CONVERGENCE AND CONTAGION IN TRANSITIONAL COUNTRIES

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Abstract

During the transition time in East Central Europe, a number of schools of thoughts clashed over the creation of a market economy and the role of the state. This study compares Slovenian, Czech, Hungarian and Russian external balance and factors of external vulnerabilities with Swedish, Danish and Finnish data bearing in mind the differences in the real economy. The comparison takes into account the bounded rational market participants on complex, scale-free global capital markets, which resulted erratic convergence in this region.

Key words: imbalances, regional comparison, correltaion, convergence, extreme capital flows

JEL classification: E44, E62, I38, O16

INTRODUCTION

This study deals with the interactions between the real economy and financial markets relating to the contagion of financial crises in transitional countries, namely the Czech Republic, Hungary and Russia. The first part of this paper presents a theoretical background to the concept of capital market being an indicator to the changes of the real economy. After outlining the worlds of complex, scale-free networks and bounded rational agents, problems of the convergence process and external vulnerabilities of domestic currency, bond and stock markets will be examined.

The global capital market was analyzed as a network of national economies, which are networks of markets themselves. The markets are networks of market actors such as investment banks, state treasuries, national banks, etc. The global network operates under the following rules: quasi free movement of production factors

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(labor, capital, goods, and intellectual properties), technical progress, international markets, deregulation, liberalization, lack of coordination of economic policies, and liberalized capital accounts. (Wang – Chen 2003, Magas 2005)

Financial engineering facilitates the transformation and reshaping of risk, but there is a common debate in the literature about the interaction between the real economy and liberalized financial systems (Fischer-Chenard 1997, Tadesse 2002, Freixas et al. 2007, Csontos et al. 1997, Jenkinson 2008). Some authors emphasize the disadvantage of network operations, in which the high efficiency on liquidity allocation capability and the ability of fast feedback through current account cause immanent instability of the current financial system with short-term orientation and unrelenting concentration of wealth (Brunnhuber et al. 2005, Magas 2005).

CAPITAL MARKETS IN DEVELOPED AND EMERGING COUNTRIES

Actual vulnerability of a country will depend on the country's macroeconomic fundamentals, the capitalization, liquidity, and general soundness of the individual banking systems (Árvai et al. 2009). Transmission of shocks takes place not only through trade, but also through interest rates, exchange rates and equity prices. Exchange rate could act as an automatic cyclical stabiliser or tends to amplify business cycles (di Mauro et. al 2008).

The relevance of studying the dynamics inside complex scale-free networks is highlighted by the decentralized, but concentrated ("hub-based") structure of capital markets (Chen 2008). The US equity markets are collecting 45% of world stock market capitalization, and more than 50 trillion are managed by private asset managers, while 2 trillion USD by hedge funds. While foreign exchange reserves and sovereign wealth funds[1] are around 6 trillion and 3 trillion USD. Due to the accumulation of foreign exchange reserves by emerging countries, the standard neoclassical predictions about the capital flows are not valid. Instead of flowing from developed countries to "others", they are flowing either between developed countries or from emerging countries to developed countries as it is described by the "Lucas paradox" (Beck – Fidora 2008).

As figure 1 suggests, there is two possible pathways of convergence: a productivity driven sustainable and an unsustainable consumption driven could exist at the same time.

The level of domestic debt could be limited by central banks managing base rate and exchange rate pass-through[2] using of inflation targeting monetary policy. In this case, the exchange rate does not seem to enter as a separate argument until they not have much consequence on inflation – and these movements may result dangerous swings in interest rates if there were a strong direct reaction to them (Sgherri 2008).

[1] Sovereign wealth funds: public investment agencies which manage part of the (foreign) assets of national states, have recently attracted considerable public attention (Beck – Fidora 2008).

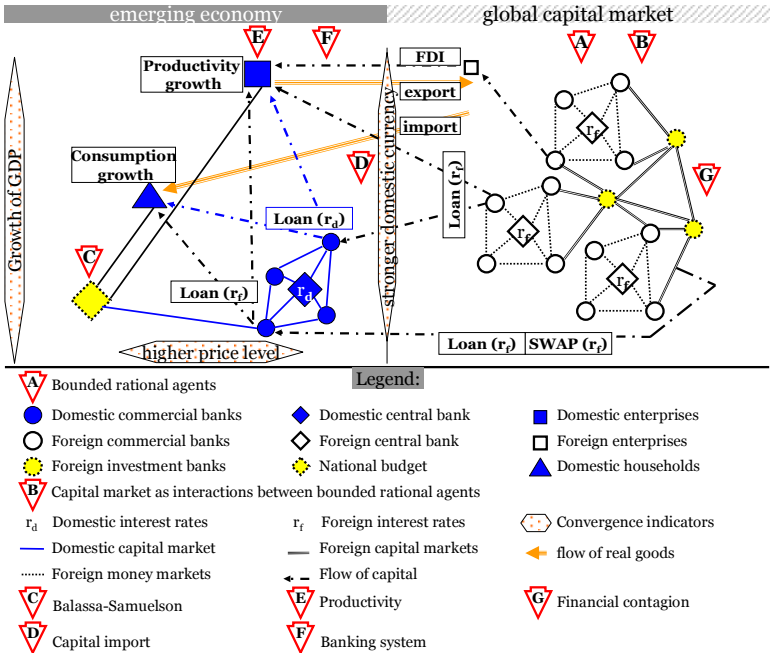
[2] Exchange rate pass-through: the percent change in the CPI for a percent change in the exchange rate – in the first stage it means the effect of exchange rate movements on import prices, than in the second step shows the effect of import price movements on consumer prices (Sekine 2006)

Due to financial innovations, such as foreign currency loans, central banks are less effective during their control on the financial markets (Koğar 1995, Jenkinson 2008). Inflow of foreign currency loans allows commercial banks to ignore domestic base rate, while the increased capital stock could generate exchange rates distortions too blowing a bubble of appreciated domestic currency as long as foreign markets are optimistic. The positive feedback generated by this process further appreciates the domestic currency, which is amplified by the company driven productivity growth. The negative side effect on convergence of the overvalued domestic currency makes domestic firms less competitive on foreign and domestic market as well. (Darvas-Szapáry 2008, Magas 2005, Horváth et al. 2004, MNB 2004, MNB 2009, Smets – Wouters 2002)

Growth of PPP GDP presents a real convergence in post communist countries in 2002-2006, as there is a linear connection between their lower base and the speed of growth. This phenomenon is only true for East Central Europe (Rosenberg 2008). It is necessary to understand what factors drive the GDP growth, which will be determined by examining the: (A) bounded rational market actors, (B) capital markets as scale-free complex networks, (C) Balassa-Samuelson effect, (D) structure of capital import, (E) productivity growth, (F) external balance of banking system, and (G) financial contagion.

The countries included in the analysis are the Czech Republic, Hungary, and Russia against a control group of Sweden, Finland and Denmark. Our objective here was to analyses how the network structure and dynamics operate during crises. To deal with singularity and historicity of market distortions, our study models economic networks as graphs, where nodes are individuals or organizations and the edges are the social interactions between them. (Barabási – Albert 1999)

Fig. 1: Convergence versus indebtedness



Source: own edition, Darvas-Szapáry 2008

Bounded rational agents (A)

Before analyzing the global financial network, it is necessary to examine the human factor in case of nodes on the market to understand the occurrence of bubbles[3] and decoupling effects[4] in a non-linear world. The conditions of the bounded rationality model, in which decisions are made under uncertainty resulting in current prices and expected future prices co-evolving over time with mutual feedback, are closer to reality by giving a deeper description of the mispricing problems than the rational homo oeconomicus model. During operations, market actors, who learn by using heuristics, are possibly biased[5], while their reactions are non linear[6]. (Chen 2008, Hommes – Wagene 2008, di Mauro et al. 2008)

Capital market as interactions between bounded rational agents (B)

After recognizing the bounded rational behaviors of market participants (nodes), this chapter will deal with the functions of edges between them.

There are two generic aspects to understand real networks: the nearest-neighbor coupled network (a lattice) and the randomly connected network (Erdősi-Rényi model). In a lattice, every node is joined only by a few of its neighbors creating a homogenous network with low level of dynamism, which is clustered, without small-world effect[7]. Random networks can appear quite suddenly. They are homogenous without showing clustering in general, but have small-world effect. The connectivity approximately follows a Poisson distribution. (Wang – Chen 2003, Watts-Strogatz 1998)

The theoretical background of the efficient market hypothesis was formed by the random networks and rational homo oeconomics models. This means that atomized and homogenous market participants are dealing with rational expectations following fair game strategies under the circumstances of continuous trade, low level of transactional costs, rapid new information adjustment. Therefore, yields following normal distribution are fluctuating around the average (expected) yield, which concurs with the mode (Molnár 2005, Dunbar 2000).

Many real-life complex networks are neither completely regular nor completely random. There are complex systems, in which conditions are constantly changing giving a rise to endogenously engendered novelty. Simple complexity models are characterized by fat tails in returns distribution, long memory and interacting

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[3] Occurrence of bubbles were simulated in a rational and well informed market environment too when markets deviate from full rationality in asset pricing. Therefore they do not request uncertain circumstances (Hommes – Wagene 2008).

[4] A divergence between development in a financial market benchmark and its effect on real economy (di Mauro et al. 2008).

[5] Their sentiment varies over time, according to prevailing market mood (Hommes – Wagene 2008).

[6] Economic agents do not respond strongly to relatively small changes in prices, but larger price movements may trigger a disproportionately larger response with a strong effect on other economic variables (di Mauro et al. 2008).

7 Small-world effect: short cuts between a few components, a logarithmic increase in average path length with the size of the network (Wang – Chen 2003, Watts-Strogatz 1998)

agents (Hommes – Wagene 2008). The extended characteristics are the followings: (1) particular states of the system are singular, (2) processes are non-linear and frequency-dependent, (3) strength and direction of causal relations are highly divergent in terms of magnitude and power, (4) exogenous events are influencing the system but events in the system are not completely dependent on the environment, (5) there is a hierarchical order between elements and particular emergent properties (Pillath 2000).

Complex networks have generic mechanisms. They are evolving by the addition of new vertices or sometimes rewiring the established connections. There is a high degree of self organizing. The new vertices attach preferentially to sites that are already well connected. Initial difference in the connectivity between two vertices will increase further as the network grows (Barabási – Albert 1999).

Scale-free[8] networks are special cases of complex networks. They are inhomogeneous in nature, which means that nodes have very few link connections and yet a few nodes have many connections. In comparison with a random network, complex networks have the same size and an average degree, but the average path length is somewhat smaller. The clustering coefficient is much higher as well, while there are a few "big" nodes (hubs) with very large degrees (very large number of connections to bring the other nodes of the network close to each other). The probability $P(k)$ that a vertex in the scale-free network interacts with k other vertices decays as a power law, following $P(k) \sim k^{\gamma}$, therefore majority of cases has very low probability presenting a dissonance between expected value and mode which is the opposite to harmony at random networks. (Wang – Chen 2003, Csermely 2008)

To understand the singularities of financial crises, we have to study how scale-free complex networks can describe synchronization, transition processes and failures. Singularities are the results of non-linear dynamics in the economy, when small changes in systemic characteristics cause large-scale implications at the macro level (Pillath 2000). Synchronizability of a scale-free network is about the same as a star-shaped coupled network driven by tiny fraction of distant links (small world effect); so hubs are playing a similar role as single star-center. In these networks, that is the explanation for the error tolerance and the attack vulnerability phenomenon. The network is robust during the random removal of a fraction of nodes; but after the preferential removal of key nodes, the system performance decreased[9]. Phase transition was described between scale-free and random networks. The connectivity number is emerging after the collapse of the "stable" scale-free state. The system is random in its "chaotic" phase with high evolutionary performance until a new "stable", scale-free combination is established (Grubesic et al. 2008, Wang – Chen 2003, Yuan – Wang – Li 2007).

[8] scale-free: "The shape of the degree distribution does not change over time, namely, does not change due to further increase of the network scale." (Wang – Chen 2003)

[9] Decrease is not an automatic result of preferential removal – knocing out a redundant node in a system can actually increase global network efficiency. But less redundancy means less tolerance of errors. (Grubesic et al. 2008)

By using the complex scale-free network model, a lot of unusual events on the financial market could be described. The "singularities", which are resulted by the scale-freeness of real networks, are summarized in three levels of complexity. The first level of time series means, that the autocorrelation function of returns is a monotonically decreasing function holding at least for approximately 20 trading days. Price returns and volatility are locally nonstationary, but asymptotically stationary. The second level, the so called event-based trade allows synchronous interaction in the same economic sector of each time series with all the others. The third level of complexity means a collective behavior during extreme market events. (Bonanno et al. 2001)

Balassa-Samuelson effect (C)

Balassa-Samuelson theory analyzes common development of productivity, inflation, interests and exchange rates (Balassa 1964, Samuelson 1964). The model focuses on the symmetrical increase of nominal wages in traded and nontraded sectors and the asymmetrical sectorial increase of productivity traded and nontraded sectors. This quasi paradox could cause inflation and appreciation of domestic currency.

There is a strong correlation between relative prices (CPI[10] at nontraded goods and PPI at traded goods) and real effective exchange rates (REER), which confirms the Balassa-Samuelson hypothesis. The Euro area had no such phenomenon due to its development, segmentation of its markets and its lower inflation rate than world average compensating the appreciation of EUR (Freeman, 2008). The impact of the Balassa-Samuelson effect is lower (but statistically significant) in the 2000's than during the first half of the 1990's. This difference is attributed to some institutional influences of the transition period. (García-Solanes et al. 2007)

Capital import (D)

Risk premiums declined after the EU accession, but remained significant to promote building carry-trade positions and to increase the share of retail foreign currency loans. Both resulted in strengthening of these currencies against EUR. Nominal effective exchange rates – referring to the structure of trade – rose higher than in the case of simple nominal rates versus EUR – while in this period EUR also rose against USD. This strong position collapsed after the escalation of subprime crisis after liquidity disappears, which illustrates how global investors consider this region to be homogen.

The rate of current account balance and PPP GDP[11] and the rate of FDI and PPP GDP[12] sign a true image of the openness of these countries. There is a strong export of real and capital goods in the case of Scandinavia,

10 The relative high nominal interest rate could be justified by emerging CPI and instable macroeconomy driven risk premiums. Significant development in case of CPI was only in 2003 due to the EU accession (internal causes), and after 2007 due to energy and agricultural resources price booms (external causes).

11 The rate of current account balance and PPP GDP was in 2007: Sweden (+8.54%), Finland (4.64%), Denmark (2.4%), Russia (5.02%), and Slovenia (-1.4%) and Hungary (-4.37%). (CIA 2008)

while post communist countries strongly import real and capital goods to handle transitional problems and to accelerate growth of added value. This process is not the same as in China, where there is current account surplus and a huge FDI import. The capital inflow into East Central European countries only partially accelerated the growth of productivity (Rosenberg 2008).

The relatively high current account deficit[13] compared to the Euro-zone made external financing necessary. Before 2004-2005, the deficit in East Central European countries was covered by FDI[14], which accounted as a non-debt-generating-item. Later on, portfolio investments and foreign currency loans got the major role in financing the deficit. Permanent current account deficit[15] indicates that the increase of consumption remained higher than the emergence of export oriented, FDI driven productivity growth. This asymmetry explains the robust deterioration of the loan/GDP ratio[16]. At the end of 2008, the sum of foreign debt in the Czech Republic became 40.9% of the GDP and 109.7% in Hungary[17]. Development of interest spreads and risk premiums reacted in a non-linear way after the escalation of crisis. Therefore, it is necessary to deal with domestic interest rates in details (Darvas – Szapáry 2008, Rosenberg 2008).

Public debt development[18] was high in East Central Europe after 2000, while the debt denominated in foreign currency increased due to lower interest rates on the developed capital markets.

Financial innovations as foreign currency based loans make monetary policy less efficient. To compensate the corporate capital import in parallel with ensuring external stability, strict fiscal policy and moderate household savings are needed. Public debt remained moderate in the EU10 countries with the exception of Hungary, while in Finland and Sweden, the recession of early 1990s helped to affirm financial sustainability of the welfare state (EIU 2008, Semjén 1999). Russia is a unique component of the sample – owing to its resource-exporter role[19] it has current account and national budget surplus. This "golden age" supplied the two quasi sovereign funds[20] for Russia, which enabled the repayment of public debt. The private sector had

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[12] In 2007 export of FDI was bigger than its import in Finland with 14.7%, in Sweden with 13.3%, in Denmark with 8.3%. Deficit were in Russia (-2.96%), in Slovenia (-7.62%), in Poland (-19.8%) and in Hungary (-32.9%). (CIA 2008)

[13] $CA = S-I = (SP-IP)+(SG-IG)$; where CA is current account balance; S and I are savings and investments rates; while G and P represented government and private sectors.

[14] Rate of FDI/GDP grown between 2000 and 2007 in Czech Republic from 19.5% to 57.7%, in Hungary from 22.8% to 70.5%, and in Russia from 12.7% to 25.1% – until this growth in the control group remained under 5pp (UN 2008).

[15] In 2008 it was 5.45% in Hungary while 2.23% in Czech Republic (IMF 2008)

[16] Rate of loan/GDP was 69.3% in Hungary, 41% in Poland, and 76.3% in Slovenia (Darvas – Szapáry 2008).

[17] CIA World Fact Book 2008; 25 billion dollar emergency loan by IMF, ECB and WB is included in the case of Hungary

[18] $Z = dD + dD^*$; where Z: debt covered sources of national budget; dD and dD^* are changes of public debt denominated in domestic and foreign currencies against GDP.

[19] Changes of raw material prices influence Russian balance of trade with 8 pp (IMF 2006a). These goods had bigger than 78% share (IMF 2006b). Russian oil extraction was 491.3 tons in 2007, 125.9 tons were consumed domestically, 332.1 tons were exported into Europe, and 26.3-22.6 tons into China and USA. (BP 2008).

[20] Stabilization Fund was formed in 2004, and sovereign debt was reduced by 61 pp in 2000-2004. This quasi sovereign wealth fund was divided into Reserve Fund (136 billion USD) to support liquidity of foreign

the same debt path as the global trend. As a result of the collapse of oil prices, the nominal rate of the ruble decreased, while the inflation rate increased over 10% based on higher import prices[21] .

Productivity (E)

Internationalisation of production means large firms headquartered in the euro area and using production facilities located in the new Member States (di Maruro et al 2008). Central and Eastern Europe have recently experienced increased productivity but without employment growth - could be explained by the transition from central planning to a market economy, the liberalization of domestic markets and the lowering of barriers to international trade and capital flows. (ILO 2008) The development of competitiveness could only be accelerated by growth of productivity. With productivity defined as larger growth of GDP than growth of work hours, the Scandinavian GDP per work hour is 43.5 USD, generally higher than East Central European for example Slovenia at 32.5 USD, Hungary at 24.4 USD and the Czech Republic at 24.2 USD in 2007 (CB 2008).

If the net wages-productivity gap (Unit Labor Cost, ULC[22]) is positive, the uncovered consumption will be financed by external loans, which induces unsustainable appreciation of exchange rate and GDP. And this appreciation is the opposite of Balassa-Samuelson effect, because it means loss of competitiveness (Darvas-Szapáry 2008, di Mauro et al. 2008). 10 year long average of Unit Labor Cost (ULC) was stable only in the Nordic countries with Denmark being the lowest at 2.23% supporting the fact of the high level of productivity-driven competitiveness in 1996-2006. In East Central Europe, there was only a negative ULC in Slovenia (-1.07%), while Czech and Hungarian ULC were positive (4.91%, 9.04%). Based on the Russian raw material exporter profile[23], ULC would be false sign.

Banking system (F)

Credit growth is significantly faster than what would be justified along the equilibrium path in some new EU member states – as Kiss-Nagy-Vonnák (2006) signed before the crisis (Kiss et. al 2006). Bank credit to the private sector and dependence on non-deposit funding has expanded rapidly in recent years. Loan–to–deposit ratios (LTD) have been doubled since the early 2000s, and in Ukraine, Hungary, and Russia where they ranged from 120-150 percent in 2007. Banks are heavily dependent on foreign funding to support credit growth, while relatively high volume of money market instruments and bond issuance by banks has provided

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exchange reserves of The Central Bank of the Russian Federation, and National Wealth Fund (83 billion USD), which can invest in sticky assets (IMF 2006b, IET 2006, Beck-Fidora 2008, MFRF 2009).

[21] Bloomberg: Russian Inflation Hits 5-Month High on Import Prices, April 6, 2009

[22] The difference between growth of productivity and growth of net wages. ULC=(W*E)/(Y/L), where is W= wages, E= nominal exchange rate, Y/L= average productivity (Tica-Jurčić 2006)

[23] Changes of raw material prices are influencing Russian balance of trade with 8 pp (IMF 2006a), and these goods had bigger than 78% share (IMF 2006b). Russian oil extraction was 491.3 tons in 2007, 125.9 tons were consumed domestically, 332.1 tons were exported into Europe, and 26.3-22.6 tons into China and USA. (BP 2008).

some support for funding – for e.g. in Hungary. These sources were also limited: financial sector bonds drying up since the subprime crisis in August 2007 and Eurobond issuance by the Russian financial sectors postponed their planned bond issues as a result of higher spreads. The parent bank's presence in the region could transfer a shock in one country to other countries in the region, because of parent bank's exposure to a host country could expose its daughter to sudden liquidity problems - generating second-round effects on other banking systems in the region. Daughter banks have substantial share of Western European bank profits, therefore host country banking systems could be affected through direct funding exposure to the parent bank. Czech Republic, Poland, Hungary and Russia have relatively diversified sources – in the case of cross-border and local claims of foreign affiliates in foreign and local currency have the largest shares in Germany and Austria, while Germany and Austria have the greatest shares at bank-to-bank claims. (Árvai et. al 2009)

Financial contagion (G)

Global integration of real economies and convertibility tend to move together with financial markets (Chen – Zhang 1997). However, under extreme bullish and bearish (leptocurtic) circumstances, volatility diffuses through the market (Giardina et. al. 2001) causing high correlation (Obstfeld – Taylor 2006). Therefore, time-series of rates are non-stationeries and correlation is unstable (Jiang et al. 2007, Bera – Kim 2001). Negative market bubbles[24] are much more common phenomena on emerging markets (Pálosi-Németh 2005). To measure bottleneck-effected external vulnerability, this study uses the cross-correlation model[25] by Kiss (2009) and Kiss, Kuba (2009).

This model focuses on the change of aggregated correlation in the portfolio. At first it is necessary to optimize the length of the period of all partial correlations to avoid distortions such as aggregation errors coming from positive and negative sides of correlation (black out effect). During the optimization process, 11, 15, 19, 23, 27, 31, 35, 39 trading day long periods were examined. As an outcome, the 25 trading day long period with

[24] A negative difference between fundamental (estimated future cash flows) and market value (Schiller 2000).
[25] The following spot prices from sample country's markets were tested between January 2002 and January 2009:
1. Global market: Dow Jones Industrial, US government bonds with maturity of 10 years, EU 10Y bond rate, Brent-type crude oil, Gold price, USD/EUR exchange rate.
2. Russian market: RTS Stock market index (GKO-OFZ governmental bonds were dropped due to lack of data before 2006), Ruble/EUR exchange rate.
3. Czech market: PX Stock market index (CZ 10Y governmental bonds were dropped due to lack of daily data, CZK/EUR exchange rate.
4. Hungarian market: BUX Stock market index, MAX governmental bond index, HUF/EUR exchange rate.
5. Sweden market: OMX Stockholm 30 stock market index, SE GVB 10Y government bonds, Swedish krona/EUR exchange rate.
6. Danish market: OMX Copenhagen 20 stock market index, DK 10Y government bonds, Danish krone/EUR exchange rate.
7. Finnish market: OMX Helsinki 25 stock market index, FI 10Y government bonds.

black out effect had a global minimum at this case with 4.4% probability of common existence of partial correlations under -0.7% and above 0.7%. Partial correlation (1) meant in this case the correlation between yields of instruments *i* and *j* in t_n time from (2) data.

$$(1)\ (\mathrm{corr}_{ij} = \mathrm{corr}_{ij}(t_n))$$

$$(2)\ r_i(t_{n-11}), r_i(t_{n-10}), \ldots, r_i(t_n), \ldots, r_i(t_{n+10}), r_i(t_{n+11});$$

$$r_j(t_{n-11}), r_j(t_{n-10}), \ldots, r_j(t_n), \ldots, r_j(t_{n+10}), r_j(t_{n+11})$$

The arithmetical aggregation of partial correlations change (4) of aggregated correlation could be defined as an adaptation of derivation at continuous functions in the case of *R* aggregated correlation (3) in domain of $\{t_0, t_1, t_2, \ldots, t_n, \ldots\}$ discrete set.

$$(3)\qquad R = R(t_n) = \Sigma_{ij} \,|\, \mathrm{corr}_{ij}(t_n) \,|\, / (|\, I \,| \times (|\, I \,| - 1) \times 0{,}5) = \Sigma_{ij} \,|\, \mathrm{corr}_{ij}(t_n) \,|\, / 21$$

$$(4)\qquad D_R = D_R(t_n) = (R(t_n) - R(t_{n-1}))$$

Turning points were set by $D_R(t_n) \times D_R(t_{n+1}) < 0$ cases, therefore monotone emerging and declining periods $\{ l_1, l_2, \ldots, l_k. \}$ could be defined.

Change of aggregated yield (5) was generated (6) by the same way, so monotone emerging and declining periods $\{ m_1, m_2, \ldots, m_o \}$ between turning points (7) were defined too.

$$(5)\qquad M = M(t_n) = \Sigma_i r_i \,/\, |\, I \,| = \Sigma_i r_i \,/\, 7$$

$$(6)\qquad D_M = D_M(t_n) = (M(t_n) - M(t_{n-1}))$$

$$(7)\qquad D_M(t_n) \times D_M(t_{n+1}) < 0$$

Monotone periods of aggregated yields were longer than monotone periods of aggregated correlation $\{l < m\}$, therefore finite number of monotone aggregated correlation periods could be classified under each monotone aggregated yield periods.

The outputs of these processes were row vectors (8), which could be classify into two parts ("normally" and "extraordinary") after a 2 step clustering and a hierarchical clustering.

$$(8)\qquad (r_m,\ t_m,\ l_d:\ D_R(t_n) \times D_R(t_{n+1}) < 0,\ R_{ld},\ l_e:\ D_R(t_n) \times D_R(t_{n+1}) > 0,\ R_{le})$$ [26]

Studying of row vectors of daily logarithmic yields[27] in the light of extraordinary market events and the nature of aggregated cross correlation showed the background of over- and underachieving at every single market.

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[26] r_m: *average decline/emergence of monotone aggregated yield*
t_m: *length of monotone aggregated yield period*
l_d: *numbers of monotone declining aggregated correlation periods inside this monotone aggregated yield period*
R_{ld}: *average decline of monotone aggregated correlation level inside this monotone aggregated yield period*
l_e: *numbers of monotone emerging aggregated correlation periods inside this monotone aggregated yield period*
R_{le}: *average emerge of monotone aggregated correlation level inside this monotone aggregated yield period*

By applying the fine-tuned, 25 trading day long periods approach (*tab. 2*), "normal" and "extraordinary" changes were identified. Under normal circumstances there were quite short monotone periods at aggregated yields (monotone decline: 2.6 days; monotone emergence: 2.8 days), with weak average change in yields (-0.011%/day and 0.017%/day). Average emergence and decline of monotone correlation periods remained weak (0.25% and 0,2%), and mostly one normal monotone yield period included maximum a half monotone correlation period. Extraordinary changes were longer (more than 5,9 days) and stronger (-0,26%/day and 0,16%/day), while a monotone aggregated yield period included more than half monotone correlation period, and correlations at extraordinary emergence were higher than declines. Average difference between extraordinary (requiring longer time) and normal aggregated yield remained negative.

Tab. 1: Connection between yield and correlation

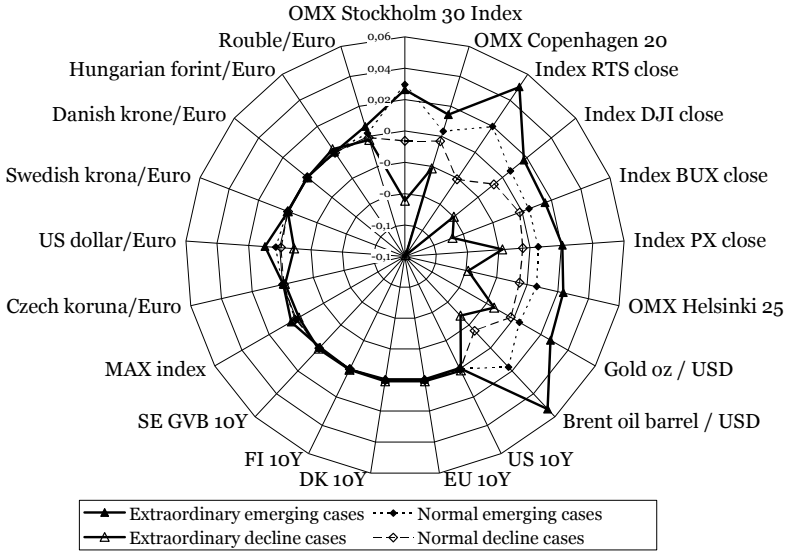
	Average change of monotone aggregated yield (%)	Numbers of monotone declining aggregation correlation periods (days)	Average decline of monotone aggregated correlation level (%)	Numbers of monotone emerging aggregation correlation periods (days)	Average emergence of monotone aggregated correlation level (%)	Length of monotone aggregated yields period (days)
Extraordinary emergence	0,16%	0,594	-0,21%	0,688	0,42%	7,875
Normal emergence	0,17%	0,462	-0,24%	0,505	0,26%	2,875
Extraordinary decline	-0,26%	0,621	-0,44%	0,517	0,24%	5,897
Normal decline	-0,11%	0,497	-0,17%	0,455	0,21%	2,575

Source: authorial calculation

Simulated market trends were followed by Czech and Scandinavian bond and currency markets, while Hungarian and Russian currency and Hungarian bond market have a divergence due to different market situations. The biggest divergence was measured on the Russian stock exchange, which was higher than divergence of raw material components. Sweden, Hungarian and Finnish stock market has also bigger divergence, in contrast to moderate Czech and Danish benchmarks. (*fig. 2*)

[27] Shapiro–Wilk test signed lack of normal distribution on the markets, QQ plots illustraded presence of fat tails - represented by the deviations below the line at the lower quantiles and above the line at the upper quantiles (Jefferiesa et al. 2002)

Fig. 2: Average difference from aggregated yield between different market circumstances



Source: authorial calculation

CONCLUSION

Imbalances of transitional countries were indicated by financial markets as models of bounded rationality and complex scale-free networks suggested. Developed countries have to face with extreme bullish and bearish (leptocurtic) circumstances, in which volatility of liquidity diffuse through the market. Capital flows are non-linear, therefore, the bottleneck-effects are caused by the withdrawal of the capital that is faster than its inflow. Under these circumstances, it is not easy to differentiate, whether capital inflow drives either the convergence of real economy or the credit exuberance, if we only examine exchange rates, prices and GDP development.

There are different possible pathways for developing countries to manage external source accelerated convergence, only productivity growth driven solutions are sustainable on the long run. Due to in the Central European Countries both processes exists, there is a "double pressure" on transitional countries. Short term labor market and long term pension system problems on the one side, and the outsourcing of low added value production to the Far-East countries on the other. This phenomenon undermines the financial base of welfare state and the reproduction of human capital (Botos 2008). In case of little, opened economies, fiscal and monetary policies have to be consistent to minimize bottleneck effect's casualties in an integrated non-linear environment.

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