

# Sudden changes in volatility: The case of five central European stock markets

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## Abstract

This paper investigates sudden changes in volatility in the stock markets of new European Union (EU) members by utilizing the iterated cumulative sums of squares (ICSS) algorithm. Using weekly data over the sample period 1994–2006, the time period of sudden change in variance of returns and the length of this variance shift are detected. A sudden change in volatility seems to arise from the evolution of emerging stock markets, exchange rate policy changes and financial crises. Evidence also reveals that when sudden shifts are taken into account in the GARCH models, the persistence of volatility is reduced significantly in every series. It suggests that many previous studies may have overestimated the degree of volatility persistence existing in financial time series.

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## 1. Introduction

In this paper we examine sudden changes of volatility in the stock markets of new EU members, which were experienced during the transition period from command to market economy and during the period of integration into the EU. Theory suggests that structural changes in fundamentals are associated with the changes in the behaviour of stock markets, since stock prices theoretically reflect expectations of future dividends, interest rates and risk premia, which in turn depend on

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macroeconomic conditions. It follows that both first and second moments of stock returns should be affected during the process of transition and integration of these economies to the extent that it affects fundamentals (Morana and Beltratti, 2002). The transition of economic systems followed by the currently on-going process of economic integration within the EU may have considerably affected the fundamentals in the new EU member states. Given the existing empirical literature on the shift in the stock market on such occasions,<sup>1</sup> it is worthwhile addressing the issue of the pattern of volatility in stock returns for the new EU member states.

Time varying volatility of stock returns has been extensively modelled by the GARCH with high frequency stock data to find high persistence in volatility. The GARCH approach assumes that there is no shift in volatility; however, in such emerging markets there may potentially be sudden shifts in volatility. It is therefore important to take account of these shifts in estimating volatility persistence. In this paper, the shifts in volatility are identified by utilizing the iterated cumulative sums of squares (ICSS) algorithm of Inflan and Tiao (1994). The GARCH model is then estimated by taking account of the volatility shifts. The ICSS endogenously identifies changes in volatility of stock returns. The technique is not much explored in empirical analysis of stock markets. Aggarwal et al. (1999) examined emerging stock markets in Asia and Latin America, and recently Hammoudeh and Li (in press) investigated the sudden changes in volatility for the volatile Gulf Arab stock markets.<sup>2</sup> This paper is the first to investigate transition economies using this technique.

Specifically, we investigate the emerging stock markets of the Czech Republic, Hungary, Poland, Slovakia and Slovenia over the period 1994–2006. Our empirical results indicate that a sudden change in volatility seems to arise from the evolution of emerging stock markets in an earlier period, from exchange rate policy changes and financial crises. Evidence also reveals that when sudden shifts are taken into account in the conventional GARCH models, the persistence of volatility is reduced significantly in every series. It suggests that many previous studies may have overestimated the degree of volatility persistence that exists in financial time series.

The remainder of the paper is organised as follows. In Section 2, potential factors for the shifts in volatility are briefly discussed, which rationalises the usefulness of the current study. Methodology and data are described in Sections 3 and 4, respectively. In Section 5, the result of the ICSS algorithm and GARCH model are presented. Section 6 will conclude.

## 2. Volatility of the stock markets of transition economies

In this section, potential internal and external factors for sudden changes in volatility of these stock markets are briefly discussed.<sup>3</sup>

Stock markets are not new in these transition economies. The Warsaw Stock Exchange was opened in 1817 and the Prague Stock Exchange in 1971, although all stock markets were closed during the socialist period. During the transition from command to market economies, stock exchanges re-emerged with mass privatization programmes in the early 1990s. This earlier stage of the stock market was characterized by the lack of an adequate regulatory framework and the

<sup>1</sup> For example, Westermann (2004) empirically showed that the introduction of the euro shifted the linkage of stock returns across the eurozone stock markets. Kim et al. (2005) find that increased stability and higher levels of integration have emerged from the European Monetary Union in the post-euro era.

<sup>2</sup> The ICSS algorithm is also applied to foreign exchange markets by Malik (2003) and large and small capitalization stocks by Ewing and Malik (2005).

<sup>3</sup> Our focus is on the economic factors, since major political events occurred before the sample period.

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