets has attracted considerable attention in the literature. The results from the relatively extensive empirical literature on contagion in equity markets tends, with some exceptions, to support the idea of contagion across markets. Following the global stock market crash of 1987, King and Wadhwani (1990) were one of the first to investigate how shocks are transmitted across borders to stock markets in different countries. They find evidence of an increase in cross market correlation coefficients between the stock markets of the USA, the UK and Japan. This finding is confirmed by Hamao et al (1990) who use an ARCH methodology to assess the extent of price volatility between New York, Tokyo and London following the 1987 crash; and by Lin et al (1994) who use a GARCH methodology to estimate correlations between returns and volatilities of stock market indices in New York and Tokyo. Lee and Kim (1990) increase the number of countries to twelve major markets and find that average weekly cross market correlations increase from 0.23 before the crash of 1987 to 0.39 after the crash.

The empirical findings of early investigations, including those cited above, into the effects of the 1987 stock market crash on cross country contagion universally find evidence of increased contagion during the crash. Hon et al (2006) find that major global events such as a financial crisis impact on cross country correlation of assets This finding is reaffirmed by Longin and Solnik (2001) who find that correlation between markets is not associated with volatility, but with the trend of the market. They conclude that while correlations increase in bear markets, they do not increase in bull markets. They further argue that it is difficult to test the hypothesis that in periods of stock market volatility the correlation between markets increases and that because of this, erroneous results have been reported many times as a consequence of the spurious relations between volatilities and correlations. Similarly Forbes and Rigobon (2002) question the contagion results presented in earlier studies. They argue that correlation coefficients are conditional on market volatility that can be ascendant in times of crisis, representing a normal reaction based on natural economic relations.

In their seminal paper, Dees et al (2007) investigate inter-country contagion. They use a GVAR model to investigate the spillover effects between 26 countries in the euro area and find that financial shocks are transmitted rapidly from the USA to the euro area and that equity markets (and bond markets) are highly synchronous. In addition, they find that euro area equity prices react quickly to a US equity market shock, though there may be some signs of an over-reaction. Chordia et al (2005) argue that in times of shocks such as a financial crisis, a positive relationship between correlations and volatilities in equity and bond markets arises. Using daily returns for the NSDAQ and T-bonds for ten years and for thirty years they argue that a negative shock might cause a "flight to quality as investors substitute safe assets for risky assets" (p68). A GVAR approach is also employed by Galesi and Sgherri (2009), who find that equity markets are more synchronous than banking systems, and that asset prices are the main channel through which financial shocks are transmitted globally.

Several studies have focused on Asian markets. Baig and Goldafin (1998) investigate contagion between Thailand, Malaysia and South Korea and the Phillapines following the Asian currency crisis of 1997. They find correlations in currency markets and sovereign spreads increase significantly during the crisis period. Equity markets, on the other hand, offer mixed results. The authors construct a set of dummy variables using daily news to capture the impact of own country and cross border news on the markets. Once this is done and after allowing own country news and other fundamentals,. The authors find evidence of cross border contagion in both currency and equity markets. Obstfeld (1996) Krugman (2000) and Goldstein and Pauzer (2004) explain contagion following the

Asian financial crisis in terms of herding behaviour, perhaps caused by a potentially negative wealth effect.

Cappiello et al (2006) investigate 21 developed stock markets to test the behaviour of international equity and bond markets. Among their other findings, they report that annualized average volatility for European countries participating in EMU, American and Australasian equities show linkages between periods of financial turmoil such as the stock market crash of 1987, the beginning of the Gulf War and the Asian financial crisis. Analyzing 60 countries in the period 2008-2011, Beirne and Gieck (2012) consider the existence of contagion for different categories of assets (bonds, stocks, and currencies) and find dissimilarities between assets and market linkages.

Fewer studies have investigated contagion in Central and East European (CEE) stock markets. In an early study Macdonald (2001) finds evidence of cointegration between CEE stock markets and the developed markets of London, Frankfurt and New York. Syriopolous (2006) finds that international cointegration linkages are stronger than intraregional linkages among stock markets in CEE countries. In a more recent study, Syllignakis and Kouretas (2011) demonstrated a significant growth of spillover effects between CEE stock markets and those from Germany and the US. In the same study, they also demonstrated increased spillovers between CEE stock markets in times of financial crisis. They conclude that contagion effects within stock markets are most pronounced in Latin America and the emerging markets of Asia. They also find evidence of contagion from global bond markets, regional stocks in CEE and the Middle East and Africa.

Other studies have found contrary findings and Gilmore and McManus (2002) find that CEE stock markets are neither cointegrated individually nor as a group with the US. Similarly Yuce and Simga-Mugan (2000) find no evidence of cointegration between CEE countries individually and only limited evidence of international cointegration with developed stock markets.

Renatas and Pierdzioch (2011) investigate whether the uniform collapse of stock markets in three CEE countries (the Czech Republic, Hungary and Poland) during the financial crisis was due to international linkages of deteriorating fundamentals or international spillovers of speculative bubbles. They find that long run linkages vary over time but that long run linkages with the US Stock Market strengthened in terms of both fundamentals and speculative bubbles during the financial crisis reflecting both a transatlantic deterioration of fundamentals and contagion effects due to international spillover of speculative bubbles that originated in the US Stock Market. This finding is important in terms of our research because the authors also find that "Transatlantic cointegration linkages with the US and US speculative bubbles strengthened to a much more significant extent than continental cointegration linkages and speculative bubbles estimated for Germany and the United Kingdom" (pp 154). The relationship between Australia and emerging markets was investigated by Gupta and Mollik (2008) who conclude that correlations between the stock markets investigated are unstable and change over time.

Our objective is to investigate the dynamics of the newly emerged markets of the Central and Eastern European region with respect to their dependence on the dynamics of global stock markets. Using a methodology that relies on panel data analysis, we investigate the extent to which the correlations of log returns of stock indices from the CEE region influence the dynamics of their volatilities over the time interval from January 2008 until July 2015, both as a whole and in a dynamic manner, using rolling windows of approximately six months.

8.3 Data and Methodology

Our data covers closing prices of ten Central and Eastern European stock market indices (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia) and daily values of the stock market indices for the developed countries in our study (the US, UK, Germany and Japan) from January 2008 until July 2015, representing 1977 observations for each index. A brief presentation of the statistical properties of the log-returns for the CEE data is presented in Table 8.1. We note the usual relatively high value of kurtosis and, in general, the relatively low skewness which is negative for almost all countries. This is an interesting early result because negative skewness is generically considered a statistical feature of developed markets, but is not generally a characteristic feature of emerging or frontier markets. However, given the fact that our data cover the period representing the most recent financial crisis, we acknowledge these phenomena but do not read too much into them – though in terms of investigating stock market development as measured through cointegrating relationships, this might be an encouraging early result.

Table 8.1: Summary Statistics of Daily Returns of CEE and European Stock Exchanges

	Mean	Max.	Min.	Std. Dev.	Skew	Kurt.	Jarque-Bera	p-value
BULGARIA	-0.001	0.073	-0.114	0.013	-1.026	13.608	9611.188	0
CZ. REP.	0.000	0.124	-0.162	0.016	-0.493	18.088	18824.037	0
ESTONIA	0.000	0.121	-0.070	0.012	0.306	12.485	7438.330	0
HUNGARY	0.000	0.132	-0.126	0.017	-0.018	10.465	4588.049	0
LATVIA	0.000	0.102	-0.079	0.013	0.205	10.068	4126.848	0
LITHUANIA	0.000	0.110	-0.119	0.012	-0.364	24.866	39407.774	0
POLAND	0.000	0.061	-0.083	0.013	-0.462	7.418	1677.708	0
ROMANIA	0.000	0.106	-0.131	0.017	-0.651	12.430	7460.607	0
THE SLOVAK REPUBLIC	0.000	0.119	-0.148	0.012	-1.367	28.538	54312.371	0
SLOVENIA	-0.001	0.405	-0.404	0.018	-0.037	282.861	6448513.035	0

In terms of methodology, the analysis focuses on the construction of panels for the indices representing the countries in our sample. For this panel data structure we developed two types of investigations: one that covers the full sample and one that investigates the dynamics of the statistical properties of the panel data. To do this, we estimate the variances of all our indices using a simple GARCH(1,1) model and we also compute the dynamic conditional correlations (via a standard DCC-GARCH(1,1) model) of each of the CEE stock market returns with the log-returns for the indices from the most developed countries. The resulting statistics were then settled into a panel data set through which we analyse the dependence of the variances of the CEE log-returns on their correlations with the developed markets log-returns. To facilitate this we estimate the following relationship:

$$\sigma_{i,t} = \alpha + \beta_1\rho_{1,i,t} + \beta_2\rho_{2,i,t} + \beta_3\rho_{3,i,t} + \beta_4\rho_{4,i,t} + u_{i,t}$$

Where i counts the ten series of log-returns for the CEE stock market indices, t is the time index, σ is the volatility of our indices estimated using the GARCH(1,1) model and $\rho_{1..4}$ represent the correlations of each CEE stock index with each of the four developed market indices which were estimated using a DCC-GARCH(1,1) model as explained above.

In keeping with the standard panel analysis algorithm, we use the Hausman test to investigate the proper estimation method (fixed effects versus random effects) and we then show the results of the panel regressions performed.

8.4 Results

Our analysis relies on a panel variable that covers the volatilities (the series of standard deviations) of the stock market indices from the CEE region which represents our dependent variable and on four panel variables representing the correlations of these stock market index log-returns on the log-returns of the S&P 500, FTSE, DAX and Nikkei indices. We therefore have a set of five panel variables for which we first investigate the panel unit root properties using the usual set of unit root tests.

Table 8.2: Unit Root Statistics for the log-returns of CEE Stock Market Indices

Levin, Lin, Chu	*t-stat*	*p-value*		
	-148.958	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-122.741	0	-147.528	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	119.7344	5.51E-14	12.99863	0

The results exhibited in Table 8.2 suggest that the log-returns for the CEE stock market indices are suitable for a panel analysis as these panels are stationary according to all the tests employed here. However, our focus is on the dynamics of the volatilities and the manner in which they are influenced by the correlations of the CEE indices with the developed stock market indices.

Figure 8.1 shows the statistical properties of the volatilities in CEE markets computed using a simple GARCH(1,1) model for each series of log-returns in our sample. It therefore provides a graphical representation of our panel of volatilities. We notice that the indices for Poland and the Slovak Republic and, to a lesser extent, Latvia, are relatively stable.

Figure 8.1: The Panels of Volatilities for the log-returns of CEE Stock Indices

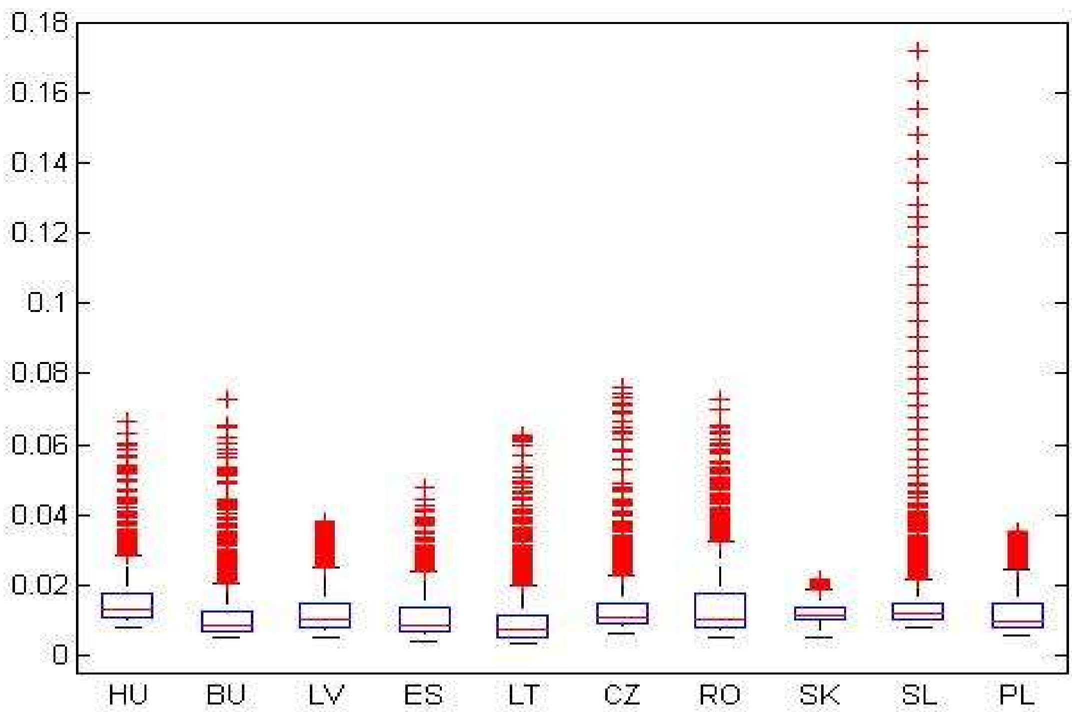
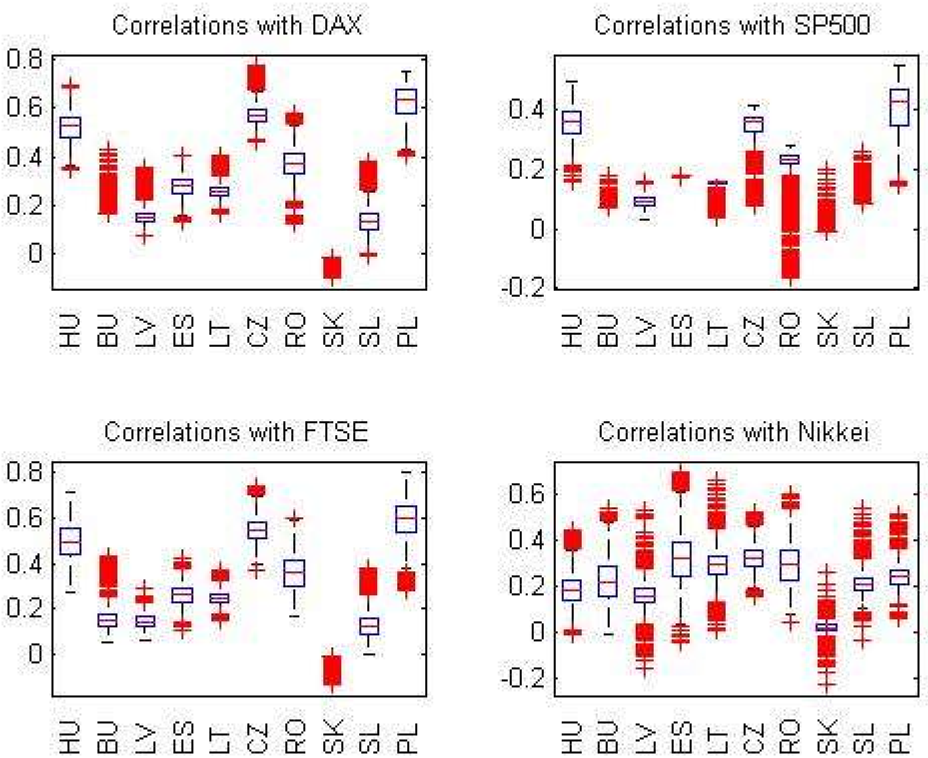


Figure 8.2 shows the same information for each of the international benchmark capital market indices in our study, alongside the volatilities of the CEE markets. In the upper left side of the chart we can see the statistical properties of the correlations of the log-returns of each CEE stock market index with the log-returns of the DAX index for the whole sample period. We notice a large spectrum of distributions, with relatively low correlations for the Slovak Republic index and relatively large correlations for the Polish and the Czech Republic indices. The means of these correlations are generally positive, but quite diverse. A relatively lower diversity is observed in the correlations with both the S&P 500 and the Nikkei. The Romanian log-returns show a relatively large set of outliers with the S&P 500 and are generally negative even though the average and

the largest part of the correlations are positive. However, the Polish index is again highly correlated with the S&P 500, which provides tentative evidence of greater integration of this capital market with our benchmark markets for the whole sample.

The panel of correlations with the FTSE seems more diverse than for the S&P 500 and the Nikkei, with positive and relatively large correlations for the Polish, the Czech Republic and Romanian indices with a weaker, and at times negative correlation reported for the Slovak Republicn index.

Figure 8.2: Panels of Correlations for the log-returns of CEE Stock Indices with the Developed Stock Market Indices



In order to develop our panel analysis of the connections between the volatilities of these indices and the correlations with the international benchmarks, we first provide the results of the unit root tests for each panel variable.

Table 8.3: Unit Root Statistics for the Volatilities of log-returns for the CEE Stock Markets

Levin, Lin, Chu	*t-stat*	*p-value*		
	-123.15	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-12.017	0	-11.73	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	83.57	9.64-10e	10.051	0

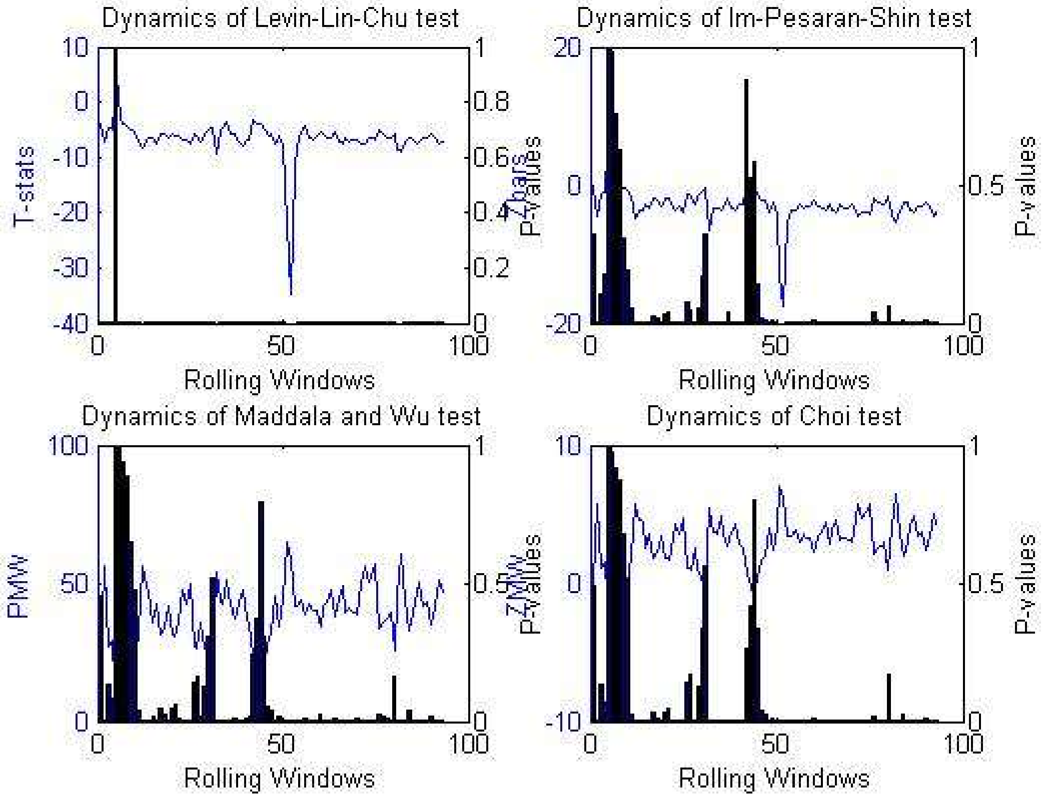
Table 8.3 shows the results of these tests for the set of volatilities. We notice that the panel is stationary for all the tests we have used, with p-values that are virtually zero in all the cases.

Table 8.4: Unit Root Statistics for the Correlations of log-returns for the CEE Stock Markets with the Developed Stock Market Indices

	Correlations with DAX			
Levin, Lin, Chu	*t-stat*	*p-value*		
	-123.15	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-26.34	0	-25.59	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	31.00574	0.055115	1.74016	0.040915
	Correlations with S&P 500			
Levin, Lin, Chu	*t-stat*	*p-value*		
	-123.15	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-965.729	0	-926.562	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	43.58392	0.00171	3.728945	9.61E-05
	Correlations with FTSE			
Levin, Lin, Chu	*t-stat*	*p-value*		
	-123.15	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-18.5897	0	-18.1469	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	34.33662	0.023936	2.266818	0.011701
	Correlations with Nikkei			
Levin, Lin, Chu	*t-stat*	*p-value*		
	-123.15	0		
Im, Pesaran, Shin	*Ztbar*	*p-value*	*Wtbar*	*p-value*
	-28.4895	0	-27.9305	0
Fisher's type	**Maddala and Wu**		**Choi**	
	PMW	*p-value*	*ZMW*	*p-value*
	51.32612	0.000143	4.953094	3.65E-07

A similar result is obtained when testing for stationarity of the correlations of each of the CEE stock market indices with the international benchmarks. In our set of tests, there is no evidence in favour of the null hypothesis of non-stationary in any of our series. This implies that our data is suitable for the panel regressions developed below.

Figure 8.3: Dynamics of the Panel Unit Root tests for the Volatilities of CEE Stock Market log-returns



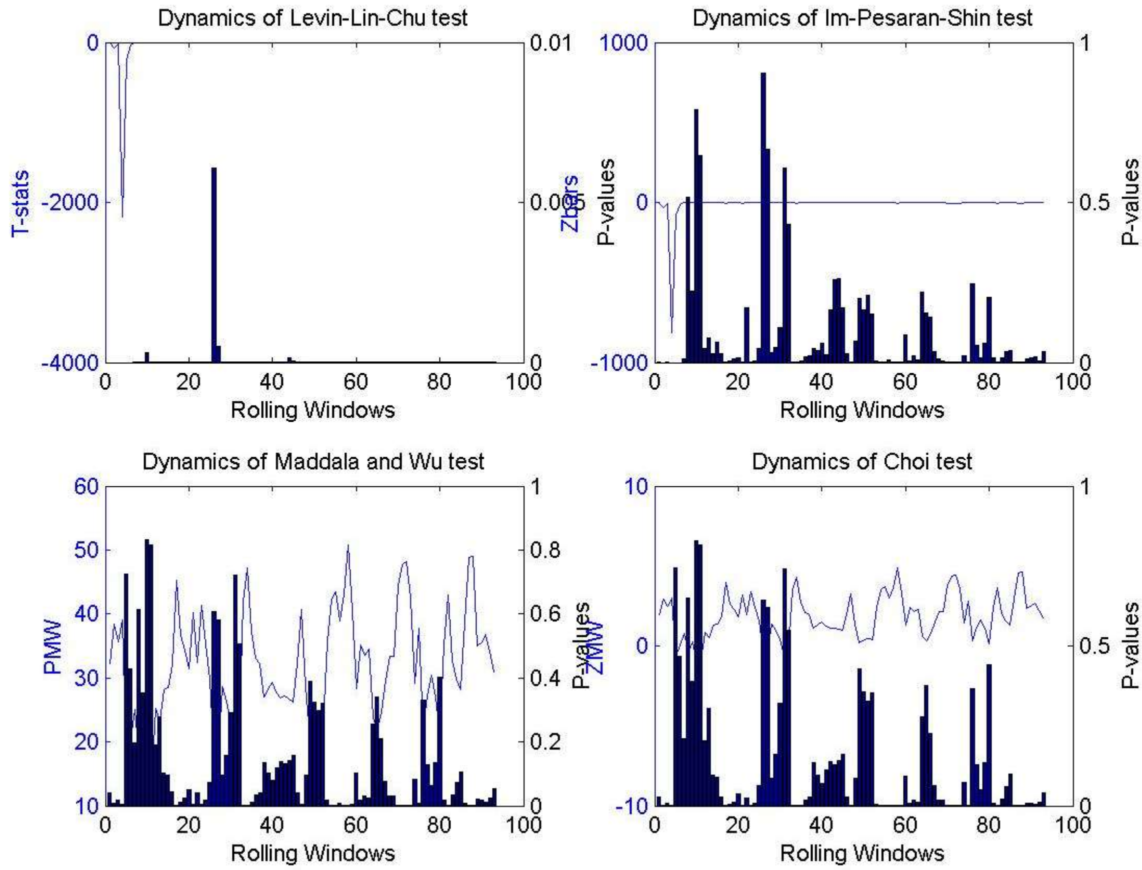
Samples of 125 days (approximately half a year) were used for the computation of the unit root tests

Our second objective is to determine the robustness of our findings in our panel regressions that we will develop. To facilitate this, we build 93 non-overlapping rolling windows of approximately 6 months (125 trading days each) that cover our entire sample. The estimation of the panel regressions will be performed for each sub sample, but before this can be done it is necessary to test for stationarity of the panel variables in each of these windows.

Figures 8.3 to 8.7 show the dynamics of both the test statistics and the p-values of the unit root tests for each rolling window. We can therefore observe the manner in which stationarity of each of our panels changed over time. For each chart in these figures the bars represent the levels of the p-values for each of the 93 samples and the continuous lines show the levels of the test statistics.

Figure 8.3 shows the results for all the samples for the panels of volatilities. It is clear that a relatively large number of situations with p-values lower than 5% exist for all four types of tests presented in the Figure 8.3 which implies stationarity in all of our panels.

Figure 8.4: Dynamics of the Panel Unit Root tests for the Correlations of CEE Stock Market log-returns with the DAX log-returns



The same type of situation is found for all the series of correlations in our analysis. We notice relatively low levels for our p-values, especially in the case of the Levin-Lin-Chu test for all correlations. Similarly, relatively low levels for the p-values are recorded for the Im-Pesaran-Shin test for correlations with the S&P 500 index and virtually all tests provide evidence of stationarity for correlations with the Nikkei index.

The least favourable results from our tests for stationary are those reported for our Fisher type of tests (both the Maddala and Wu and the Choi tests) for correlations with the DAX and, to a lesser extent for correlations with the FTSE.

Figure 8.5: Dynamics of the Panel Unit Root tests for the Correlations of CEE Stock Market log-returns with the S&P 500 log-returns

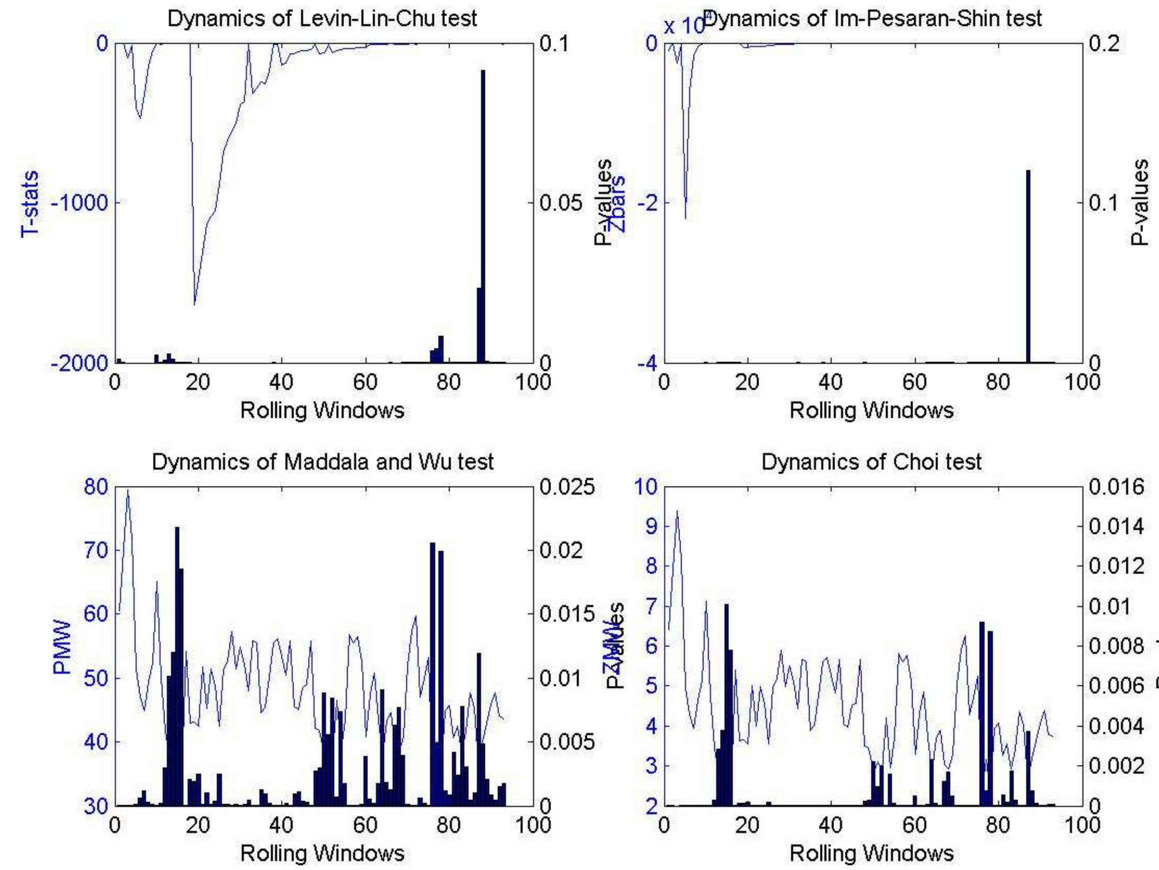


Figure 8.6: Dynamics of the Panel Unit Root tests for the Correlations of CEE Stock Market log-returns with the FTSE log-returns

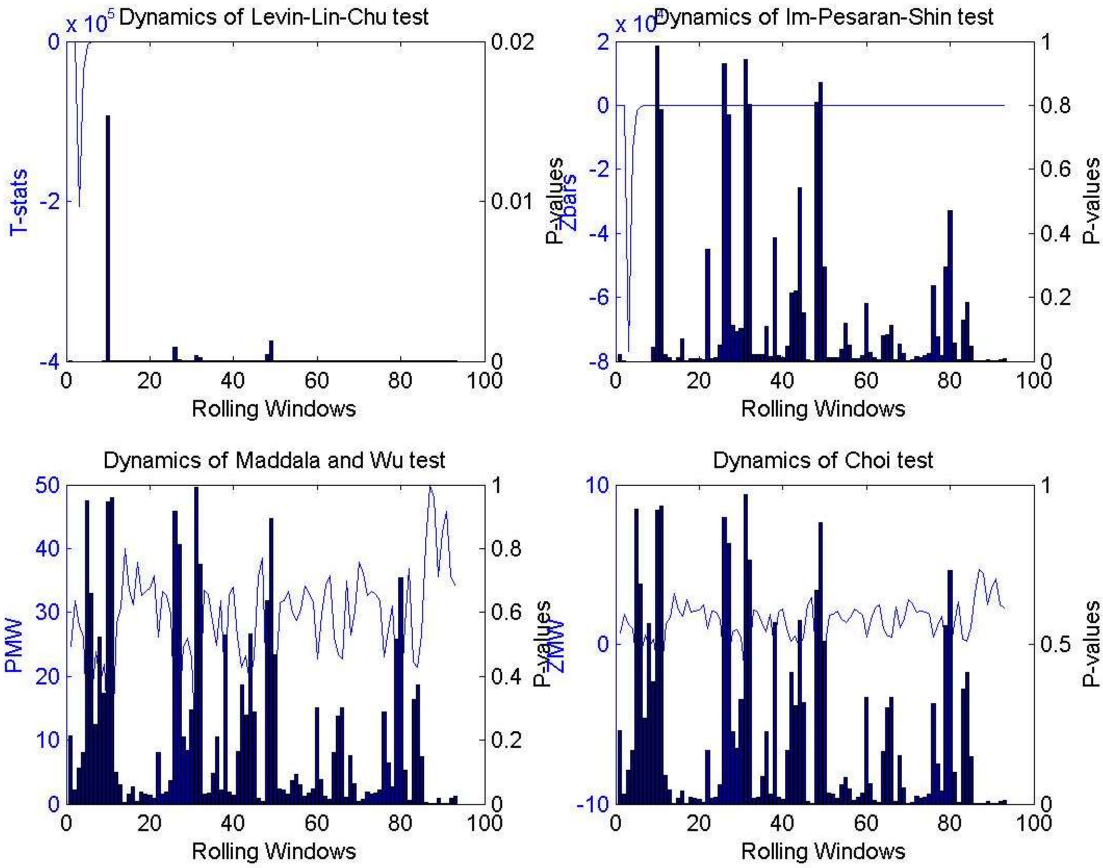
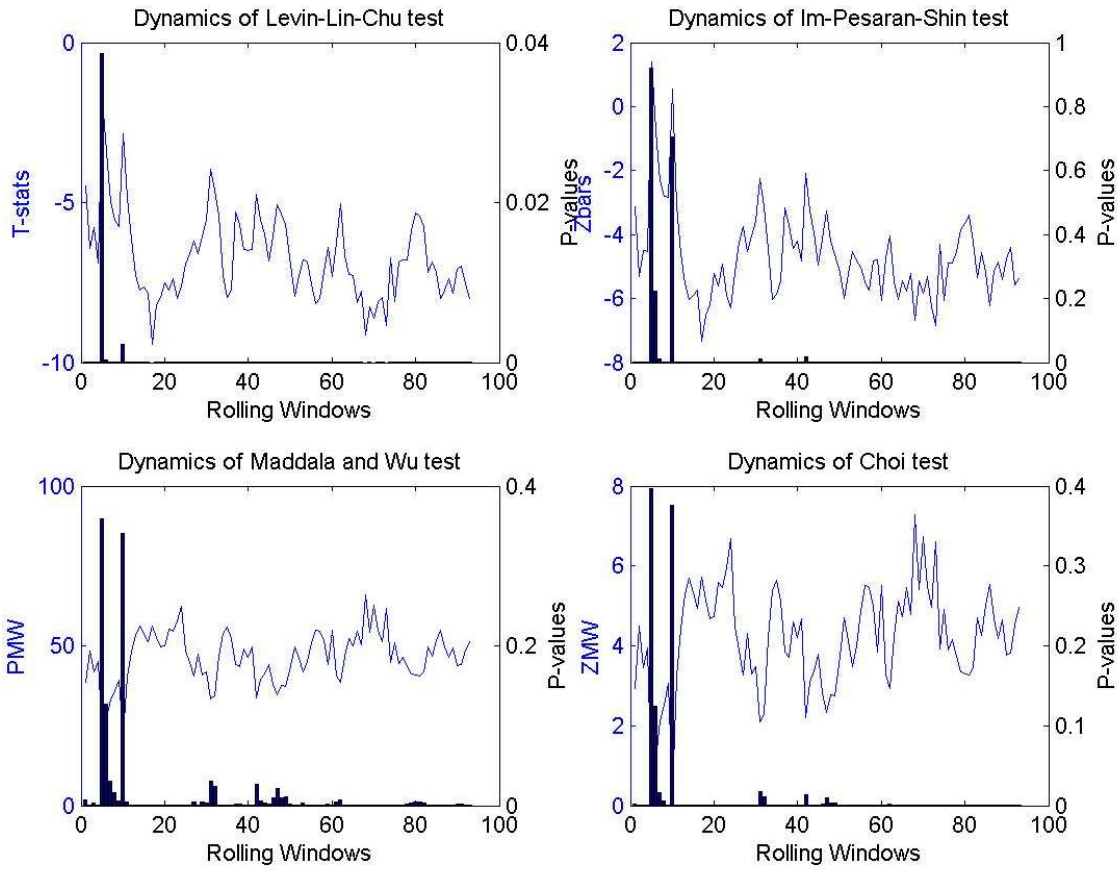


Figure 8.7: The Dynamics of the Panel Unit Root tests for the Correlations of CEE Stock Market log-returns with the Nikkei Log-Returns



Author's computations

8.5 Panel Regression Tests

In this section we report the results for our panel regressions. We report two types of results – those that cover the whole sample of log-returns for all the variables in our analysis, and those that provide results for the same type of panel regression performed for each rolling window.

In this investigation we rely on the standard panel analysis methodology and therefore run the Hausman test to determine the type of estimation procedure most appropriate for each situation considered.

For the whole sample, the results of the Hausman test are presented in Table 8.5.

Table 8.5: The results of the Hausman test for the whole sample

Varname	A:FE	B:RE	Coef. Diff	S.E. Diff
CorrsDAX	-0.0071	-0.0091	0.0020	0.0003
CorrsSP	-0.0112	-0.0124	0.0012	0.0002
CorrsFTSE	0.0378	0.0381	-0.0003	0.0000
CorrsNIKKEI	0.0259	0.0259	0.0000	0.0000

The A variant is consistent under H0 and H1 and represents the fixed effects estimation, while the B variant is consistent under the H0 hypothesis only and represents the Random Effects estimation. The Hausman test takes the value of 83.5183, which yields a p-value of 0 under the Chi squared distribution. Hence we find evidence to reject the null of random effect estimation and we conclude that our panel is suited to a fixed effects estimation.

The results of our fixed effects estimation are provided in Table 8.6 which shows that the connection between the volatilities and the correlations with the log-returns of the DAX index for the whole sample is significant at the 5 per cent level. Table 8.6 also shows that our coefficients that measure the dependence on the correlations with the log-returns of the FTSE and the S&P 500 indices are significant at the one per cent level.

Table 8.6: The results of the Fixed Effects estimation for the whole sample

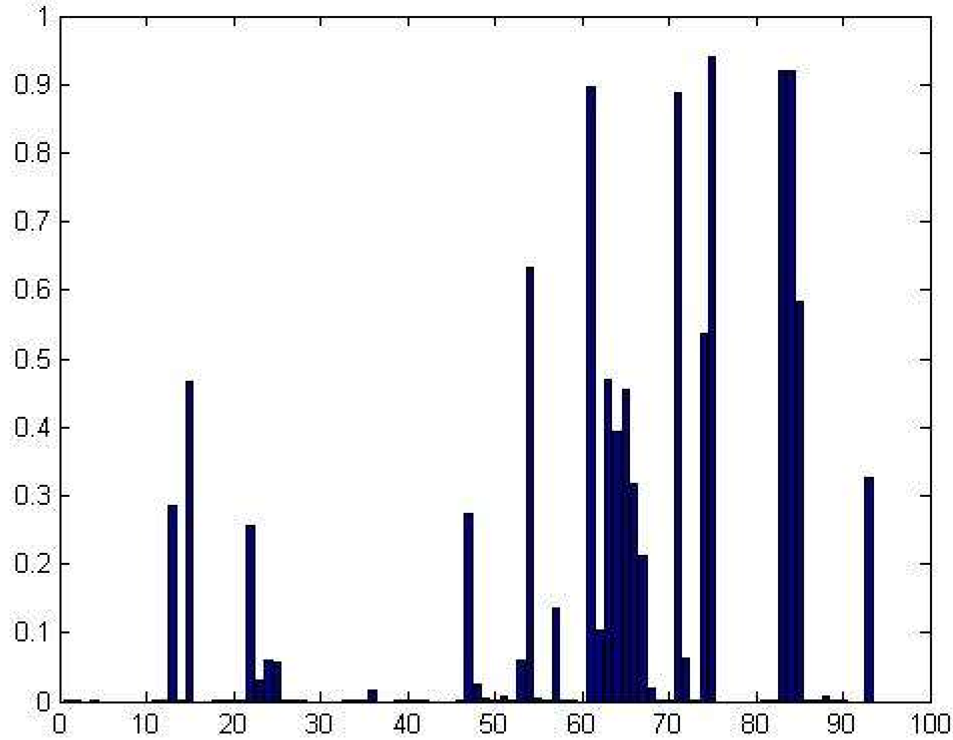
Varinces	Coefficient	Std. Error	t-stat	p-value	
Corrs DAX	-0.0071	0.0135	-0.5263	0.6110	
Corrs S&P 500	-0.0112	0.0064	-1.7562	0.1130	
Corrs FTSE	0.0378	0.0134	2.8119	0.0200	**
Corrs NIKKEI	0.0259	0.0035	7.3779	0.0000	***

We now use ther same methodology to investigate the dynamics of the relationship between the volatilities of the log-returns for the CEE Stock Market indices and the correlations with the international stock market benchmarks in each non-overlapping window of 125 days.

Using the Hausman test for each of the rolling windows we find that in approximately 74% of the cases there was sufficient evidence to reject the null of

Random Effects estimation (69 out of the 93 samples). Figure 8 shows the dynamics of the p-values for the Hausman tests.

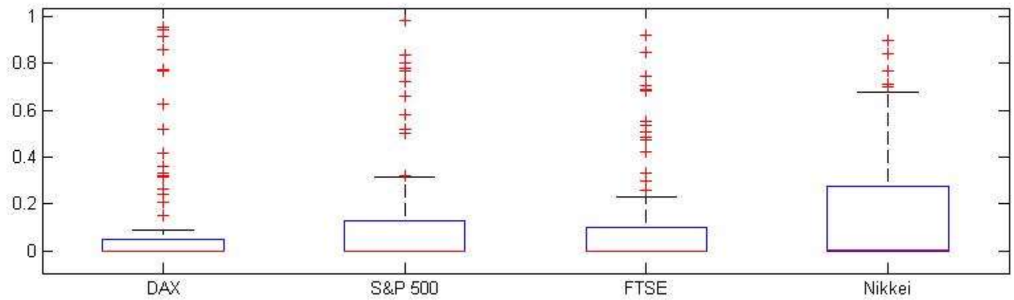
Figure 8.8: Dynamics of the p-values of the Hausman tests for the rolling Windows



Author's computations

The situations of significant coefficients for all the 93 panel regressions are also presented in Figure 8.9, where we can see their statistical properties. We notice a tendency of the correlation coefficients with the Nikkei indices to have larger p-values, and therefore less significant vis-à-vis the CEE stock markets. On the other hand, the correlation coefficients with the other three benchmark indices show more encouraging results with lower p-values

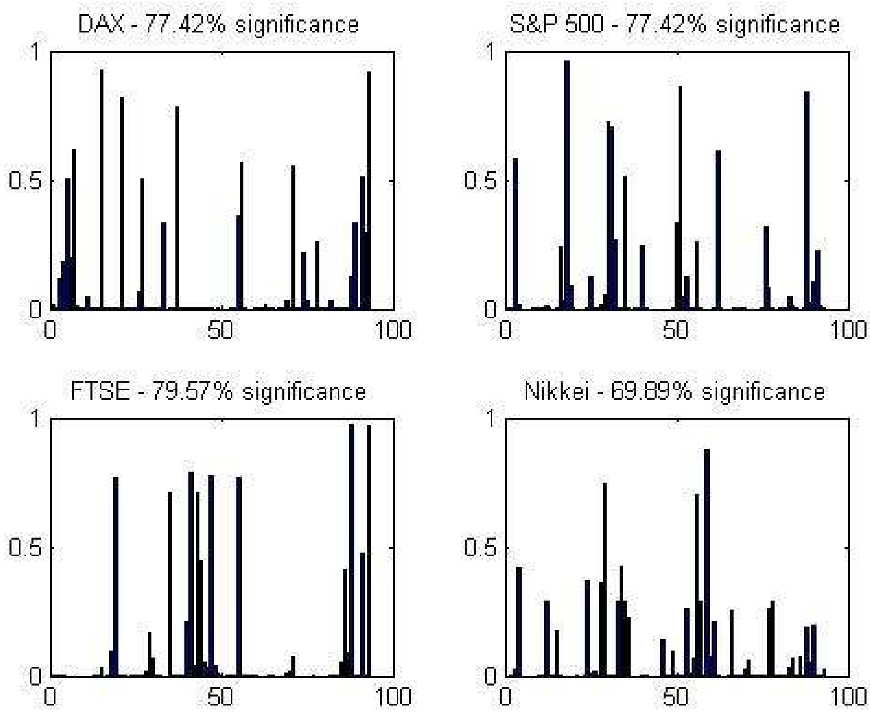
Figure 8.9: Boxplot of situations for significant coefficients in the panel regressions



Author's computations

The dynamics of the linear dependences is also shown in Figure 8.10 where we can see the percentages of the situations in which we find significant coefficients in our 93 panels, as well as their dynamics over time (the x-axis shows the 125-day samples in time). The y-axis shows the level of the p-values reported in each case. We notice a lower percentage of significant coefficients for correlations with the Nikkei index and a larger level of dependence on the correlations with the FTSE index.

Figure 8.10: Evolution of the significant coefficients according to the specific model estimated dynamically for each rolling window



The coefficients that reveal the connections with the correlations with the DAX and the S&P 500 indices are significant in approximately two thirds of the cases reported.

Conclusions

This chapter investigates the dynamics of correlation between CEE stock market indices on the international stock market benchmarks. We refer to the literature on contagion among capital markets in order to build our analysis, as well as on the panel analysis methodology. We use a GARCH(1,1) and the DCC-GARCH(1,1) model applied to the log-returns of a set of 10 CEE stock market indices with a daily frequency covering the period of January 2008 until July 2015. We estimate the volatilities of each of these indices and their correlations with the daily log-returns of the DAX, S&P 500, FTSE and the Nikkei indices. After running the usual panel data stationarity tests, we use standard panel regression analysis to investigate the dependence of the volatilities of the log-returns of the CEE stock market indices with the international benchmarks. In order to investigate the robustness of our findings we run this methodology on the whole sample and on 93 samples of 125 days (approximately half a year). We found evidence that the correlations with the international capital market benchmarks influence the volatilities of the CEE stock market indices and show the intermittence of these influences. We therefore find significant spillovers from our benchmark indices to the CEE stock markets investigated implying that the developed markets lead the CEE markets investigated. We take this as evidence that the CEE markets investigated are developed since, as argued in chapter 7, comovement is a feature of developed stock markets.

CHAPTER 9

CONCLUSIONS

9.1 Introduction

This thesis has investigated the emergence and development of stock markets in ten former transition economies of CEE. The establishment of functioning stock markets is a necessary part of the transition process and no market economy can exist without a stock market where ownership rights in companies can be traded and long term capital can be raised for companies to begin and/or expand their activities as they grow. Trading in the secondary market is important because no long term investors would be forthconming in the absence of a mechanism through which their assets could be converted into cash as and when required. However, the mere existence of a stock market is no guarantee that it will discharge its role optimally. If a stock market is not efficient, it will not generate fair prices and investors will be reluctant to invest in companies when they can so easily be separated from their savings by those able to exploit opportunities presented by the operation of an inefficient market. This would not only restrict the emergence and growth of companies, it also implies a sub-optimal allocation of resources in the economy generally since inability to attract capital for investment by potentially successful companies would mitigate the ability of companies to respond to emerging opportunities reflecting the changing preferences of consumers. This is the main advantage of a market economy that, subject to certain conditions, it achieves an optimal allocation of resources. In the absence of an efficient stock market therefore, the implication is that transition from Communism to functioning market econonmy would be impossible.

This is the issue at the heart of this thesis and it is contended that stock market development can be assessed by whether the stock markets investigated function efficienctly. The evolution from stock market creation to information efficiency as well as being a function of time in the sense that there is a learning curve to be followed by generations who grew up under Communism and who therefore initially possessed at best, rudimenraty knowledge of the operation of a stock market and markets generally, also depends on institutional changes.

Paramount here is establishing the rule of law that grants and protects rights of ownership to private property. However, more specific institutional changes are also necessary to facilitate the emergence of efficient stock markets. These include introducing profit and loss accounting systems, reliable and independent auditing of company accounts, establishing governance structures comparable to those in developed market economies and so on. All of these institutional changes are necessary channels through which information can be disseminated so that investors are able to make informed choices confident in the knowledge that the market is generating prices that reflect the fundamentals and, in particular, an accurate assessment of risk based on existing knowledge. This does not imply that fraud and other criminal activities aimed at deception do not exist in a market economy. It simply implies that these possibilities are discounted by investors when making their choices because safeguards are in place which are accepted as minimising the risk of criminal activity to the extent that it is discounted in investment decisions.

9.2 Overview of Research in this Thesis

To investigate stock market development as implied by the existence of efficient markets, we use empirical methods and therefore adopt a positivist approach to the research carried out in this thesis. Positivism implies that "the best way to find the truth is to use scientific method" (Jankowicz, 2005, p. 111). According to Remenyi *et al.* (1998), the positivist philosophy tests theories with the help of quantitative data. This means that the positivist philosophy takes a generalised approach to situations.

This research investigates the development of stock markets in the CEE countries investigated (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia). A full discussion of the specific data used and the individual tests carried out in each case is given in chapters 4-8. These chapters detail specific investigations which test for defined outcomes for each of the stock markets examined in the CEE countries that are the subject of this thesis, and the methodology and data used for each specific investigation is detailed there.

We test whether stock markets in our target group of countries are efficient. If these markets are informationally efficient they are fully emerged and are, by implication, discharging the role a stock market plays in a functioning market economy. This research also tests for comovement between these markets with London and Frankfurt. If there is comovement between the newly established stock markets with London and Frankfurt, then, by implication, these markets have fully emerged and are integrated with other stock markets on a global scale. As argued in Chapter 3, this is important because stock market comovement might imply that stock markets are jointly efficient. The basic premise is that stock market development can be proxied by market efficiency and the extent to which markets are integrated internationally. In an efficient market, past prices give no indication of future prices and it is impossible to make abnormal returns except by chance. Market efficiency is one of the tools used to evaluate stock market performance and, by implication, how developed a stock market is. Market efficiency is even more important for relatively small markets such as those investigated in this thesis because they initially lack liquidity and this inhibits growth and development of the wider economy. If these markets are informationally efficient, this will give investors confidence that they are not being cheated which will encourage trading and enhance growth.

As noted above, we further assess the extent of stock market development by testing for comovement between stock prices in the CEE markets investigated here with London and Frankfurt. From an investor’s perspective, the extent of comovement matters because if stock exchanges are not fully integrated in terms of price movements, there is an opportunity for portfolio diversification along international lines. The higher the degree of comovement between assets in a given portfolio, the lower the gains in terms of risk management stemming from portfolio diversification. However, the lower the degree of comovement, the greater the incentive for investors to diversify their portfolios along international lines thereby offering increased opportunities for markets to grow and develop. In that sense, if comovement between the relatively new stock markets in the CEE countries investigated here and the developed stock markets of London and Frankfurt is strong, we might argue that markets have reached a similar stage of information efficiency either because they are individually efficient or because they are jointly efficient. Either way, comovement might imply that the stock markets of CEE are fully developed.

9.3 Brief Summary of Each Chapter

Chapter 1 provides background on the state of the economies investigated when transition first began. The collapse of Communism left a trail of structural destruction in its wake and the magnitude of the task these (and all former Communist) economies faced in order to evolve into functioning market economies was enormous. Apart from black markets, Communism provided no background in how markets functioned and operated to allocate resources. As the economies of CEE imploded and GDP collapsed, change was forced on them and the signs of progress were discernible in the opening of small kiosks catering for local demand and serving small communities with whatever could be provided for which consumers were willing to pay. From these fledgling beginnings, the concept of private property grew, reinforced by the rule of law. As transition progressed, whole industries and organisations were privatised and markets began to develop. Privatisation was the catalyst that made the creation of stock markets essential as investors need an organised route through which trust could emerge and their newly acquired assets could be disposed of at informationally fair prices.

Chapter 2 surveys the development of stock markets from small beginnings where markets were universally characterised by thin trading and relatively low market capitalistation compared to levels characteristic of developed markets. Indeed, initially newly created stock markets opened for only a few hours, usually on one or two days a week. Slowly trading increased as investors developed trust, encouraged, at least in part, by legal protection and the establishment of standards of corporate governance comparable with those in developed markets.

Chapter 3 sets out the theoretical foundations that underpin this research. The concept of market efficiency is one of the corner stones of the theory of finance and stock markets will fail to discharge their role effectively if they are not information efficient. Since stock markets were established from scratch in the former Communist countries investigated in this thesis, market efficiency could not exist as an immediate state of affairs and would be an evolutionary process (if it evolved at all) as the number of investors and the volume of trading increased. Three ever more stringent degrees of information efficiency have been identified: Markets are weak form efficient when market prices contain no history and therefore give no guide to future prices. This implies that no information can be used to identify recurring patterns in the behaviour of prices that might be exploited to gain consistent exces returns over and above the market return. Since data on past prices is readily available, it is relatively easy to test for weak form efficiency in stock markets and most empirical work investigating this concept has tested whether markets are weak form efficient. Semi-strong form market efficiency implies that prices quoted in the market reflect all publicly available information. This notion appeals most to common sense since the alternative, that of ignoring relevant information, would be irrational and would result in sub-optimal returns being earned. Note that all publicly available information includes information on past price behaviour and therefore a market that is semi-strong form efficient is, by definition, also weak form efficient. A market is strong form efficient when all relevant information, public and private, is reflected in prices. This is the tightest and most appealing category of market efficiency but it is almost impossible to test empirically since those who posess private information have every incentive to keep it private and they are therefore unlikely to subject the strong form hypothesis to empirical testing.

Chapter 3 also explains the rationale for testing for comovement between the CEE countries investigated here and the developed markets of London and Frankfurt. Comovement is an increasingly common feature among stock markets for several reasons, not least that stocks are often cross listed and traded in different markets. In our case, another factor is that the CEE countries investigated, with one exception, have become members of the EU which has led to an explosion of international trade and investment between these countries and other EU members. However, recent years have also seen a reduction in the costs of trading, alongside the emergence of mechanisms that facilitate international trading of assets so that geographical borders no longer present problems for those wishing to trade in markets abroad. Stock market comovement is important because, as noted in Chapter 3, it is possible that one country’s stock market is not information efficient but that that stock market is jointly information efficient with another country's stock market. This clearly implies that investors can invest in both markets to create portfolio diversification but cannot arbitrage riskless gains despite one market being informationally inefficient. Because of this, it is possible that 'joint efficiency' among several markets occurs when these markets are cointegrated. Since we argue that stock market development is proxied by the existence of information efficiency in that market, we investigate stock market comovement among our target group of countries with the developed stock markets, particularly London and Frankfurt, in the same vein.

Chapter 4 provides some results from tests of market efficiency in the CEE markets investigated. In general, the results are not encouraging, though limited evidence of emerging market efficiency in some cases is provided. The data set for this series of tests is daily and covers a relatively early period in the development of the stock markets investigated and truncates on 31st July 2009. The earliest observations begin on December 31st 1999 in the case of Hungary and the latest set of obsrvations is for Bulgaria and begin on October 20th 2000. One reason why the results for the entire sample period fail to provide convincing evidence of market efficiency in all of the markets investigated might simply be that the sample inevitably covers the early period of stock market trading where there can be no expectation of efficiency. To explore this possibility further, the data was broken into a later sample beginning 1st May 2004 to take in the accession of most of the countries into the EU. However, here again the results for all markets were less than convincing though again in the later sample some markets were efficienct on some of the tests. In terms of the overall thesis, the results of the tests in Chapter 4 certainly implied that the markets investigated merited further investigation when more data would be available.

Chapter 5 provides another test of market efficiency using a different methodology and a later data set consisting of daily observations and runs from 6th January – 29th July 2015. In this chapter we derive a panel of data because this gives a greater data set than a simple time series data set that is not broken down into panels of data. The later start date of the data set is selected so as to avoid any repurcussions following the financial crisis which might distort the efficacy of the tests and give misleading results. By 2012 it is reasonable to assume that any fall out from the financial crisis was long gone and therefore any results obtained from tests in this later period would be uncorrupted by earlier events that had a significant impact on global stock markets at the time. Once our panel was created, we again used a battery of statistical procedures to test for market efficiency. The results are far more encouraging with all CEE markets except Romania, being weak form efficient. Important though this is, in other research not included in this thesis, Harrison and Paton (1994 and 2007) find evidence that the Romanian stock market is informationally efficient. In terms of this thesis, there is clear evidence that, notwithstanding the case of Romania, that stock markets in the CEE countries investigated were developed on our efficiency criterion.

Chapters 6-8 test the extent of comovement with the world's major stock markets. In finance, markets are said to be integrated when assets of identical risk command the same expected return. In theory, liberalization should bring about integration with the global capital market, and its effects on equity markets are then clear. Foreign investors will bid up the prices of local stocks with diversification potential, while inefficient sectors will be shunned by all investors. As noted earlier, stock market comovement is important in terms of this thesis because stock markets might be jointly efficient when cointegrated, though not necessarily individually efficient. The data used in this chapter consists of daily obnservations and runs from 1st January 2001 -31st December 2014. This data set encompasses the global financial crisis which might impair the accuracy of the tests used. To allow for this, we use the Hansen and Johansen (1992) recursive cointegration method with a rolling window. The results presented in this chapter show that there are linkages between stock exchanges in CEE countries and those in Western Europe, both before and after the financial crisis, and that this relationship has been augmented since the period of the world financial crisis 2007-2009. However, the degree of comovement between these exchanges is not, as yet, sufficiently strong to raise issues of international financial stability stemming from symmetrical changes in wealth that well developed comovement implies. There is therefore only limited evidence of stock market development on our comovement criterion.

In chapter 7 we use the same data set as used in chapter 6 but this time our methodology uses both linear and non-linear cointegration tests, though the tests using linear cointegration techniques differ from those used in Chapter 6. Again we use a rolling window to allow for the effects of the financial crisis. Our tests using linear cointegration techniques yield only limited evidence of comovement between the stock markets in Latvia, Lithuania and Bulgaria with those of Western Europe. However, we find stronger evidence of comovement between these exchanges and Western Europe using Breintung's non-linear cointegration statistic. We also find evidence that while comovement between the Czech Republic, Hungary Poland and Romania with Western Europe is limited, it seems to be increasing over time. In terms of this thesis, these reults provide clear evidence of stock market development.

The spread of the financial crisis across global markets first became apparent with the collapse of Leman Brothers and the fall out from this significantly impacted on the volatility of financial markets. In Chapters 6 and 7, where we tested for cointegration, it was noted that the financial crisis might have corrupted the results of our tests. This raised the question of whether testing for spillover effects between markets by investigating whether volatilies are related might yield interesting insights into the relationship between the markets investigaed in this thesis. We do this in Chapter 8 and our data set cvonsists of daily obsefrvations and runs from Jan 1st 2008-July 31st 2015. It therefore takes in the financial crisis and its aftermath. We again construct a panel of data significantly increasing the number of observations and facilitating the use of more powerful statistical tests. We investigate the possibility of cointegrating volatility relationships between our stock markets and developed Western markets using a battery of statistical procedures. We then test the robustness of our results by building 93 non-overlapping rolling windows of approximately 6 months (125 trading days each) that cover our entire sample. We find evidence that the correlations with the international capital market benchmarks influence the volatilities of the CEE stock market indices. The implication is that significant spillovers exist from our benchmark indices to the CEE stock markets investigated implying that the developed markets lead the CEE markets investigated. We take this as evidence that the CEE markets investigated are developed since, as argued earlier, comovement is a feature of developed stock markets.

These chapters therefore are the main focus of this thesis and stock market integration between CEE markets and developed stock markets is used as a proxy for assessing the extent to which markets in the former CEE transition economies have emerged and reached developed status. The results, though not unambiguously conclusive, are certainly encouraging and, at the very least, we show that markets in the CEE countries investigated are becoming more integrated over time with the developed stock markets of Western Europe.

9.4 Problems with the Concept of Market Efficiency

There are many issues surrounding the concept of market efficiency and it is by means accepted as a universal truth either by academics, practitioners or commentators. At best, it is certainly an incomplete paradigm of market behaviour and a major problem with the concept is that it says nothing about the 'supply side' of the information market. It makes no distinction between the amount of information that is available and whether the information comes from the accounts of firms or the financial press etc. Neither does it question the reliability of the information , the frequency of extreme movments and so on. The efficient market hypothesis says only that there is a given supply of information and that investors trade on this until equilibrium is reached and that there are no gains at the margin from further trading.

There is nothing wrong with this and information is either available or unavailable. However, the salient point is that information is assumed to be totally objective with exactly the same impact on all investors. But investors might interpret the information differently and rational investors will base their actions not only on how they interpret the available information, but also on the way they think other investors will interpret the same information. Their trading is therefore influenced by their incomplete knowledge of the motives of others for trading. This uncertainty becomes more important during periods of relatively rapid price changes. During periods of relative stability, investors can reflect on what moved prices the previous day when reflective financial commentary is available. During periods of volatility, up to the minute background information is not available in a timely manner. The efficient market hypothesis has nothing to say on these issues.

A crucial assumption of the efficient market hypothesis is that information processing is costless and is therefore incorporated into prices immediately and precisely. The cost of acquiring information is costless and is as close to an example of a public good as it is possible to find, but information processing is a different matter. Again, the efficient market hypothesis is silent on this issue. Yet the whole concept of market efficiency depends on the accurate processing of information by investors who do not act on impulse. What if the cost of processing information is inordinately high in comparison to its value? The implication is that although information is available, it does not always impact on investment decisisons because investors will exercise different judgements on the quality of information and will process some information more thoroughly than other information. This will inevitably lead to 'mitakes' and with hindsight investors might exercise better judgement. This might lead to unreliable results in tests for market efficiency.

Another problem is that, in general, stock markets are low cost, high volume markets; but they are not completely costless. This limitation raises an important conundrum: If there are pricing errors that are not eliminated because they are smaller than the transactions costs of exploiting them, is the market judged to be efficient because of the absence of profits from exploitable errors or inefficient because pricing anomalies persist because of transactions costs? To the best of my knowledge, the role of transactions costs is nowhere addressed in the efficient market hypothesis and therefore again tests might report inaccurate results because the effects of these on investment decisions are not considered.

Similarly other frictions are not considered and the efficient market hypothesis ignores taxes. In reality, many investors pay taxes on dividends and capital gains. Transactions are also subject to VAT. The effects of taxation are not well understood and are certainly not apparent in the efficient market hypothesis. Here again, investigations of market efficiency might report inaccurate results which could differ significantly if the effects of taxation were considered.

9.5 Reflections

The thesis grew out of my changing research interests and offered the opportunity to marry the two (transition economies and capital market efficiency) together. Following the collapse of Communism, the emerging economies of CEE posed an exciting challenge to economists with an interest in this area. Countless papers have been written on the transition from Capitalism to Communism but, at the time Communism collapsed, not a single paper existed on the reverse process because no-one thought it would happen. When it did happen, it was spectacular and change occurred with breath-taking speed. Disquiet emerged in East Germany and quickly spread to many countries in the former Soviet Union finally erupting into an unstoppable force as people sought greater freedom from State involvement in their lives generally, and this led to the collapse of Communism and the emergence of decentralised decision taking which is the hallmark of Capitalism.

Capital market efficiency was, in some ways, a natural choice of research area since my main teaching role is in the area of finance. Capital market efficiency is one of the cornerstones of financial theory. Market efficiency implies that prices reflect all available information, though the easiest and most tested dimension of this is weak form efficiency whereby prices quoted in the market have no memory and all information contained in them is incorporated into the current price of the asset. The common sense underpinnings of market efficiency defy argument and therein lies its appeal.

The journey from beginning this thesis to completion has been revealing not just in terms of the research embodied within these pages, but also because I have not worked under pressure of deadlines for many years prior to undertaking work on this thesis. This sometimes resulted in some curtailment of social activities which took some getting used to. That the journey was worthwhile in all respects is beyond doubt.

Were I to undertake this work again, I would certainly pay much more attention to time management though, as everyone who knows me will testify, this is not my strong suit. I wish I could say I have learned, but perhaps, like most other people, my experience simply confirms that I work best under pressure. I have also had confirmation that, like Lennon and McCartney, I get by with a little help from my friends. I am certainly grateful to my friends who helped in more ways that they are probably aware of.

Initially the motivation for this thesis was an investigation into market effieicny in the CEE markets. The idea for investigating this emerged from the realisation that once created in countries where little or no understanding of markets existed, stock markets would evolve towards efficiency and this might take quite some considerable period of time. I published in this area, though these papers do not appear as part of this thesis. However, it quickly became apparent that conventional tests of market efficiency for the CEE countries alone would not result in a fully worked thesis. Simultaneously my research interest shifted to stock market comovement between CEE countries and the developed markets of the West. Were I to start my thesis now, I would focus entirely on this rather than matching it with the emergence of market efficiency through conventional testing. Stock market comovement probably offers a greater range of testing procedures and is still in the process of evolution. On the other hand, the debate on market efficiency is far from settled, but it has clearly become one of the dominant features of financial theory and is therefore a clearly important concept worthy of investigation.

9.6 Conclusion

Demonstrating market efficiency is important in giving investors confidence that investments are properly priced and that the risks they face are the same as those facing other investors in the market and in particular that information cannot be exploited to make ‘unfair’ gains. To the extent that this encourages the growth of trading, companies will be able to raise risk capital more easily than otherwise. This will facilitate their individual growth, but will also encourage economic growth as new companies emerge and existing companies expand to reap the benefits of economies of scale.

The ultimate stage of development is complete integration of CEE markets with the developed markets of the world. If these markets do not exhibit comovement with developed markets, then opportunities exist for investors to diversify their portfolios along international lines. Such opportunities are important for investors, but also for host economies because if investors are attracted to a particular market in order to diversify their portfolios, this again will encourage growth of these markets to the benefit of investors, companies and the economy generally.

To the extent that the research questions are answered, I hope that this thesis makes a contribution to understanding the development of stock markets in the CEE region following the collapse of Communism and throughout their transition to functioning market economies.

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APPENDIX

OVERALL TRANSITIN INDICATORS

Large-scale privatisation

1 Little private ownership.

2 Comprehensive scheme almost ready for implementation; some sales completed.

3 More than 25 per cent of large-scale enterprise assets in private hands or in the process of being privatised (with the process having reached a stage at which the state has effectively ceded its ownership rights), but possibly with major unresolved issues regarding corporate governance.

4 More than 50 per cent of state-owned enterprise and farm assets in private ownership and significant progress with corporate governance of these enterprises.

4+ Standards and performance typical of advanced industrial economies: more than 75 per cent of enterprise assets in private ownership with effective corporate governance.

Small-scale privatisation

1Little progress.

2 Substantial share privatised.

3 Comprehensive programme almost ready for implementation.

4 Complete privatisation of small companies with tradable ownership rights.

4+ Standards and performance typical of advanced industrial economies: no state ownership of small enterprises; effective tradability of land.

Governance and enterprise restructuring

1 Soft budget constraints (lax credit and subsidy policies weakening financial discipline at the enterprise level); few other reforms to promote corporate governance.

2 Moderately tight credit and subsidy policy, but weak enforcement of bankruptcy legislation and little action taken to strengthen competition and corporate governance.

3 Significant and sustained actions to harden budget constraints and to promote corporate governance effectively (for example, privatisation combined with tight credit and subsidy policies and/or enforcement of bankruptcy legislation).

4 Substantial improvement in corporate governance and significant new investment at the enterprise level, including minority holdings by financial investors.

4+ Standards and performance typical of advanced industrial economies: effective corporate control exercised through domestic financial institutions and markets, fostering market-driven restructuring.

Price liberalisation

1 Most prices formally controlled by the government.

2 Some lifting of price administration; state procurement at non-market prices for the majority of product categories.

3 Significant progress on price liberalisation, but state procurement at non-market prices remains substantial.

4 Comprehensive price liberalisation; state procurement at non-market prices largely phased out; only a small number of administered prices remain.

4+ Standards and performance typical of advanced industrial economies: complete price liberalisation with no price control outside housing, transport and natural monopolies.

Trade and foreign exchange system

1 Widespread import and/or export controls or very limited legitimate access to foreign exchange.

2 Some liberalisation of import and/or export controls; almost full current account convertibility in principle, but with a foreign exchange regime that is not fully transparent (possibly with multiple exchange rates).

3 Removal of almost all quantitative and administrative import and export restrictions; almost full current account convertibility.

4 Removal of all quantitative and administrative import and export restrictions (apart from agriculture) and all significant export tariffs; insignificant direct involvement in exports and imports by ministries and state-owned trading companies; no major non-uniformity of customs duties for non-agricultural goods and services; full and current account convertibility.

4+ Standards and performance norms of advanced industrial economies: removal of most tariff barriers; membership in WTO.

Competition policy

1 No competition legislation and institutions.

2 Competition policy legislation and institutions set up; some reduction of entry restrictions or enforcement action on dominant firms.

3 Some enforcement actions to reduce abuse of market power and to promote a competitive environment, including break-ups of dominant conglomerates; substantial reduction of entry restrictions.

4 Significant enforcement actions to reduce abuse of market power and to promote a competitive environment.

4+ Standards and performance typical of advanced industrial economies: effective enforcement of competition policy; unrestricted entry to most markets.

Banking reform and interest rate liberalisation

1 Little progress beyond establishment of a two-tier system.

2 Significant liberalisation of interest rates and credit allocation; limited use of directed credit or interest rate ceilings.

3 Substantial progress in establishment of bank solvency and of a framework for prudential supervision and regulation; full interest rate liberalisation with little preferential access to cheap refinancing; significant lending to private enterprises and significant presence of private banks.

4 Significant movement of banking laws and regulations towards BIS standards; well-functioning banking competition and effective prudential supervision; significant term lending to private enterprises; substantial financial deepening.

4+ Standards and performance norms of advanced industrial economies: full convergence of banking laws and regulations with BIS standards; provision of full set of competitive banking services.

Securities markets and non-bank financial institutions

1 Little progress.

2 Formation of securities exchanges, market-makers and brokers; some trading in government paper and/or securities; rudimentary legal and regulatory framework for the issuance and trading of securities.

3 Substantial issuance of securities by private enterprises; establishment of independent share registries, secure clearance and settlement procedures, and some protection of minority shareholders; emergence of non-bank financial institutions (for example, investment funds, private insurance and pension funds, leasing companies) and associated regulatory framework.

4 Securities laws and regulations approaching IOSCO standards; substantial market liquidity and capitalisation; well-functioning non-bank financial institutions and effective regulation.

4+ Standards and performance norms of advanced industrial economies: full convergence of securities laws and regulations with IOSCO standards; fully developed non-bank intermediation.