FINANCIAL THEORY AND PRACTICE

Vol. 34, No. 3
Zagreb, September 2010
pp. 219-327

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FOREWORD

The present issue of "Financial Theory and Practice" contains some of the articles presented at the conference *Finance and Growth in Central and Eastern Europe*, organized by the Institute of Public Finance and the Friedrich Ebert Foundation, in Zagreb on April 29 and 30, 2010.

The conference aimed at addressing a broad variety of research questions in the area of finance and growth, such as: aspects of central and eastern European economies affecting the relationship between finance and economic growth; lessons from the recent financial crises and the prospects of the region after the crises; advantages and disadvantages of different ownership structures in the banking sector; available policy options for strengthening the potential positive link between financial sector development and economic growth in central and eastern European countries.

The program committee, consisting of Evan Kraft (Croatian National Bank), Dubravko Mihaljek (Bank for International Settlements) and Athanasios Vamvakidis (International Monetary Fund), had the challenging task of selecting the papers to be presented at the conference. After the welcome speeches by the director of the Institute of Public Finance Katarina Ott, and the director of the Friedrich Ebert Foundation in Croatia, Mirko Hempel, Fabrizio Coricelli (Université Paris 1 Panthéon-Sorbonne) gave the keynote lecture entitled: *The global financial crisis: some implications for emerging European markets.* His lecture was followed by the presentations of fourteen selected papers, organized in four sessions, over two conference days. Each session was enriched with constructive discussions in a very pleasant atmosphere.

Some of the papers from the conference are published in this issue of the journal, while some will be published in subsequent issues. The program and the abstracts of all the addresses delivered can be found on the web site of the Institute of Public Finance, at http://www.ijf.hr/conf2010/.

As organizers, we would once again like to thank all the speakers, guests and members of the program committee, and of course the Friedrich Ebert Foundation, who made this successful conference possible. We also gratefully acknowledge the support provided by Splitska Banka – Societe Generale Group.

Marijana Bađun and Goran Vukšić
Organizing committee

PAPERS PRESENTED AT THE CONFERENCE

Keynote lecture

Fabrizio Coricelli: The global financial crisis: some implications for emerging European markets

Session 1: Financial Crises

Davide Furceri and Aleksandra Zdzienicka: The real effect of financial crises in the European transition economies

Arjana Brezigar-Masten, Fabrizio Coricelli and Igor Masten: Financial integration and financial development in transition economies: what happens during financial crises?

Ruben Atoyan: Beyond the crisis: revisiting emerging Europe's growth model

Session 2: Macro/Financial Markets/Banking

George Anayiotos, Hovhannes Toroyan and Athanasios Vamvakidis: The efficiency of emerging Europe's banking sector before the 2008 crisis

Betrand Gruss and Silvia Sgherri: The volatility costs of procyclical lending standards: an assessment using a DSGE model

Daniel Ibrahim, Peter Haiss and Bernhard Mahlberg: The internationalization of banking: a micro-macro approach with a focus on Romania

Gancho Todorov Ganchev: Twin deficit hypothesis: the case of Bulgaria

Session 3: Banking/Financial Markets

Miroslav Mateev and Yanko Anastasov: Determinants of small and medium sized fast growing enterprises in central and eastern Europe: a panel data analysis

Olena Havrylchyk and Emilia Jurzyk: Foreign bank presence and its effect on firm entry and exit in transition economies

Deniz İkizlerli and Numan Ülkü: The interaction between foreigners' trading and stock returns: evidence from Turkey

Debora Revoltella, Fabio Mucci and Dubravko Mihaljek: Properly pricing country risk: a model for pricing long-term fundamental risk applied to central and eastern European countries

Session 4: Banking

Elmas Yaldız and Flavio Bazzanna: The effect of market power on banks' risk taking in Turkey

Gianni de Nicolò and Elena Loukoianova: Bank ownership, market structure and risk

Marijana Bađun: The determinants of bank interest margins: a political economy view

PROPERLY PRICING COUNTRY RISK: A MODEL FOR PRICING LONG-TERM FUNDAMENTAL RISK APPLIED TO CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Article**
JEL: G30, G10, G14, F21
UDC: 336.71

Abstract

The private sector has used proxies such as sovereign credit ratings, spreads on sovereign bonds and spreads on sovereign credit default swaps (CDS) to gauge country risk, even though these measures are pricing the risk of default of government bonds, which is different from the risks facing private participants in cross-border financing. Under normal market conditions, the CDS spreads are a very useful source of information on country risk. However, the recent crisis has shown that the CDS spreads might lead to some underpricing or overpricing of fundamentals in the case of excessively low or excessively high risk aversion. In this paper we develop an alternative measure of country risk that extracts the volatile, short-term market sentiment component from the sovereign CDS spread in order to improve its reliability in periods of market distress. We show that ad-

* The authors thank Fabrizio Coricelli, Jacob Gyntelberg, two anonymous referees and participants of the Institute of Public Finance conference *Finance and Growth in Central and Eastern Europe* for insightful comments. Matteo Consalvi provided valuable support in the estimation part, and István Horváth and Hans Holzhacker in analysing the data for Hungary and Kazakhstan. The views expressed in this paper are those of the authors and do not necessarily represent those of UniCredit Group or Bank for International Settlements.

** *Received*: April 26, 2010
Accepted: July 26, 2010

verse market sentiment was a key driver of the sharp increase in sovereign CDS spreads of central and eastern European (CEE) countries during the most severe phase of the crisis. We also show that our measure of country risk sheds some light on the observed stability of cross-border bank flows to CEE banks during the crisis.

Keywords: country risk, credit default swaps, credit ratings, cross-border flows, financial crisis, central and eastern Europe, foreign-owned banks

1 Introduction

Over the past two decades the composition of private capital inflows to the emerging market economies has changed significantly. The shares of foreign direct investment and portfolio inflows have decreased, while the share of international bank loans has increased. The change has been particularly pronounced in the years leading up to the latest crisis, when cross-border bank flows came to account for almost 40% of gross private capital inflows, compared to less than 10% on average in the first half of the 2000s.

Despite the greater importance of private cross-border bank loans, a benchmark for pricing country risk in such loans has not yet developed, partly because market participants associate country risk with different concepts. So far, three main proxies have emerged: sovereign credit ratings; spreads on sovereign bonds; and spreads on sovereign credit default swaps (CDS). International banks have used these measures extensively even though they are in fact pricing the risk of default of government rather than private sector debt in a given country. Given that government debt on average accounted for less than 7% of gross capital inflows to the emerging markets in the 2000s, applying these measures to cross-border loans, which accounted for 70-80% of gross inflows in many countries, might lead to potentially serious mispricing of country risk in private cross-border lending.

The latest crisis has highlighted the potential for such mispricing to occur. In the years preceding the crisis, sovereign CDS spreads emerged as a leading benchmark for pricing country risk in private lending operations. Under normal market conditions, the CDS spreads are a very useful source of information on country risk as they are flexible enough to capture changes in the relevant set of information and seem to do so earlier than changes in country credit ratings. In particular, the level of CDS premia across countries at a given point in time is clearly related to differences in default risk.

However, the relationship between the CDS spreads and country risks over time is more tenuous. The CDS spreads tend to fluctuate significantly over time and in some cases there is little apparent relationship to movements in default risk – the time variation of CDS spreads seems to be driven largely by shifts in risk appetites of investors rather than by changes in default risk. For instance, emerging market sovereign CDS premia narrowed steadily between 2004 and 2007, a period when sovereign risks were declining, as indicated by distinct increases in emerging market sovereign credit ratings. Improved ratings reflected stronger fiscal positions, lower external debts, and higher foreign reserve holdings. However, sovereign premia then surged sharply in late 2008, when there was still little evidence of worsening sovereign risks.

The use of CDS spreads might thus lead to underpricing or overpricing of fundamentals in the case of excessively low or excessively high risk aversion. Such mispricing can exacerbate market inefficiencies and add to the collapse of capital inflows during a crisis. The development of a country risk measure more closely related to fundamentals has proved to be particularly relevant during the latest crisis in central and eastern Europe. Banks in the region rely heavily on external funding, which comes mostly from foreign mother companies. Sovereign CDS spreads have been commonly used as a benchmark for pricing such loans. However, during the period of market disruption from early 2008 through the first half of 2009, sovereign CDS spreads in some cases surged 10-20 times above the pre-crisis levels, well above any increase justified by the deterioration in fundamentals. This surge in CDS spreads greatly increased the likelihood of overpricing cross-border loans to CEE subsidiaries and, given the dominant role of foreign-owned banks, threatened to cut off credit supply in local markets.

In this paper we claim that, in view of the long-term strategic focus of international banks in the CEE region, funding provided to subsidiaries should be priced according to long-term market fundamentals. Undershooting or overshooting of market risk above the long-term fundamental level might lead to excessive easing or tightening of funding conditions. We test an alternative measure of country risk that extracts the volatile, short-term market sentiment component from the sovereign CDS spread in order to improve its reliability in periods of market distress. The model is developed for the CEE countries, but is applicable to other emerging market economies as well.

Only a few papers have discussed explicitly the potential impact of crisis-related disruptions on country risk pricing. This study aims to fill this void. We estimate a panel regression between sovereign CDS spreads and the average probability of sovereign default associated with credit ratings of major rating agencies. We also use a proxy for the degree of international risk aversion in order to capture (common) shifts in market sentiment which may have contributed to the observed increase in sovereign CDS spreads. The estimated long-term coefficient and constant term from the regression are then used to calculate a new country risk premium indicator based on the average probability of default associated with credit ratings for each country. Our panel covers 14 CEE countries from January 2000 to December 2009.

We test the economic implications of these estimates on the data on cross-border bank flows to CEE and other emerging markets in order to shed light on the role played by parent banks in guaranteeing a stable source of financing during a crisis. We find that cross-border bank flows are generally better explained by the fundamental component of country-specific risk than by global risk repricing. This is particularly the case for CEE economies, where the domestic banking sector is mostly dominated by large international banking groups which generally take a long-term view when providing funding to their local subsidiaries. The pattern of cross-border flows during the latest crisis has confirmed the strong commitment of these groups to the CEE region.

The paper is structured as follows. Section 2 reviews the issue of country risk pricing for private sector operations, and describes the sovereign CDS market for CEE titles, highlighting the potential weaknesses in CDS pricing that emerged between September 2008

and March 2009. Section 3 discusses the relevance of CDS spreads as a benchmark for the pricing of country risk for banks. Section 4 reviews the literature on various models for decomposing CDS spreads. In Section 5 we estimate an alternative measure of the country risk premium that captures the long-term relationship between CDS spreads and credit ratings. Section 6 evaluates the economic implications of this measure. We test its explanatory power on the data on cross-border loans during the crisis in CEE and other emerging markets, showing that parent banks – particularly in those countries where large international banks were present – adopted a long-term perspective in the pricing of country risk. Section 7 summarises the results.

2 Pricing of country risk in cross-border financing

Pricing of country risk for sovereign borrowers is well developed and several benchmarks are widely available, including sovereign credit ratings, sovereign bond spreads (usually for bonds issued in international markets relative to benchmark risk-free bonds such as German Bunds or US Treasuries), and sovereign CDS spreads.

Pricing of country risk for private cross-border borrowers is less well developed, partly because underlying risks are more difficult to define. Different market participants associate country risk premia with different concepts, including the foreign exchange transfer risk, the risk of expropriation or government interference in the business activities of the borrower, the overall political risk, and sometimes even the economic risk of working in a less stable operating environment.

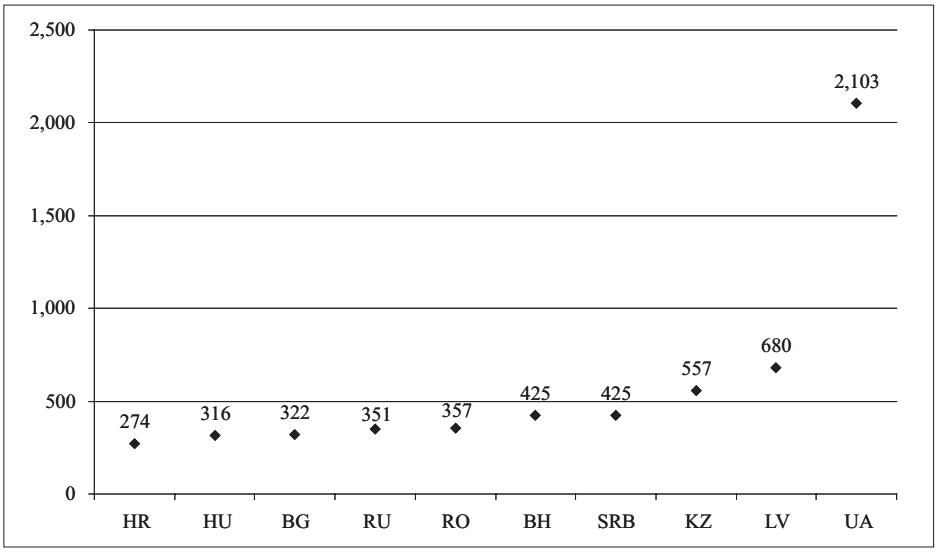
Reflecting this diversity of concepts, international banks consider at least five different measures of country risk in their cross-border financing operations.

First, export credit agencies and international financial institutions that facilitate private sector investment in developing countries have elaborated their own measures of country risk that they occasionally provide to banks on a confidential basis. For instance, the World Bank's Multilateral Investment Guarantee Agency (MIGA) and regional multilateral development banks (EIB, EBRD, IADB, ADB, etc) sometimes provide quotations of country risk premia on a deal-by-deal basis. This is a useful and often well considered measure of country risk. However, some of these institutions fulfil certain social policy functions for the international community at large – for instance, they partly subsidise country risk. Moreover, they do not face the risks they insure or price for in the same way that private institutions do. Because of their status of preferential creditors, who are the first in line to claim the assets of a bankrupt borrower, the risks they face – and hence the premia they quote – tend to be lower than those facing private creditors.

To illustrate this point, graph 1 shows differences in country risk premia measured by sovereign CDS spreads and those generated by either internal rating models of international banks or international financial institutions during 2009. The CDS spread provided in all cases the highest estimate of country risk. The lowest estimates were in some cases those generated by internal rating models of banks, and in others those quoted on a confidential basis by international financial institutions. These data indicate that the market clearly puts a higher price on country risk than individual banks or IFIs. The di-

fference ranges from about 270 basis points in the case of Croatia, to 2,100 points in the case of Ukraine.

Graph 1: Market and internal measures of country risk, difference in basis points[1]



[1] *Difference between the highest and lowest pricing of country risk in 2009. The highest pricing was for all countries represented by the market CDS spread; the lowest was given by either an internal rating model of banks or an international financial institution's confidential quote.*

Note: BH – Bosnia and Herzegovina; BG – Bulgaria; HR – Croatia; HU – Hungary; KZ – Kazahstan; LV – Latvia; RO – Romania; RU – Russia; SRB – Serbia; UA – Ukraine.

Source: UniCredit Group CEE Strategic Analysis.

The second widely used measure of country risk is the spread based on banks' internal rating models, which are built in order to comply with Basel II regulations. Such spreads are usually generated by shadow model-based systems that incorporate both quantitative information (e.g. macroeconomic data) and qualitative information (e.g. evaluation of the economic and political situation). While internal rating models tend to approximate very closely the results of rating agencies, they are more flexible to changes in the set of available information and own risk propensity of a bank.

Third, international banks rely extensively in their cross-border operations on credit ratings for sovereign and corporate bonds produced by rating agencies such as Moody's and Standard and Poor's. Bank analysts often use credit ratings as a proxy for the creditworthiness of bond issuers rather than the quality of bonds per se. In the case of sovereign bonds, for instance, the credit rating is used as a proxy for the overall level of risk – including political risk – related to investing in a particular country.

Fourth, international banks often use the spread between bonds issued in international markets and benchmark risk-free bonds. For some emerging market economies (e.g.

Brazil, Mexico, Korea, Russia, South Africa) these spreads are available for private sector corporate bonds. But in most emerging market countries private domestic companies are not large enough to issue, or to issue regularly, in international bond markets, so banks have to rely on sovereign bond spreads when assessing country risk in lending to private sector borrowers.

The fifth measure of country risk, and the one that has emerged as a key innovation in the credit risk market over the past decade, is the CDS spread. A CDS provides insurance against the risk of default by a reference entity such as a sovereign or a corporate bond issue (see Appendix box A1). In theory, CDS spreads are closely related to both bond spreads and rating changes, given that all three indicators are driven by the credit quality of private or sovereign borrowers.

In practice, CDS spreads do move together with bond spreads in the long run. But the CDS market often moves ahead of the bond market in the short run. The reasons include institutional factors (the CDS and bond markets operate differently), and the fact that the risk-free bond rates, which are used as a reference in pricing of CDS contracts, tend to move randomly (see Zhu, 2004).

Table 1: Evolution of sovereign credit ratings and CDS spreads, 2008-09

Country name	Date of rating change	Change in S&P long-term foreign currency rating	5-year CDS spread, basis points		
			On the date of rating change	Change on the date of rating revision	Change vs. previous week
Bulgaria	30/10/2008	from BBB+ to BBB	432	–64	–39
Estonia	10/08/2009	from A to A–	223	0	–8
Hungary	30/03/2009	from BBB to BBB–	523	46	3
	17/11/2008	from BBB+ to BBB	437	22	124
Latvia	10/08/2009	from BB+ to BB	617	–13	–42
	24/02/2009	from BBB– to BB+	970	43	63
	10/11/2008	from BBB to BBB–	690	127	–17
	27/10/2008	from BBB+ to BBB	921	–60	233
Lithuania	24/03/2009	from BBB+ to BBB	695	–43	–100
	27/10/2008	from A– to BBB+	608	–30	125
	30/01/2008	from A to A–	7	0	0
Romania	27/10/2008	from BBB– to BB+	610	–21	94
Russia	08/12/2008	from BBB+ to BBB	780	–35	39
Slovakia	27/11/2008	from A to A+	152	–6	12
Ukraine	25/02/2009	from B to CCC+	3,742	–34	375
	24/10/2008	from B+ to B	2,695	–108	1,022
	12/06/2008	from BB– to B+	322	–5	23

Note: Shaded areas indicate instances where the CDS spreads widened ahead of rating downgrades.
Sources: Bloomberg; S&P's; authors' calculations.

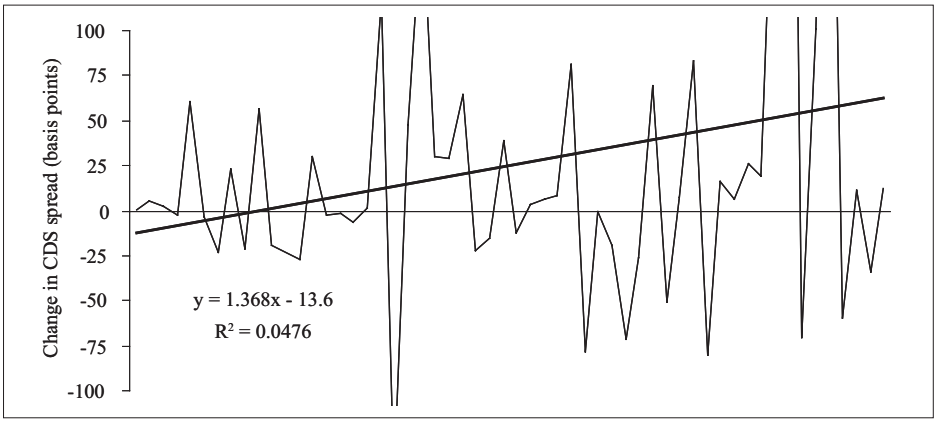
More important for the purpose of this paper is the relationship between changes in CDS spreads and changes in credit ratings. Rating agencies have stability as one of their

objectives, i.e., they try to avoid getting into a position where a rating change is made and has to be reversed a short time later. This implies that rating changes are infrequent and generally lag changes in CDS spreads. However, rating agencies base their ratings on many different sources of information, some of which are not in the public domain. The possibility of rating changes leading credit spreads therefore cannot be ruled out.

Table 1 shows the relationship between sovereign CDS spreads and rating downgrades for a sample of CEE countries during the latest crisis (the only upgrade in the table is for Slovakia, ahead of its joining of the euro area). The last two columns show that, relative to the day before the downgrade (and, in several cases, the week before the downgrade), the CDS spreads generally widened. This implies that the CDS market anticipated the downgrade, i.e., reacted to market information faster than the credit ratings.

The relationship between changes in credit ratings and changes in CDS spreads predicted by the theory – positive for downgrades negative for upgrades – is even more evident in the longer run. Graphs 2 and 3 show this relationship for a sample of 15 CEE countries from 2003 through early 2010. As shown earlier in the literature (e.g. Hull et al., 2004; Zhu, 2004), this relationship is asymmetric: the change in CDS spreads is greater for rating downgrades than for the upgrades.[1] Graph A3 in the Appendix shows that the relationship predicted by the theory also holds for *levels* of credit ratings and CDS spreads in the long run: the lower the rating, the higher the CDS spread, and vice versa.

Graph 2: CDS spreads and rating downgrades, change in CDS spreads around the time of ratings downgrade[1]



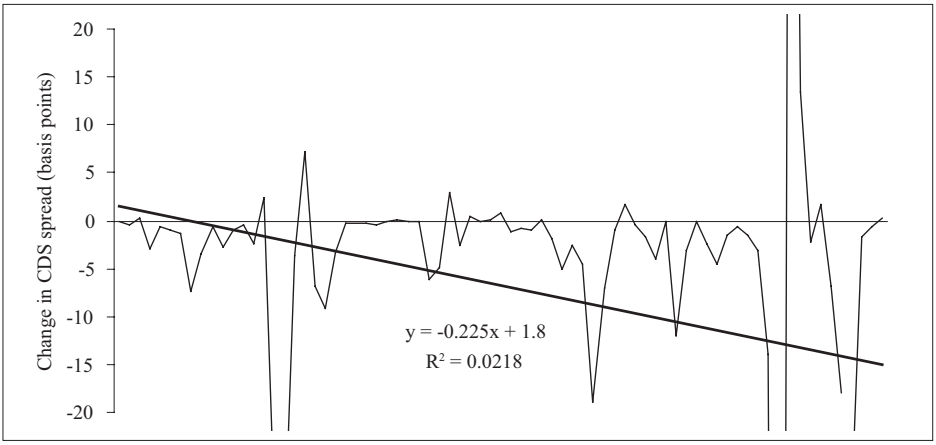
[1]Average of daily changes in CDS spreads four weeks before the ratings downgrade: the week of the downgrade; and four weeks after the downgrade; in basis points. Credit ratings are for long-term foreign currency sovereign debt.

Note: The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations based on market and BIS data.

[1] Note that the absolute value of the slope of the regression line in Graph 2 is greater than in Graph 3, i.e., CDS spreads widen more in the case of a rating downgrade than they narrow in the case of an upgrade.

Graph 3: CDS spreads and rating upgrades, change in CDS spreads around the time of ratings upgrade[1]



[1]Average of daily changes in CDS spreads four weeks before the ratings upgrade: the week of the upgrade; and four weeks after the upgrade; in basis points. Credit ratings are for long-term foreign currency sovereign debt.

Note: The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations based on market and BIS data.

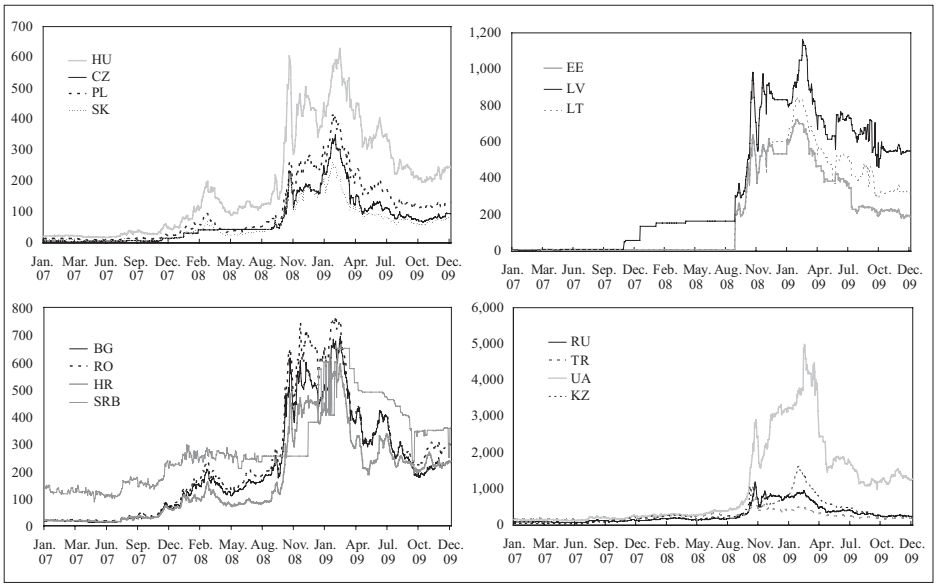
On the basis of this evidence one might conclude that the CDS spreads capture all information relevant for the assessment of country risk facing the private sector. However, the recent crisis has also shown that this market can be subject to shifts in sentiment that are unrelated to underlying country risk fundamentals. In particular, developments in the CDS market during the run-up to the latest crisis (from early 2007 through September 2008), and in the aftermath of the Lehman collapse (from October 2008 through March 2009), raise concerns that the CDS market might underprice or overprice fundamentals in the presence of excessively low or excessively high risk aversion. In particular, the breakout of the US subprime crisis in August 2007 had only a moderate impact on sovereign CDS spreads of emerging market countries (graph 4). From a market efficiency perspective this is not surprising: the emerging market sovereign debt was not at the centre of the crisis, and therefore any impact on CDS spreads should have been small.

However, the collapse of Lehman Brothers and the rescue of AIG, both of which were major counterparties in a very large number of CDS contracts, triggered a process of worldwide deleveraging and market exit in September 2008. As most markets lost liquidity, trading volumes in the CDS market collapsed, the spreads skyrocketed (graph 4) and CDS markets for some titles (including CEE sovereigns) stopped operating temporarily. This increase in spreads, however, was unrelated to any increase in default probabilities of the underlying debt: at that time, public finances in emerging markets were still unaffected by the crisis and there was no indication of worsening sovereign risks. Rather, the

increase in CDS spreads was almost entirely related to the crisis that engulfed major international investment banks participating in the CDS market.

Another piece of evidence on the existence of pricing inefficiency in the CDS market in times of distress comes from the analysis of market liquidity. A good proxy for the level of liquidity is the volatility of bid-ask spreads for the instrument being traded. The intensification of the crisis in late 2008 resulted in a significant increase in the volatility of bid-ask spreads for CEE sovereign credit default swaps: from September 2008 through March 2009, the bid-ask spread was ten times more volatile on average than in the December 2007–August 2008 period (graph 5). The huge demand for hedging in the context of low market liquidity was probably the main driver of the exponential increase in volatility of bid-ask spreads, especially for CIS countries.

Graph 4: Evolution of sovereign CDS spreads in CEE; in basis points, five-year CDS in USD



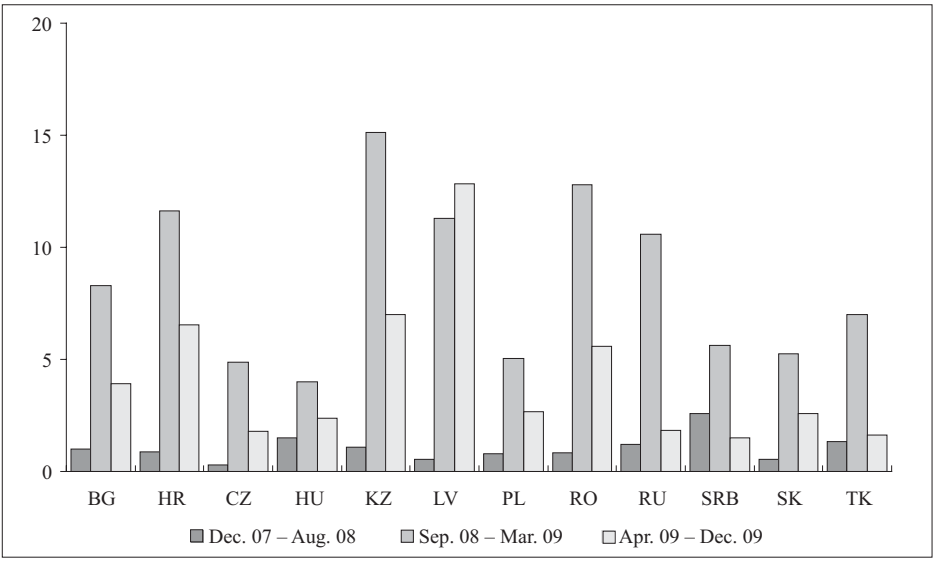
Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; SK – Slovakia; SRB – Serbia; TR – Turkey; UA – Ukraine.

Source: Bloomberg.

There are also a number of country-specific examples of overpricing of risk due to structural inefficiencies and high level of concentration in the CDS market. In Hungary, for instance, only a few market makers quote indicative – though not executable – prices for specific CDS maturities. None of these market makers are from the Hungarian financial sector. During 2007, the weakening of the forint was accompanied by a significant widening of CDS spreads, particularly toward the end of the year. But although the forint strengthened in the first quarter of 2008, the CDS spreads did not decrease. In contrast to the foreign exchange market, local political and economic news throughout 2008 did not

have a significant impact on CDS spreads. The only exception was the announcement of the IMF and EU aid package, where the size of the support positively surprised the market. This suggests that pricing in the Hungarian CDS market may not have reflected country risk fundamentals correctly for an extended period of time because of the oligopolistic structure of the market.

Graph 5: Volatility of bid-ask spreads in CDS markets[1]



[1] *Standard deviation of bid-ask spreads for sovereign CDS contracts.*

Note: BG – Bulgaria; CZ – Czech Republic; HR – Croatia; HU – Hungary; KZ – Kazahstan; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; SK – Slovakia; SRB – Serbia; TR – Turkey.

Source: Authors' calculations based on Bloomberg.

In summary, although the level of CDS spreads across countries at a given point in time clearly reflects market information and differences in default risk, the level of spreads and country risks can be subject to pronounced misalignments over time. The CDS spreads tend to fluctuate significantly over time and in some cases there is little apparent relationship to movements in default risk. One reason for this misalignment is that the CDS spreads incorporate not only the implicit risk of default, but also changes in market sentiment. These changes are most discernible when new information comes as a shock, the timing of which is by definition unpredictable.[2] Apart from country-specific factors, the most important driver of intertemporal movements in CDS spreads is changes in risk aversion, which drive the market price of risk. Thus CDS spreads fell in the 2000s when risk aversion was declining, and jumped in autumn 2008 when risk aversion rose shar-

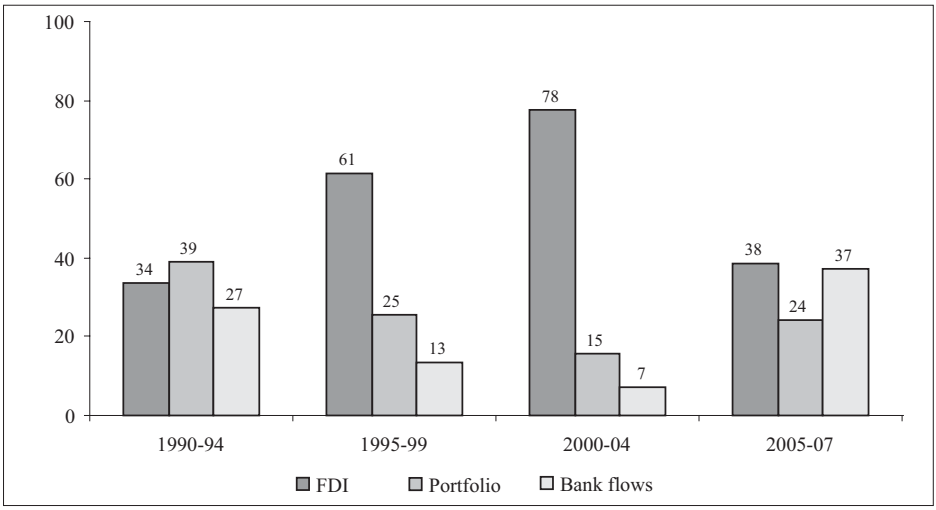
[2] One recent case in point is Greece. Greek CDS premia rose sharply after the disclosure in 2009 that the budget deficit had been understated in the past. Before that, the CDS premia had been low even though the Greek public debt to GDP ratio had been above 100% for a number of years.

ply. In addition, the nature of CDS contracts as over-the-counter derivative instruments; the size and structural opacity of the market (which seem to be correlated with high margins of major market players); and the high degree of concentration and interconnectedness of key players create an environment that may encourage market misuse and lower the informative content of CDS spreads as a measure of country risk.

3 Cross-border lending and pricing of country risk

Finding an appropriate benchmark for the pricing of country risk is particularly important in cross-border lending to the emerging markets, given the growing importance of bank-intermediated capital inflows to EMEs. Between the early 1990s and the mid-2000s, the share of cross-border bank flows decreased from 27% to 7% of gross private capital inflows (graph 6). Over this period, the share of portfolio (debt and equity) inflows also decreased significantly, while the share of FDI inflows rose to almost 80% of gross inflows. But from 2005 to 2007 these trends reversed sharply: the share of cross-border inflows increased to 37%; the share of portfolio inflows to 24%; while the share of FDI inflows halved to 38%. These shifts were even more pronounced in some countries, especially in CEE, where cross-border bank flows came to account for up to 80% of gross private capital inflows.

Graph 6: Composition of gross private capital inflows to EMEs,[1] in percent of total



[1] Period averages. Includes 29 most important emerging market economies from Asia, Latin America and central and eastern Europe, as well as Saudi Arabia and South Africa.

Sources: BIS; IMF; authors' calculations.

Finding an appropriate benchmark for the pricing of sovereign risk is also important for CEE countries because of the significant role played by foreign banks in the region and the resulting dependence of local banking systems on foreign funding. In the years

before the crisis, banking systems in CEE experienced a veritable deluge of cross-border bank inflows. The stock of external liabilities of local banks at end-2008 was more than four times higher than at end-2004. As domestic saving rates in CEE were low and the region was catching up rapidly with the EU, foreign-owned banks began to channel large amounts of external funds to local banks and the non-bank sector in the mid-2000s. In most countries of the region large international banks were funding their local subsidiaries through direct intra-company loans. In Russia, Kazakhstan and few other countries, large domestic corporations tapped the global capital market through international bond issues and direct borrowing from international banks. The dependence on foreign funding has been particularly high in the Baltic States and south-eastern Europe. The Czech Republic, Slovakia and Turkey have been less dependent on foreign funding because of their relatively large domestic deposit base (Appendix graph A4).

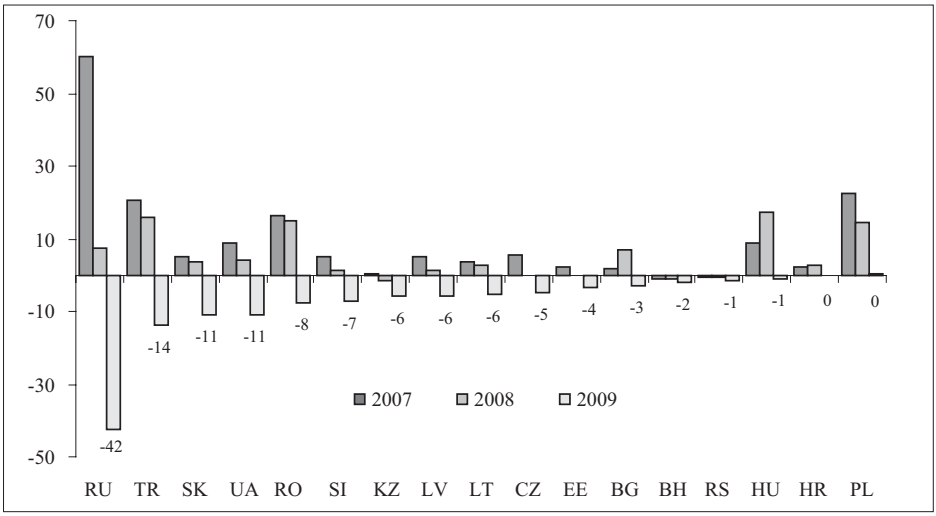
When the crisis erupted, proper pricing of funding to the local banking sector in CEE became a key issue. In those countries where banks used to fund their activities by borrowing in international capital markets, funding was completely cut off. In those countries were foreign banks were present as strategic investors, funding continued to flow, but fixing the right price became a major challenge. Banks used to price their own funds to local subsidiaries using the sovereign CDS spreads as a measure of country risk, despite the drawbacks mentioned above. But during the crisis the inefficiencies in the CDS market came to full light. Sovereign CDS spreads ceased to represent a reliable measure of long-term fundamental country risk and became excessively tied to the short-term market sentiment.

Long-term strategic investors had to adjust by developing risk pricing techniques that smoothed the peaks in CDS pricing while still taking into account changes in country risks. Reflecting these adjustments, cross-border bank flows to the region were not disrupted as seriously as feared (graph 7), despite the fact that financial markets were seriously hit by the crisis and the whole region (except for Poland) plunged into deep recession (see Mihaljek, 2010). Major international banks thus demonstrated that they had a long-term horizon when deciding their funding strategy to local subsidiaries in this region. By contrast, in countries such as Russia, where cross-border bank flows were not related to intra-group funding, the reduction of inflows was much sharper, probably because foreign creditors continued to price risk according to the CDS benchmark, thus overreacting to the crisis.[3]

Although the economic growth model of CEE countries and the business model of international banks active in the region will likely be readjusted, CEE is expected to remain dependent on external financing for the foreseeable future. This reinforces the need to develop a proper benchmark to price the country risk. Underpricing of risks might lead to a new round of excessive lending and asset price increases. Overpricing might lead to excessive tightening of capital inflows, which would hamper the long-term growth.

[3] Slovakia is a special case, partly because it adopted the euro in 2009 (see Mihaljek, 2010). Note that the changes shown would be considerably smaller if they were expressed in terms of GDP or private sector credit.

Graph 7: Evolution of cross-border financing of CEE economies,[1] in billions of USD



[1] *External loans of BIS reporting banks vis-à-vis individual countries banking sector, exchange rate adjusted changes in gross amounts outstanding.*

Note: BH – Bosnia and Herzegovina; BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RS – Serbia; RU – Russia; Sl – Slovenia; SK – Slovakia; TR – Turkey; UA – Ukraine.

Source: Authors' calculation based on BIS data.

4 Review of the literature on CDS spreads decomposition

Although credit default swaps are a relatively recent financial innovation, there is already a large literature on their pricing and valuation. Two main theories on CDS pricing have emerged so far: the "probability model", which looks at the present value of a series of cash flows weighted by their probability of non-default; and the "no-arbitrage model" of Duffie (1999) and Hull and White (2000a and 2000b).

The relatively small empirical literature has focused on the determinants of CDS spreads and their role in forecasting rating events. Cossin and Hricko (2001) showed that the determinants of CDS premia were quite similar to those of bond spreads, including ratings, yield curves, stock prices and leverage ratios. Houweling and Vorst (2001) and Hull et al. (2003) compared the credit risk pricing between the bond market and the CDS market. Both papers found that, when swap rates were used as benchmark risk-free rates, the price discrepancies between bond spreads and CDS premia were quite small (about 10 basis points). Moreover, Hull et al. (2003), and Norden and Weber (2004a and 2004b) found strong evidence that the CDS market anticipated credit rating announcements, particularly negative rating events. The strong impact of negative rating events on CDS spreads was also found by Micu et al. (2004).

Zhu (2004) confirmed the theoretical prediction that bond spreads and CDS spreads moved together in the long run, but found that this relationship did not always hold in the short run. The deviation was largely due to different responses of the two markets to changes in credit conditions; in particular, the CDS market often moved ahead of the bond market in price adjustment. Varga (2009) found that Hungary's credit risk premium was primarily defined in the Hungarian sovereign CDS market, i.e., new information pertaining to Hungary's credit risk was captured by CDS spreads ahead of the foreign currency bond market. Nevertheless, during particularly turbulent market periods, Hungarian sovereign CDS spreads tended to rise higher than was fundamentally justified. Varga also noted that the CDS spreads of emerging market countries with a higher credit rating were often significantly higher for an extended period than the average CDS spreads of lower-rated countries.

5 Alternative measure of country risk premium: econometric approach

The above findings suggest that in periods of market distress the component of CDS spreads that captures short-term risk aversion and market sentiment tends to drive the spreads. To gain an insight into this issue, in our empirical analysis we test an alternative measure of country risk premium based on the long-term relationship between CDS spreads and external ratings, which are taken to reflect the fundamental component of country risk. This allows us to extract from the CDS spreads the volatile short-term component that is subject to extreme fluctuations when markets are disrupted. In addition, we use a proxy for the degree of international risk aversion to capture shifts in market sentiment which may have contributed to the widening of sovereign CDS spreads beyond fundamentals.

5.1 Data

Our data set comprises monthly data for the period 2000-09 covering 14 CEE countries grouped into two main panels: new EU member states (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and Slovakia), and other CEE, which includes two EU candidates (Croatia and Turkey), one potential candidate (Serbia), plus Kazakhstan and Russia.

The dependent variable is the sovereign CDS spread. Given that for some maturities market data are not available (or the underlying securities are illiquid), we opted for spreads on five-year CDSs in US dollars provided by Bloomberg, as these turn out to be among the most liquid credit default swaps. The regressions are computed using the logarithm rather than the level of CDS spreads, because changes in credit ratings are generally not followed by linear changes in CDS spreads.

The main explanatory variable is the probability of default on a sovereign bond. This data series is obtained from a conversion matrix based on multi-year cumulative default rates for sovereign issuers calculated by the main rating agencies – Moody's, S&P's and Fitch. Cumulative defaults rates associated with each rating scale are generally based on a "static pool" approach. In the case of S&P's, for example, they are obtained by calculating marginal weighted average default rates conditional on survival (survivors being

non-defaulters) for each possible time horizon, and accumulating marginal default rates. The cumulative default rate is then equal to one minus the proportion of survivors. In our regressions we use a simple average of cumulative default probabilities by the three rating agencies in order the better to reflect the "consensus" view on country risk.

The enormous criticism of rating agencies in light of the latest financial crisis has brought into question the reliability of ratings as an indicator of long-term probability of default. Rating agencies have often been blamed for reacting after the fact rather than anticipating changes in fundamentals. The rating changes have often turned out to be procyclical and a possible cause of market instability. Although we are sympathetic to some of this criticism, we would like to point out that rating agencies provide the only externally available estimates of the probability of sovereign default. Efforts to build a more accurate measure of the probability of sovereign default would go far beyond the scope of this paper. One should also admit that, over a longer time period, the performance of rating agencies in the sovereign area has not been so bad, especially in comparison to the newer instruments such as CDOs. Large changes in sovereign credit ratings have been relatively uncommon, especially for higher rated countries, and the percentage of unchanged ratings declines with the passage of time.[4]

To model the observable shifts in global risk aversion, we use the Chicago Board Options Exchange Volatility Index, also known as the VIX. Although the VIX mainly measures market expectations of near-term volatility in the S&P 500 index, it is also a good proxy of future volatility in global financial markets. The VIX also helps identify episodes of lower- and higher-than normal volatility and thus allows us to define more precisely periods of financial market disruption. This approach is hence preferable to the use of crisis dummies, which is always somewhat arbitrary.

5.2 Estimation approach and results

Following Varga (2009), we estimated a panel regression with logarithm of CDS spreads as the dependent variable, and average probability of sovereign default and a proxy for global risk aversion as explanatory variables:

$$log(CDS_{i,t}) = \alpha_0 + \alpha_1 PD_{i,t} + \alpha_2 VIX_t + u_i + \varepsilon_{i,t}$$

where $CDS_{i,t}$ is the sovereign CDS spread for country i at time t; $PD_{i,t}$ is the average rating agencies' probability of default for sovereign bonds of country i at time t; VIX_t is the Chicago Board Options Exchange Volatility Index at time t; u_i is an unobserved country specific effect; and $\varepsilon_{i,t}$ is the error term.

The model was estimated using two techniques: fixed effects and OLS with panel-corrected standard errors (PCSE). The choice of the fixed effects estimation was based on the Hausman test, which consistently showed that the fixed effects model was preferred over the random effects model. The intuition behind this result is that the determinants of CDS spreads are correlated with country-specific effects (see Varga, 2009). We also report an OLS estimator with panel-corrected standard errors, following the approach pro-

[4] For more details, see Standard & Poor's (2010).

posed by Beck and Katz (1995). This approach helps address a potential inconsistency of estimators in the presence of heteroskedasticity and spatial correlation among panels. To check the robustness of the relationship between the CDS spreads and credit ratings the model was first estimated on the full sample of countries, and then on the two subsamples, the EU members and other CEE countries.

Table 2: Estimated relationship between sovereign CDS spreads and sovereign default probabilities

	Estimate 1 Full sample FE	**Estimate 2 Full sample PCSE**	**Estimate 3 EU sample PCSE**	**Estimate 4 Other CEE sample PCSE**
Constant	1.9730	1.8033	1.3305	2.9301
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
PD	0.1958	0.2435	0.2354	0.1767
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
VIX	0.074	0.0724	0.0859	0.0536
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Observations	1,082	1,082	648	434
No. of groups	14	14	9	5
R^2		0.7242	0.7265	0.7239
R^2 within	0.6592			
Hausman test	chi^2 (2) = 6.80 Prob>chi^2 = 0.0333			

Note: p-values in brackets. FE refers to fixed effects estimates, PCSE to OLS estimates with panel-corrected standard errors.

* *Significance at 10%.*

** *Significance at 5%.*

*** *Significance at 1%.*

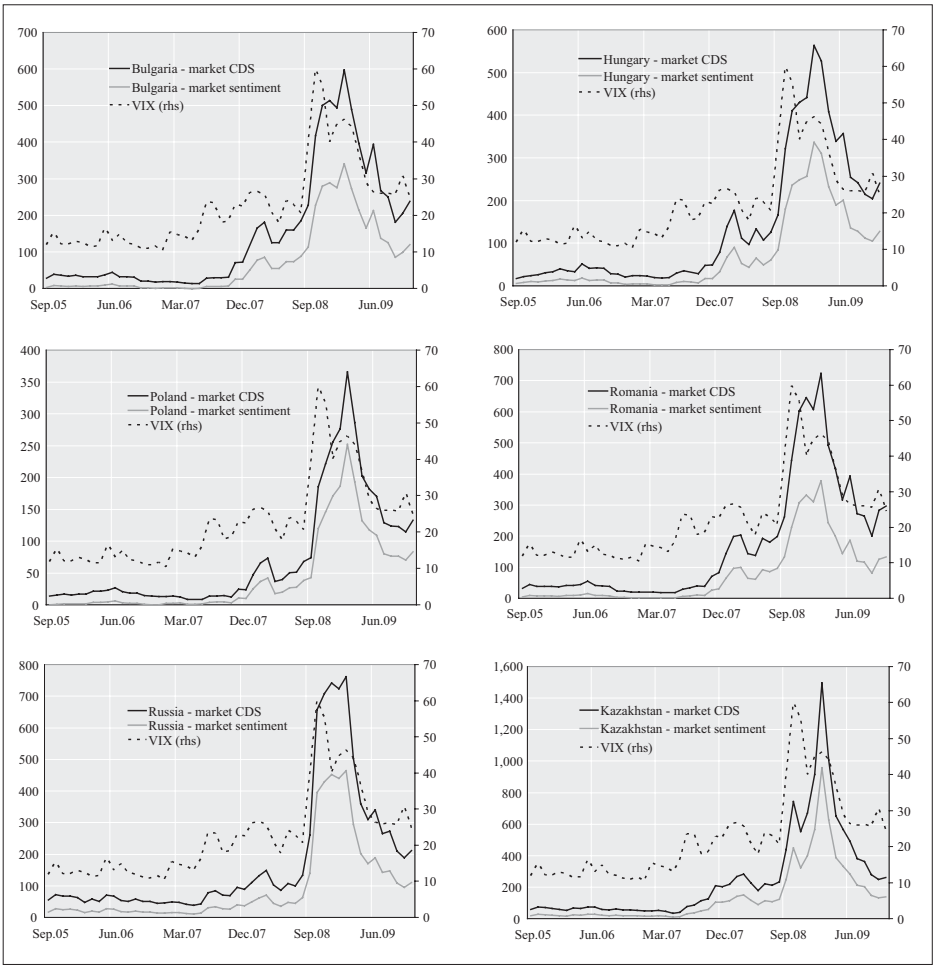
Source: Authors' calculations.

The results are shown in table 2. The estimates confirm that a statistically significant positive relationship exists between the CDS spreads and the probability of sovereign default measured by external credit ratings. A 1% increase in the probability of sovereign default is estimated to increase the corresponding CDS spread on average by about 0.20%. The estimated risk aversion coefficient indicates that an increase in market volatility of 1% translates into an average increase in CDS spreads of about 0.07%. This implies that in the aftermath of the Lehman collapse, when market volatility increased in the order of about 2,500 basis points compared to the 2000-08 historical average, the average increase in CDS spreads was around 170 basis points, regardless of any change in underlying default probabilities. The estimated coefficients are fairly stable across different specifications.

The estimates from table 2 can be used to calculate a long-term "fundamental" and a short-term "market sentiment" component of the CDS spread. The results of this decomposition are shown in graph 8, where we used the estimated coefficient on the probability

of default from Estimate 2 in table 2 to obtain the long-term fundamental component of the spread. Adverse market sentiment, shown as the area below the yellow line in graph 8, was clearly a key driver of the sharp increase in sovereign CDS spreads during the most severe phase of the crisis from September 2008 through March 2009.

Graph 8: Decomposition of CDS spreads: fundamental and market sentiment components[1]



[1] *The market sentiment component of the CDS spread is obtained as the difference between the market CDS spread and the estimated long-term fundamental component based on sovereign default probability.*

Source: Authors' calculations.

Table 3 shows the size of these two components of CDS spreads in 2009. For EU member countries, the long-term fundamental component of CDS spreads – which represents our measure of the country risk premium – "explained" on average between 35%

(Estonia) and 53% (Romania) of the market CDS spread. For other CEE countries, the fundamental component "explained" between 41% (Kazakhstan) and 68% (Turkey) of the market CDS spread. In other words, out of the 300 basis points CDS spread for Croatia in 2009, only about half represented a fundamental country risk premium, while the other half represented the impact of market sentiment factors – both observable and unobservable – that were unrelated to Croatian economic fundamentals.

Table 3: Market CDS spread and its estimated fundamental component; in basis points, for five-year CDS contracts in USD

	Market CDS spread	Estimated fundamental component of CDS spread	Percentage of CDS spread explained by the fundamental component
	2009 average, in basis points		
	(a)	(b)	(b) / (a)
EU members			
Bulgaria	352	165	47
Czech Rep.	136	50	37
Estonia	382	133	35
Hungary	336	149	44
Latvia	710	328	46
Lithuania	498	205	41
Poland	190	67	35
Romania	391	206	53
Slovakia	106	42	39
Other CEE			
Croatia	304	146	48
Serbia	458	257	56
Russia	374	163	44
Kazakhstan	587	241	41
Turkey	283	193	68

Sources: Authors' calculations, Bloomberg.

6 Implications for cross-border bank flows

To evaluate the implications of alternative country risk measures for cross-border bank flows we estimated an additional set of regressions where the dependent variable was cross-border loans to banks, and the explanatory variables were our measure of the country risk premium and the VIX as a proxy for global, common and observable risk aversion. The model was tested for an extended panel of 21 emerging market countries including 14 CEE economies from our sample and seven Asian emerging markets (China, Indonesia, Korea, Malaysia, the Philippines, Thailand and Vietnam). We selected these economies in order to analyse the reaction of cross-border loans to shifts in long-term country fundamentals and risk aversion in countries with different degrees of foreign ownership in the banking sector, i.e., a generally high degree of foreign ownership in CEE and a low degree in emerging Asia.

We first estimated the model for the whole sample, adding a dummy variable with a value of 1 for countries with more than 50% of foreign-owned assets in the banking sector and a value of 0 otherwise. Next we estimated the model for the panels with low and high degrees of foreign bank ownership. The first panel included countries where foreign banks own from 10% to 35% of banking sector assets: Asian emerging economies, Kazakhstan, Russia and Turkey. The second panel included the remaining CEE countries, where foreign bank ownership shares exceed 50% of total banking sector assets.

Data on cross-border loans were taken from the BIS locational banking statistics. We looked at exchange rate-adjusted changes in cross-border loans to banks as a percentage of the borrowing country GDP. To isolate the impact of shifts in global risk aversion on cross-border bank flows we focused on the period from Q3:2005 to Q4:2009. The estimates were done using the OLS with panel-corrected standard errors.

As indicated in table 4, the results of the regression on the full sample confirm that cross-border bank flows react negatively to increases in the country-specific component of sovereign risk as well as to increases in global risk aversion, while the impact of foreign bank ownership is positive. More precisely, a 1% increase in our measure of country risk reduces cross-border bank flows by 0.004% of GDP per quarter; a 1% increase in global risk aversion reduces the flows by 0.024%; while a percentage point higher foreign bank ownership increases cross-border flows by 0.6%.

Table 4: Cross-border flows and alternative measures of country risk premium

	Estimate 1 Full sample	**Estimate 2 High foreign bank ownership sample**	**Estimate 3 Low foreign bank ownership sample**
Constant	0.9743	1.6063	0.8408
	[0.000]***	[0.002]***	[0.000]***
Country risk premium	–0.0040	–0.0060	–0.0019
	[0.013]**	[0.032]**	[0.098]*
VIX	–0.0237	–0.0185	–0.0279
	[0.084]*	[0.461]	[0.000]***
Foreign bank ownership	0.5806		
	[0.013]**		
No. of observations	330	171	159
No. of groups	20	11	9
R^2	0.120	0.088	0.144

Note: p-values in brackets. OLS estimates with panel-corrected standard errors.

* *Significance at 10%.*
** *Significance at 5%.*
*** *Significance at 1%.*

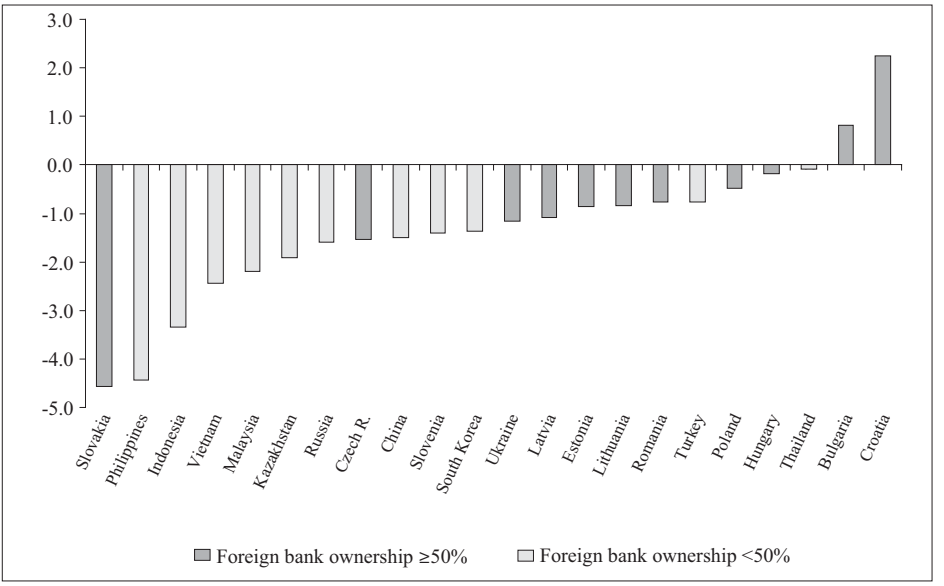
Source: Authors' calculations

In the sample of countries with a high degree of foreign bank ownership, the estimated country risk coefficient is 50% higher than in the full sample: a 1% increase in our measure of fundamental country risk reduces exchange rate-adjusted cross-border flows

to banks in CEE by 0.006% of GDP in a quarter. The coefficient of global risk aversion is statistically insignificant for this group of countries. By contrast, in the sample of countries with a low degree of foreign bank ownership, the estimated country risk coefficient is 50% lower than in the full sample, and the coefficient of global risk aversion is statistically highly significant.

These results suggest that cross border bank flows are strongly correlated with the presence of foreign-owned banks in the domestic banking sector. This evidence is consistent with the observed stability of cross-border bank flows to CEE countries after the Lehman collapse, including at the peak of the crisis in Q1:2009. At the time, parent banks from western Europe provided large amounts of liquidity support to their local subsidiaries in CEE, making a judgment – which ex post turned out to be correct – that long-term fundamentals in the region had not deteriorated as much as suggested by headline measures of country risk such as the CDS spreads or measures of global risk aversion such as the VIX. Banks in Asian emerging economies had a different experience: reflecting a large increase in global risk aversion, foreign-owned banks withdrew large amounts of liquidity from local banking systems during this period, even though country fundamentals in emerging Asia deteriorated very little. As indicated in graph 9, countries with a high degree of foreign bank ownership indeed experienced a smaller decrease (or in some cases, saw an

Graph 9: Evolution of cross-border bank financing in emerging markets;[1,2] percentage change in cumulative cross-border flows, 2008-09 vs. 2006-07



[1] Based on exchange rate adjusted changes (in USD) in external loans of BIS reporting banks vis à-vis individual countries' banking sector.

[2] Foreign bank ownership as a percentage of total banking sector assets.

Source: Authors' calculation, based on the BIS data.

increase) in cross-border bank flows during 2008-09 relative to 2006-07, compared with countries with a low degree of foreign bank ownership. As noted above, Slovakia is an exception – foreign-owned banks used the highly liquid Slovak banking system to obtain liquidity for their headquarter operations during the crisis (see Mihaljek, 2010).

7 Summary and conclusions

In recent years sovereign CDS spreads have emerged as a leading benchmark for private sector pricing of country risk in international business operations, including cross-border bank lending. Under normal market conditions, the CDS spreads represent a very useful source of information on country risk, as they capture changes in the set of available information much earlier than the rating changes. However, the CDS market can be subject to rapid shifts in sentiment that are unrelated to underlying country risk fundamentals. This can in turn lead to underpricing or overpricing of sovereign risk, thus lowering the informative content of CDS spreads as a measure of country risk.

Finding a proper benchmark with which to price sovereign risk is of particular importance for CEE countries because of the large role played by foreign banks in the region and the high dependence of local banking systems on foreign funding. In this paper, we tested an alternative measure of country risk premium based on a long-term relationship between CDS spreads and external ratings, which are taken to reflect the fundamental component of country risk. Our findings suggest that adverse market sentiment was a key driver of the sharp increase in sovereign CDS spreads of CEE countries during the most severe phase of the crisis, from September 2008 through March 2009. Our measure extracted the volatile short-term component of CDS spreads from the country risk premium and was therefore more stable in the period of market distress.

Our measure of country risk also helps explain the stability of cross-border flows to banks in countries with a high degree of foreign bank ownership. In particular, cross-border flows to CEE countries with a high degree of foreign bank ownership have been driven to a much greater extent by country risk fundamentals and to a much lesser extent by global risk aversion than cross-border flows to banks in emerging Asia, Kazakhstan, Russia and Turkey, which have a considerably smaller presence of foreign banks. This evidence confirms that major international banks have a long-term horizon in funding of their local CEE subsidiaries.

APPENDIX

Box A1: Main features of CDS markets

The credit default swap in its simplest form is a contract between two private parties in which the buyer of the CDS makes a series of payments to the seller and in exchange receives a payoff if a specified credit instrument ("reference entity"), typically a bond or loan, undergoes a defined "credit event" such as a failure to pay, restructuring or default. Although the CDS contract refers to a specified bond obligation, usually a corporation or government, the reference entity is not a party to the contract. The protection buyer makes quarterly premium payments, the "spread", to the protection seller. If the reference entity defaults, the protection seller usually pays the buyer the par value of the bond in exchange for physical delivery of the bond.

The largest players in the global CDS market are commercial banks, insurance companies, financial guarantors and hedge funds. Banks figure prominently on both the buying and selling sides of the market because CDS contracts offer them an attractive way to transfer the credit risk associated with the loans they have made without removing these assets from their balance sheets and without involving the borrowers. Insurance companies, financial guarantors and hedge funds primarily act as sellers of protection in the CDS market, because it offers them an opportunity to enhance investment yields via arbitrage, hedging and speculation involving CDS contracts.

The spread paid by the protection buyer to the seller is quoted in basis points per annum of the contract's notional value and is usually paid quarterly. The CDS spread is a different concept from the yield spread of a bond: it is not based on any risk-free bond or benchmark interest rates, but rather indicates the annual price of protection in basis points of the notional value of the bond. For instance, a CDS spread of 300 basis points indicates that the buyer of the CDS has to pay the seller $300,000 annually in order to insure a notional amount of $10 million of a given bond. Most CDS contracts are in the $10-20 million range with maturities between one and 10 years, with the five-year maturity being the most common tenor.

Although CDS contracts have been compared with insurance – because the buyer pays a premium and in return receives a payment if one of the events specified in the contract occurs – there are a number of important differences between CDS and insurance contracts.

- To purchase insurance, the buyer is generally expected to have an insurable interest such as owning a debt obligation. In contrast, the buyer of a CDS does not need to own the underlying bond or other form of credit exposure, or does not even have to suffer a loss from the credit event.
- The cost of insurance is based on actuarial analysis, whereas CDS are derivatives whose cost is determined using financial models and arbitrage relationships with other credit market instruments such as loans and bonds from the same reference entity.
- While insurers manage risk primarily by setting loss reserves based on the law of large numbers, dealers in CDS contracts manage risk primarily by means of offsetting CDS contracts, i.e., by hedging with other dealers and entering into transactions in underlying bond markets.
- Insurance contracts require the disclosure of all known risks involved. CDS contracts have no such requirement.
- Unlike insurance companies, sellers of CDS contracts are not required to maintain any capital reserves to guarantee payment of claims. Banks, which are major CDS dealers,

are subject to bank capital requirements, but they typically keep CDS contracts off their balance sheets and hence do not necessarily keep reserves for contingent payments.

- While an insurance contract provides an indemnity against the losses actually suffered by the policy holder, the CDS provides an equal payout to all holders, calculated using an agreed, market-wide method.

When entering into a CDS contract, both the buyer and the seller of credit protection take on counterparty risk: the buyer takes the risk that the seller will default and that he will thus lose protection against default by the reference entity; the seller takes the risk that the buyer will default and thus stop making the agreed payments on the contract. The CDS contracts also involve liquidity risk: if one or both parties to a CDS contract must post collateral (which is common), there can be margin calls requiring the posting of additional collateral. The counterparty and liquidity risks figured prominently in the latest financial crisis, notably in the case of the bankruptcies of Lehman Brothers and American Insurance Group (AIG), both of which were major players in the CDS and other derivative markets.

If a credit event specified in the CDS contract occurs, the seller of the CDS can compensate the buyer via either physical or cash settlement. In a physical settlement the protection seller buys the distressed loan or bond from the protection buyer at par. In a cash settlement the payment from the seller to the buyer of a CDS is determined as the difference between the notional and market value of the reference obligation. Market value of the distressed obligation is typically determined in an auction (also known as a *credit-fixing event*) in which participating dealers (e.g., big investment banks) submit prices at which they would buy and sell the reference entity's debt obligations, as well as net requests for physical settlement against par.

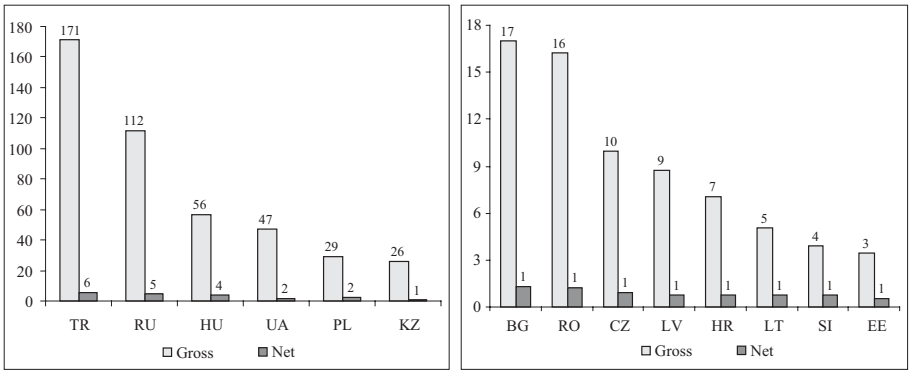
In the early stages of CDS market development, documentation for CDS contracts was not standardised, which led to many disputes when credit events occurred. Since then, documentation has been standardised to a great extent. Trading of CDS contracts is expected to shift from "over the counter" transactions to central clearing houses, which will act as central counterparties to both sides of a CDS transaction, thus practically eliminating the counterparty risk.

Since the introduction of first credit default swaps in the late 1990s, the CDS market has expanded exponentially.[1] According to the BIS derivatives statistics, the notional amount outstanding of sovereign CDS increased from around $870 billion at the end of 2004 to $1,660 billion at the end of June 2008, which corresponds to an annual growth rate of 20%. From end-June 2008 to end-June 2009, however, the sovereign CDS market shrank by 20%.

In CEE, the gross notional amount of sovereign CDS contracts outstanding as of mid-February 2010 was around $515 billion. About 55% of the market was accounted for by the contracts insuring against the default of Turkish and Russian bonds, with the next 30% insuring against the default of Hungarian, Kazakh, Polish and Ukrainian sovereign bonds (graph A1). The total number of contracts with CEE sovereigns as reference entities was around 42,000 as of mid-February 2010 (graph A2). The average size of a contract was around $10.5 million.

[1] *The first modern credit default swaps were apparently developed in 1997 by a team working for JPMorgan Chase. They were designed to protect the EBRD from the risk of default of Exxon.*

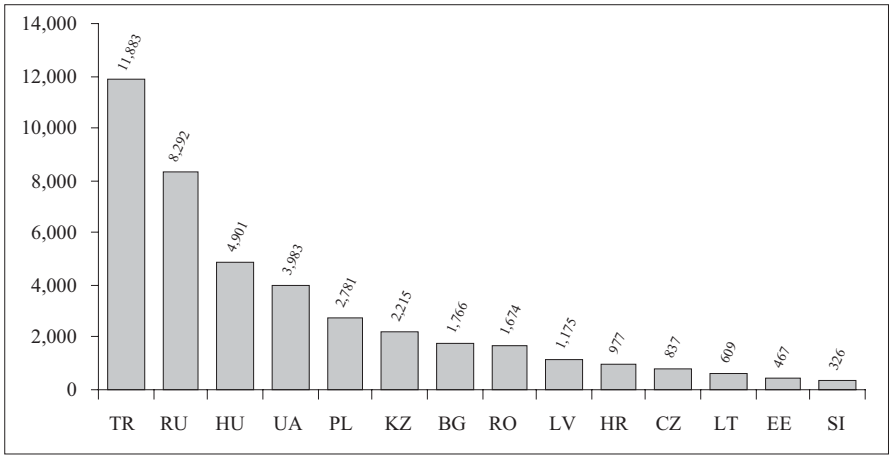
Graph A1: CDS volumes of central and eastern European sovereigns; notional amounts as of 12 Feb. 2010, in billions USD



Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; Sl – Slovenia; TR – Turkey; UA – Ukraine.

Source: DTCC.

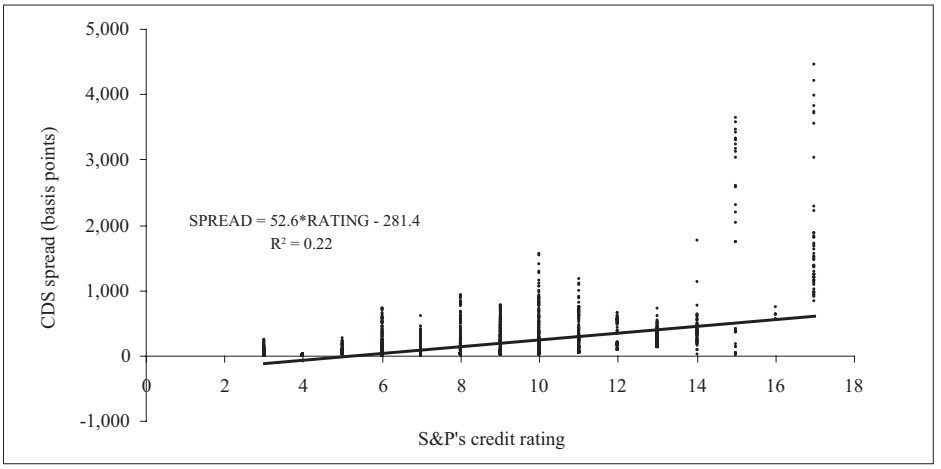
Graph A2: Number of CDS contracts on CEE sovereigns, as of 12 Feb. 2010



Note: BG – Bulgaria; CZ – Czech Republic; EE – Estonia; HR – Croatia; HU – Hungary; KZ – Kazahstan; LT – Lithuania; LV – Latvia; PL – Poland; RO – Romania; RU – Russia; Sl – Slovenia; TR – Turkey; UA – Ukraine.

Source: DTCC.

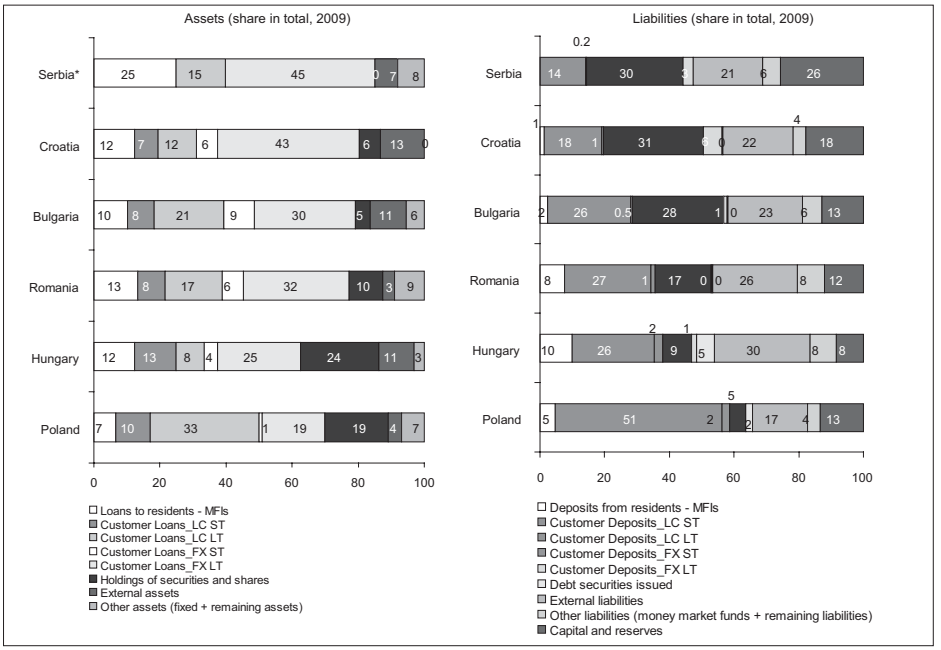
Graph A3: Sovereign credit ratings and CDS spreads



Note: The horizontal axis measures S&P's sovereign credit ratings on a scale from 1 (AAA) to 23 (SD). The sample of countries includes Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Turkey and Ukraine; from 1 January 2003 through 16 April 2010.

Source: Authors' calculations.

Graph A4: Banking sector balance sheet in selected CEE countries, percentage



Note: For Serbia, breakdown of customer loans by maturity not available.

Source: UniCredit Group CEE Strategic Analysis.

LITERATURE

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THE EFFICIENCY OF EMERGING EUROPE'S BANKING SECTOR BEFORE AND AFTER THE RECENT ECONOMIC CRISIS

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Review article**
JEL: G21, O52
UDC: 336.7

Abstract

This paper provides estimates for the relative efficiency of banks in emerging Europe before the recent boom, just before the crisis, and right after the crisis, using a Data Envelopment Analysis (DEA). The results suggest that DEA efficiency scores before the recent crisis were strongly linked to the host country's level of development; were higher for foreign-owned banks; but did not stand out for bank groups with a presence in more than one country. The results also suggest that bank efficiency increased during the pre-crisis boom, but fell during the crisis. Finally, foreign-owned banks in emerging Europe seem to be less efficient than their mother banks, suggesting that although they may bring some efficiency benefits to their host country, they are highly affected by the local business and operational environment.

Keywords: emerging Europe, macro-financial links, bank sector efficiency

* We would like to thank the participants of the Institute of Public Finance conference on *Finance and Growth in Central and Eastern Europe* (April 2010, Zagreb, Croatia) and two anonymous referees for their useful comments and suggestions. The views in this paper are those of the authors and should not be attributed to the International Monetary Fund.

** *Received:* June 16, 2010
Accepted: July 17, 2010

1 Introduction

Emerging Europe grew fast before the onset of the economic crisis in 2008. During this period, the region included some of the fastest growing emerging economies, even after controlling for differences in initial per capita GDP (figure A1).

The region's pre crisis boom was to a large extent driven by fast bank-led credit growth.[1] As part of the EU-driven reforms and widespread liberalization – in new EU members and countries with EU aspirations – capital controls and credit market regulations were dismantled in most countries (figures A2 and A3). Financial openness, measured by foreign assets plus foreign liabilities as a share of GDP, increased substantially (figure A4), and borrowing costs fell sharply throughout the region. As a result, private credit expanded in emerging Europe faster than in other emerging economies (figure A5).

The opening up of the emerging European economies combined with privatization in the financial sector led to a sharp increase in foreign bank ownership throughout the region. Before the crisis, the share of foreign banks in total bank assets reached a range from 29 percent in Slovenia to 99 percent in Estonia, with an average of 77 percent and a median of 84 percent (figure A6). The easy access of foreign owned banks to financing from their parent banks was to a large extent the engine of the pre-crisis credit boom.

The importance of bank lending in emerging Europe's recent boom-and-bust cycle raises questions about the efficiency of the banks in the region. It could be argued that bank efficiency could suffer during a credit boom, as temporarily high bank profitability relaxes incentives to save costs. On the other hand, intense competition during a boom may increase bank efficiency. With almost all major banks retaining their exposure in the region during the crisis – coordinated through the Vienna initiative[2] – questions related to bank efficiency are also relevant for the growth prospects of emerging Europe looking forward.

Previous literature has focused primarily on bank efficiency in emerging Europe during the liberalization years, before the recent boom-and bust-cycle. Poghosyan and Kumbhakar (2010), who review the early literature, also focus on the cost efficiency of banks in 20 emerging European economies during 1993-2004 and find it to depend on progress in economic reforms, economic stability, capital regulation, and market structure in the banking sector. They also find foreign ownership to increase bank efficiency, but only in less developed economies. Their results also suggest that the adoption of EU standards by the new EU members has improved bank performance. Poghosyan and Poghosyan (2010) address similar issues, but focus on foreign owned banks. Their sample includes banks in 11 countries, during 1992-2006. They find foreign owned banks to be more efficient than domestic banks, particularly foreign green-field banks. Similar evidence in support of foreign owned banks is provided by Havrylchyk and Jurzyk (2006; 2008).[3]

[1] For more details see Vamvakidis (2009) and Ranciere, Tornell and Vamvakidis (2010).

[2] The Vienna initiative avoided any sudden halt to new lending and the resulting fire-sale of assets that would have resulted if banks had pulled out of emerging European economies during the crisis. Foreign mother banks agreed to roll-over the exposure of their subsidiaries in countries of the region, as they would have been worse off if all of them were to exit at the same time.

[3] For a review of country studies see Poghosyan and Poghosyan (2010).

This paper uses Data Envelopment Analysis (DEA) to examine bank efficiency in emerging Europe before and after the recent crisis. It compares DEA scores before the recent boom, just before the crisis, and right after the crisis. Focusing on the period just before the crisis, it compares DEA scores in different countries and attempts to explain differences based on a number of determinants, including ownership, bank size and country characteristics. In addition, the paper compares estimates of bank efficiency in bank groups that are present in more than one country and compares DEA scores in foreign owned banks with the scores of their mother banks; as far as we know, the existing literature has not addressed these issues. The sample includes only large commercial banks, as defined by Bankscope, to reduce noise and to focus on banks that could be systemic for the countries in the sample and, potentially, the region.

The results suggest that DEA efficiency scores before the recent crisis were strongly linked to the host country's level of development. Furthermore, foreign-owned banks seem to be more efficient than domestic banks, although with a relatively small difference. Bank groups with a presence in more than one country do not have higher DEA scores than the other banks in the sample. The results also suggest that bank efficiency increased during the pre-crisis boom, but fell after the crisis. Finally, foreign-owned banks in emerging Europe seem to be less efficient than their mother banks, suggesting that although they may bring some efficiency benefits to their host country, they are also affected by the local business and operational environment.

The rest of the paper is organized as follows: section two discusses the methodology; section three discusses the data and the empirical approach; section four presents results for DEA efficiency scores in banks in emerging Europe just before the recent crisis and analyses their determinants; section five compares DEA efficiency scores in banks in emerging Europe before the pre-crisis boom, just before the recent crisis and after the crisis; section six compares DEA efficiency scores in foreign-owned banks in emerging Europe with that of their mother banks; and section seven concludes.

2 Methodology

In general, a financial institution (referred to as decision-making unit or DMU) can be said to be efficient if it cannot produce more output without a consequent relative increase in inputs, or if it cannot reduce its inputs without a consequent relative decrease in output. Traditional approaches to efficiency measurement are often focused on simple ratios, although such ratios have a number of deficiencies and may be misleading because they do not control for product mix or input prices (Berger, Hancock and Humphrey, 1993; DeYoung, 1998; Diacon, 2001). The traditional accounting approach provides opportunities for comparison of the trends, and measures the performance of banks in terms of profitability. More modern approaches to efficiency measurement try to avoid the problems associated with traditional methods by using frontier efficiency methodologies. These methods proceed by identifying "best practice" frontier (and the DMUs which lie nearest to that frontier). The frontier represents the best performance that can be achieved using the currently available production technology. The efficiency of each DMU can then be measured by comparing it to the "frontier" firms which are closest to it.

There are two major classes of efficiency frontier estimation methods: the parametric approach and the non-parametric approach. Berger and Humphrey (1997) identify five different approaches to determining the efficiency frontier. The three main parametric approaches to specification of the efficiency frontier are the stochastic frontier approach (SFA), the distribution-free approach (DFA) and the thick frontier approach (TFA), while the two non-parametric approaches are DEA and the free disposal hull (FDH) method.

A major challenge for both sets of approaches is in distinguishing random error arising from accounting practice or some other source from inefficiency. Each of the parametric approaches has different ways of dealing with random error, whereas the non-parametric approaches generally ignore it. Thus, the above approaches to efficiency measurement mainly differ in the distributional assumptions imposed on random error and inefficiency.

Charnes, Cooper and Rhodes (1978) were the first to use the term DEA. Their approach applied the efficiency concept outlined by Farrell (1957). DEA gets its name because the empirical frontier truly envelops the entire data set. Since then, there have been a large number of studies that have applied and extended the methodology.

To establish the frontiers, we use linear programming-based DEA, as it is more proficient than parametric approaches at describing frontiers. DEA constructs a piecewise linear surface that connects the set of the best-practice DMUs, yielding a convex production possibilities set. We choose the DEA approach for the following reasons:

- the DEA approach has been used extensively in estimating efficiency for banking and insurance research;
- the non-parametric approach avoids the potentially inappropriate assumption for the distribution of the error terms of the parametric approach; and
- the DEA approach separately evaluates the efficiency of every DMU relative to its reference set, thus providing a relative measurement of efficiency for every single DMU.

Due to the flexible feature and its various advantages (Sengupta, 1999; and Lewin and Minton, 1986), DEA has been widely used in a variety of research areas, including in banking (Charnes et al., 1994). The DEA approach enables the determination of multiple outputs and multiple inputs in efficiency score calculation. At the same time, unlike parametric approaches, it needs no long time series. As Evanoff and Israilevich (1991) note, DEA allows one to work with fewer data, fewer assumptions and a smaller sample. A rule of thumb commonly used with DEA suggests that the number of observations in the data set should be at least three times the sum of the number of input and output variables (Cooper, Seiford and Tone, 2000; 2006).

DEA estimates the frontiers by solving a series of linear programming problems. The efficiency of each DMU is then measured by computing its distance from the frontiers. Efficiency ranges from 0 to 1, with a DMU operating on the frontier (efficiency of 1) measured as fully efficient. As this approach focuses primarily on the technological aspects of production functions, it can be used to estimate productive efficiency without requiring estimates of input and output prices. Moreover, as Cooper, Seiford and Tone (2000) describe it, for DEA the measurement units of the different inputs and outputs do not need to be congruent: inputs and outputs can be expressed in different units.

A non-parametric technique originally developed by Charnes, Cooper and Rhodes (1978) was based on constant returns to scale (CRS), but was subsequently extended by Banker, Charnes and Cooper (1984) into a model providing for variable returns to scale (VRS). However, under VRS, most large banks might appear fully efficient, possibly because of the lack of truly comparable efficient banks (Berg, Førsund and Jansen, 1991; and Berg, Hjalmarsson and Suominen, 1993). In this case, the CRS assumption allows comparing large banks to be compared with much smaller banks, thus avoiding them appearing artificially efficient.

As DEA assesses efficiency by comparing a bank's efficiency with those of others, each inefficient bank will have a group of efficient banks against which its performance is identified as inefficient. This group of efficient banks is the reference set for that inefficient bank, and the methodology directly identifies ways in which inefficiency can be increased.

DEA models may have either an input or an output orientation. An input orientation aims at reducing the input amounts as much as possible while keeping at least the present output levels, while an output orientation aims at maximizing output levels without increasing use of inputs (Cooper, Seiford and Tone, 2000; 2006). To date, the theoretical literature is uncertain as to the best choice among the alternative orientations of measurement. Nevertheless, in many cases, the choice of orientation has only a minor influence on the obtained scores (Coelli, Prasada and Battese, 1998).

A distinction is also made between the production and intermediation models, with the intermediation model having a number of different forms. Under the production approach, banks are considered as using labor and capital to produce deposits and loans, with both inputs and outputs usually measured on a physical scale, rather than in money measures. However, this approach fails to capture the role of a bank as a financial intermediary and does not include interest expenses, which is usually the largest portion of total costs.

This paper uses the intermediation approach, originally developed by Sealey and Lindley (1977). The intermediation approach perceives deposits and other funds being transformed into loans, with its different versions: the asset approach, which uses funds as inputs and loans as outputs; the user cost approach, which looks at the various contributions to banks' net revenue; and the value added approach, where inputs and outputs are identified according to their share of value added (Berger and Humphrey, 1992).

A brief description of the underlying linear programming model follows. It is assumed that there are m inputs and s outputs for every DMU. Specifically DMU_j uses amount x_{ij} of input i and produces amount y_{rj} of output r. We further assume that $x_{ij} \geq 0$ and $y_{rj} \geq 0$ and that each DMU should at least have one positive input and one positive output. For each DMU we try to obtain a measure of the ratio of all outputs over all inputs. To select the optimal weights (u and v are vectors of weights), the following problem is proposed:

$$\begin{aligned} &\max h_o(u,v) = \textstyle\sum_r u_r y_{ro} / \sum_i v_i x_{io} \\ &\textstyle\sum_r u_r y_{rj} / \sum_i v_i x_{ij} \leq 1 \quad \text{j=1,…,n;} \quad \forall r,i \,;\; u_r, v_i \geq 0 \end{aligned} \tag{1}$$

The numerator in (1) represents a set of desired outputs and the denominator represents a collection of resources used to obtain these outputs. The value h_o^* obtained from this ratio satisfies $0 \leq h_o^* \leq 1$ and can be interpreted as an efficiency rating in which $h_o^*=1$ represents full efficiency and $h_o^* < 1$ means inefficiency is present.[4] The optimal values u_r^* and v_i^* may be interpreted as weights when solutions are available from (1). But, they are determined in the solution of the model and not a priori. So these multipliers are called *virtual multipliers* and they yield a *virtual output* and a *virtual input* which can allow the efficiency ratio to be computed.

This can easily be converted to a linear programming problem (Charnes, Cooper and Rhodes, 1978):

$$\begin{aligned} &\max h_o(u,v) = \sum_{r=1}^{s} u_r y_{ro} \\ &\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0 \\ &\sum_{i=1}^{m} v_i x_{io} = 1 \\ &u_r, v_i \geq 0 \\ &\text{j=1,…,n; } \forall r, i \end{aligned} \tag{2}$$

The objective is to maximize virtual output (as defined above) subject to unit virtual input, while maintaining the condition that virtual output cannot exceed virtual input for any DMU that is considered in the study.

This problem is solved *n* times (once for every single DMU) and the results include relative efficiency scores of all DMUs. Thereafter, every DMU selects the combination of inputs and outputs that maximizes its efficiency.

DEA has been used extensively in studies of the banking industry in developed and developing economies. The method was applied for cases in the U.S., Norway, Spain, U.K., Italy, Greece, New Zealand, Malaysia, Poland, Estonia, Canada and several other countries (Emrouznejad and Podinovski, 2004; and Berger and Humphrey, 1997). It has also recently been used for Central America (Wezel, 2010) and Sub-Saharan Africa (Anayiotos and Toroyan, 2009). In addition, there are a lot of inter-country comparisons based on DEA (Berg, Hjalmarsson and Suominen, 1993; Pastor, Perez and Quesada, 1997; and Bergendahl, 1998).

3 Data and empirical approach

The sample includes 125 large commercial banks from 14 emerging European economies. It includes all commercial banks defined by Banscope as large, with available data. From these banks, 41 are domestic banks and 84 are foreign owned. From the domestic banks, 6 are stated owned and 35 are private banks. The sample also includes 9 bank groups with a presence in more than one country. The estimates are for: 2004, which

[4] The star (*) indicates an optimal value obtained from solving the model.

is the year when growth accelerated and spread in emerging Europe; 2007, which is the year before the crisis in emerging Europe; and 2009, which is the crisis year – the crisis in emerging Europe started in late 2008, while 2009 was the first year with negative growth rates throughout the region.

The relative efficiency of banks was assessed using the DEA methodology described in the previous section. As emphasized above, the choice of inputs and outputs is essential in the DEA methodology. An intermediation approach was applied in this case. Within the intermediation approach, an asset approach was chosen. In this case, resources used by the DMU should serve as inputs, while assets and incomes are outputs.

The variables chosen as inputs and outputs were determined based on data availability and considerations from previous literature. Total capital, interest expense and operating expense were chosen to serve as inputs:

- Capital indicates investment in the firm by shareholders. It can be seen as an input in two ways. First, it is a fund that banks can use to allocate and earn profit on it. Second, capital determines how much risk a bank can take and hence it limits investment in risky assets, including loans.
- Interest expense measures the cost of bank funding.[5]
- Operating expenses proxy for the operational efficiency of a DMU and, to some extent, the size of a bank.

Total loans, pre-tax profit and securities portfolio were chosen as outputs:

- The loans and securities portfolio constitute almost 80 percent of bank assets in the sample. Assets are treated as outputs as they indicate future financial inflow.
- Profit is the final outcome of a business entity. The choice of pre-tax profit is caused by the existence of the different business (tax) environments in which the banks in the sample operate.
- Security portfolio has the second biggest stake in the income bearing assets.

4 Bank efficiency in emerging Europe before the crisis

This section discusses consolidated results for different bank groups in emerging Europe for 2007, which is the year before the crisis. First, it discusses results by country of operation. It then discusses some simple comparisons and correlations of DEA scores. Finally, a simple cross-section regression is estimated with the DEA scores as the dependent variable.[6] The next section re-estimates DEA scores pooling data for all the banks in the sample for the years 2004, 2007 and 2009, in order to compare bank efficiency before, during and after emerging Europe's recent boom-and-bust cycle.

Before discussing the DEA estimates, it is interesting to examine which factors affect the efficiency scores the most. The results suggest that interest expense from inputs

[5] One could include deposits instead. However, many foreign owned banks in emerging Europe have financed a large share of their lending through borrowing from their mother banks. Domestic banks also borrowed from abroad before the crisis. Therefore, including the overall cost of funds may be more appropriate.

[6] Detailed results by bank are available from the authors.

and pre-tax profit from outputs have the largest impact on relative efficiency scores (table A1).[7] In contrast, capital and securities portfolio affect the DEA score the least. However, in the case of inputs, this sequence does not hold for some countries (in the Czech Republic, Estonia, Hungary, and Poland, operating expense has the most effect on DEA scores), while it holds for almost all countries in the case of outputs-with the exception of Hungary.

Grouping by country of operation, the results in figure A7 suggest the highest efficiency in the Czech Republic, FYR Macedonia and Bulgaria, followed by Poland, Lithuania, Estonia, Latvia, and the Slovak Republic. The lowest efficiency estimates are in Albania, Ukraine, and Serbia. Croatia, Romania and Hungary seem to be intermediate cases. These results seem close to what one would expect, at least based on each country's income levels, with the exception of FYR Macedonia, where banks seem to be more efficient than one would expect.[8]

Table A2 presents some simple comparisons of the average DEA bank scores with country characteristics. The correlation between the DEA estimates and the per capita PPP GDP is equal to 0.5 – it increases to 0.7 if FYR Macedonia, which seems to be an outlier, is excluded. However, there is no correlation of DEA scores with recent real GDP growth. The correlation with bank credit/GDP and financial openness is close to zero. However, the correlation of DEA scores with the country interest rate spread between lending and deposit rates, which to a large extent is determined by competition in the banking sector, is negative, suggesting that more competition is linked to more efficiency. The correlation with the ratio of nonperforming to total loans is also negative, suggesting that higher efficiency and better loan quality are linked. An index of credit market regulation is positively correlated with the DEA estimates (the index increases as regulation declines), suggesting that less regulation is correlated with more efficiency. The ratio of stocks traded to GDP is also positively correlated with DEA scores, suggesting that more competition from nonbank financing sources could increase bank efficiency. Finally, EU country members seem to have slightly more efficient banks – again, the difference is higher if FYR Macedonia is excluded.

When banks are grouped into domestic- and foreign-owned, the results suggest that, on average, foreign-owned banks are more efficient, with a score of 0.7, compared with 0.5 for domestic banks.

Turning to banks with a presence in more than one country, the results suggest no difference with the rest of the sample. The sample includes 9 financial institutions with a presence in more than one country.[9] Even though one may expect some similarities in the relative efficiency scores of such banks, we find no evidence in support of this hypothesis. The average DEA score in banks that belong to a group is equal to 0.67, compared with 0.63 in the other banks in the sample, which is a negligible difference. Moreover, the average standard deviation within bank groups is equal to 0.14, compared with 0.21 in the

[7] This analysis has been done on individual bank level, although the paper discusses consolidated results.

[8] Note that only two banks were represented from FRY Macedonia hence the results could be somewhat misleading.

[9] Erste (Austria), Raiffeisen (Austria), BRE (Denmark), MKB (Denmark), Komercni (France), Alpha (Greece), UniCredit (Italy), Parex (Latvia), Swedbank (Sweden).

other banks in the sample, which again is very small. These results suggest that country specific factors dominate bank efficiency and that foreign owned banks with a presence in more than one country do not transfer their knowledge and experience across-borders, at least not as much as would have been expected.

A regression framework helps determine which of the above correlations are the most robust. Table A3 presents estimates from a cross-section of the 125 banks in the sample, with the DEA scores as the dependent variable. The independent variables include: the log of the initial PPP GDP per capita, a dummy variable if the bank is foreign owned, a dummy variable for EU membership, the log of total assets, a dummy variable if a bank belongs to a group, an index of credit market regulations, the ratio of domestic bank credit to GDP, the interest rate spread, a dummy for state-owned banks, the ratio of non-performing loans to total loans, and stock traded as a percent of GDP.

The results suggest a strong link between bank efficiency and per capita GDP, foreign ownership and the stock of domestic credit to GDP. The estimate of the per capita GDP is positive and statistically significant at the 5 percent level in all but one specification. Therefore, more developed economies in emerging Europe have more efficient banks. The estimate of the dummy variable for foreign bank ownership is always positive and statistically significant at the 5 percent level – however, the estimate is relatively small, which is consistent with results in the earlier literature. Therefore, foreign owned banks seem to be somewhat more efficient in emerging Europe, even after controlling for other possible bank and country characteristics. The estimate of the stock of domestic credit to GDP is negative and statistically significant, although at the 10 percent level. This suggests that as credit expands bank efficiency suffers. This result may be linked to the period of the estimates, which is just before the recent crisis and the bursting of bubbles in the region.

The other variables do not turn out to have statistically significant estimates, in contrast to what some of the simple correlations in table A2 would suggest. The last regression in table A3 is a stepwise OLS, and confirms that per capita GDP, foreign ownership and the stock of domestic credit to GDP have the most explanatory power from the variables considered. This specification also includes EU membership, bank size, and credit market regulation.

5 Bank efficiency in emerging Europe during the boom-and-bust cycle

This section reestimates DEA scores pooling data for all the banks in the sample for the years 2004, 2007 and 2009, in order to compare bank efficiency before, during and after emerging Europe's recent boom-and-bust cycle.[10] The comparisons with respect to 2004 should be treated with caution, as there are missing values. However, data are available for almost all banks in the sample for 2009.

The results suggest that bank efficiency increased during the boom, but fell during the crisis (figure A8). On average, bank efficiency was equal to 0.55 in 2004, increasing to 0.61 in 2007, just before the crisis, but falling to 0.52 just after the crisis. Bank effi-

[10] Therefore, the DEA scores for 2007 in this case may differ from the scores in the previous section.

ciency during the boom years increased the most in Romania, Poland, and Bulgaria. It fell only in Estonia and, somewhat less so, in Slovakia and in Lithuania. In contrast, the fall in bank efficiency following the crisis was almost universal in the region. It fell the most in Bulgaria, Romania, and Lithuania, and did not increase in any of the countries in the sample.

These results also confirm higher efficiency scores in foreign owned banks, although there seems to be no difference between foreign and domestic banks in efficiency trend during the recent boom-and-bust cycle in the region (figure A9). During all this period, foreign banks had on average higher DEA scores than domestic banks. Efficiency scores increased only slightly more in foreign banks during the boom years (from 2004 to 2007) than in domestic banks. However, they fell in both cases during the crisis.

6 Bank efficiency in emerging Europe's foreign banks compared with their mother banks

This section focuses on the foreign-owned banks in the sample and compares their efficiency with that of their mother banks abroad. The above results suggest that foreign-owned banks are somewhat more efficient than domestic banks in emerging Europe. However, bank groups, with presence in more than one country, do not stand out. By comparing the efficiency scores of foreign-owned banks with that of their mother banks, this section helps to determine whether and to what extent the former are affected primarily by the business environment in their host or their source country.

Data availability limits the sample to 43 foreign owned banks operating in emerging Europe. The total number of mother banks equals 18, as one mother bank could own more than one foreign owned bank in emerging Europe. The analysis focuses on the period just before the crisis – which is the year 2007 – as there are more missing values for the earlier or later periods. Moreover, the period after the crisis involved substantial shocks in the financial sectors of most advanced European economies, which could affect the results.

The results suggest that mother banks are more efficient than their subsidiaries in emerging Europe. The average DEA score of mother banks is 0.88 compared with an average of 0.74 for their subsidiaries in emerging Europe. The standard deviation of the difference of DEA scores by bank is equal to 0.23. Moreover, from the sample of 43 subsidiaries, only 13 of them have higher DEA scores than their mother banks. Figure A10 shows that the difference in DEA scores is relatively high in some cases.

These results suggest that although foreign-owned banks in emerging Europe are more efficient than domestic banks, they are not as efficient as their mother banks. Therefore, although they may bring some efficiency benefits to their host country, they are also affected by the local business and operational environment.

7 Conclusions and further research

This paper provides estimates for the relative efficiency of banks in emerging Europe before the pre-crisis boom, just before the recent crisis, and after the crisis, using a DEA. It assesses the relative importance of possible determinants of DEA bank efficiency sco-

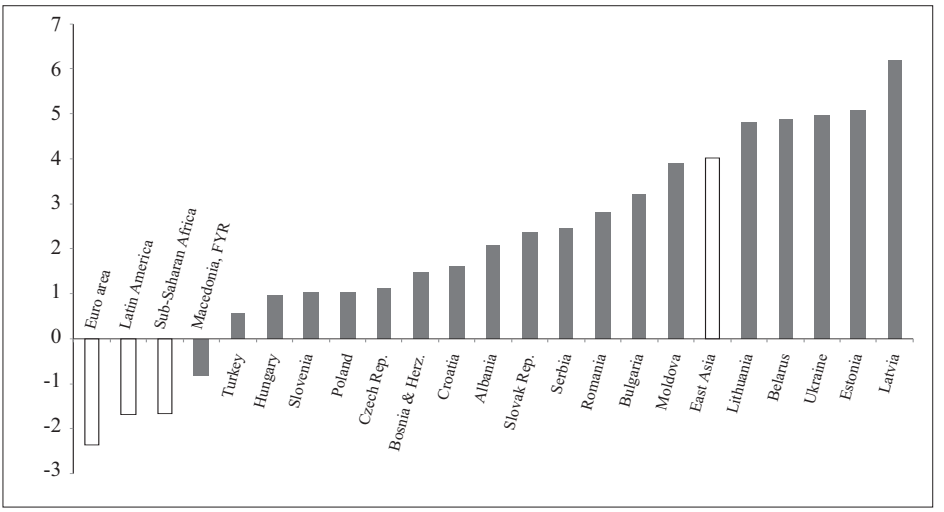
res in the region, estimates scores for bank groups with a presence in more than one country, and compares efficiency scores between foreign-owned and domestic banks, and between foreign-owned banks and their mother banks.

The results suggest that DEA efficiency scores before the recent crisis were strongly linked to the host country's level of development. Furthermore, foreign-owned banks seem to be more efficient than domestic banks, although with a relatively small difference. Bank groups with a presence in more than one country do not have higher DEA scores than the other banks in the sample. The estimates also suggest that as credit expanded before the crisis, bank efficiency suffered, which could be linked to the bubbles building in the region during this period. Other possible determinants of bank efficiency, including size, EU membership, being in a financial group with a presence in more than one country, credit market regulation, interest rate spreads, state ownership, asset quality, and stock market size do not turn out to have a statistically significant impact.

The results also suggest that bank efficiency increased during the pre-crisis boom, but fell during the crisis. Foreign owned-banks remained more efficient than domestic banks during this period. Finally, foreign-owned banks in emerging Europe have lower DEA efficiency scores than their mother banks, suggesting that although they may bring some efficiency benefits to their host country, they are highly affected by the local business and operational environment.

APPENDIX

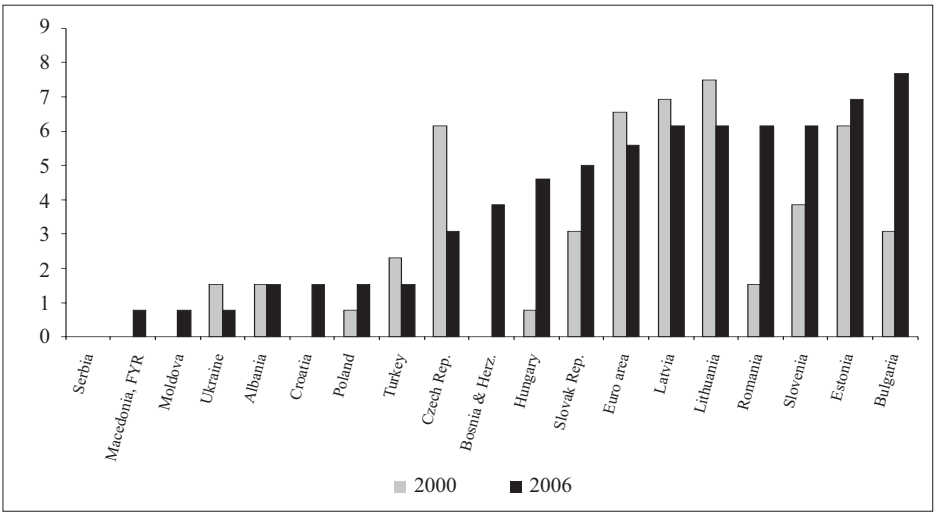
Figure A1: Real per capita GDP growth, emerging Europe and the rest of the world, 2000-2007



Note: Residuals from a growth regression that controls for initial GDP per capita.

Source: IM World Economic Outlook.

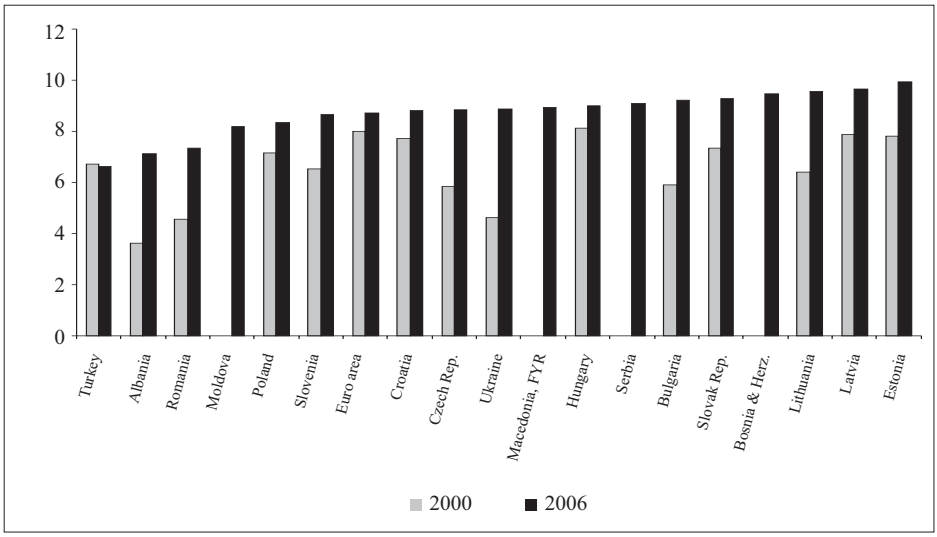
Figure A2: Capital controls, emerging Europe, 2002-2006 (an increase suggests less capital controls)



Note: Index from 1 to 10, increasing when capital controls are removed.

Source: Index of Economic Freedom, Frasere Institute.

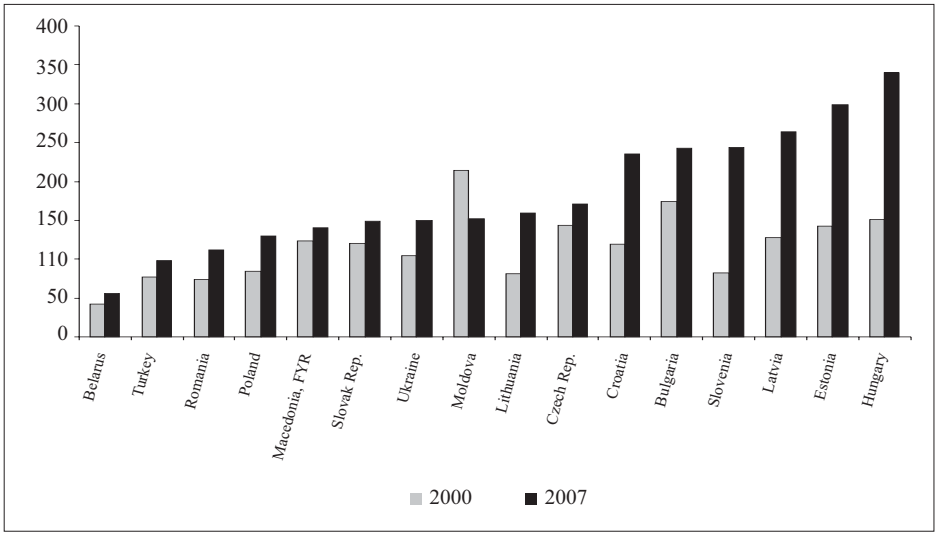
Figure A3: Credit market regulations, emerging Europe, 2000-2006 (an increase suggests less regulation)



Note: Index from 1 to 10, increasing as credit markets are liberalized.

Source: Index of Economic Freedom, Fraser Institute.

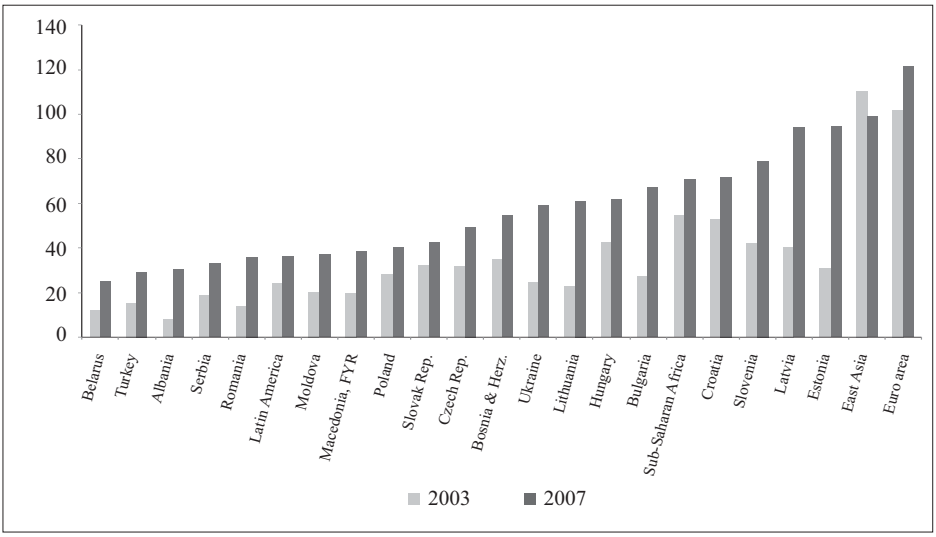
Figure A4: Financial openness (foreign assets plus foreign liabilities/GDP), emerging Europe, 2000-2007



Note: The sum of total foreign assets plus total foreign liabilities of a country's banking sector as a share of GDP proxies for financial openness.

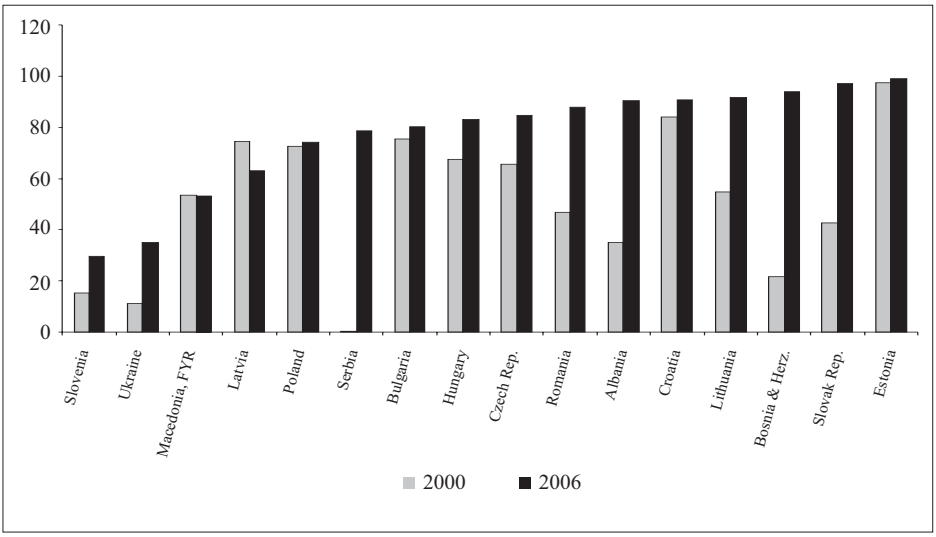
Source: IMF, International Financial Statistics.

Figure A5: Domestic private sector credit/GDP, emerging Europe and the rest of the world, 2003-2007



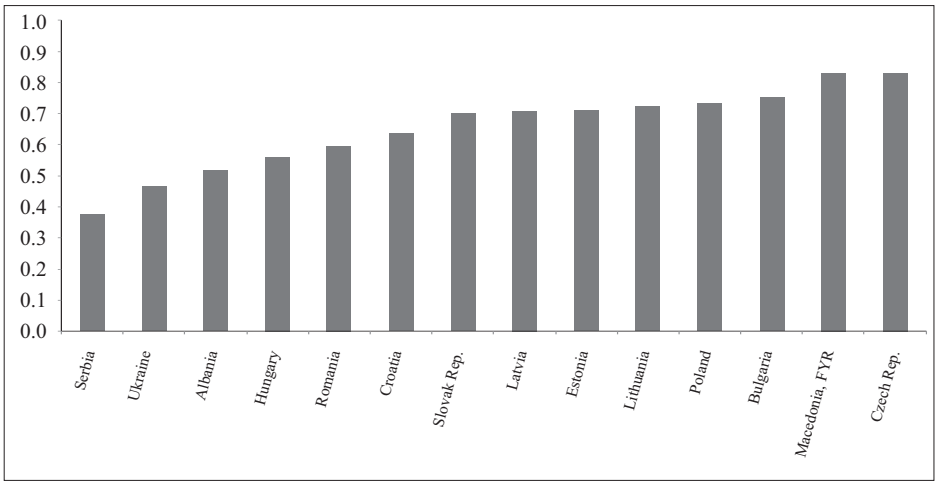
Source: IMF World Economic Outlook.

Figure A6: Asset share of foreign-owned banks, emerging Europe, 2000-2006



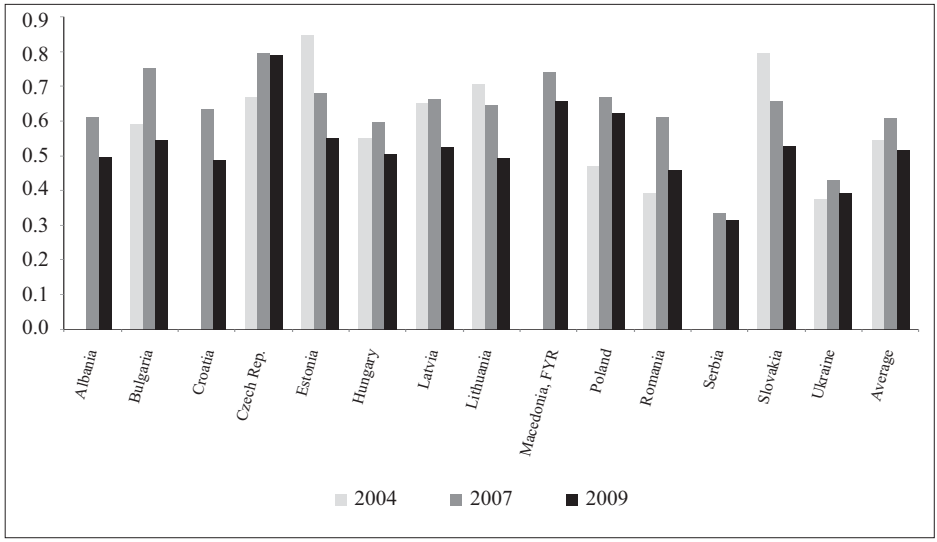
Source: Arvai, Driessen and Otker-Robe (2009).

Figure A7: Average bank sector DEA by country in emerging Europe before the crisis (2007)



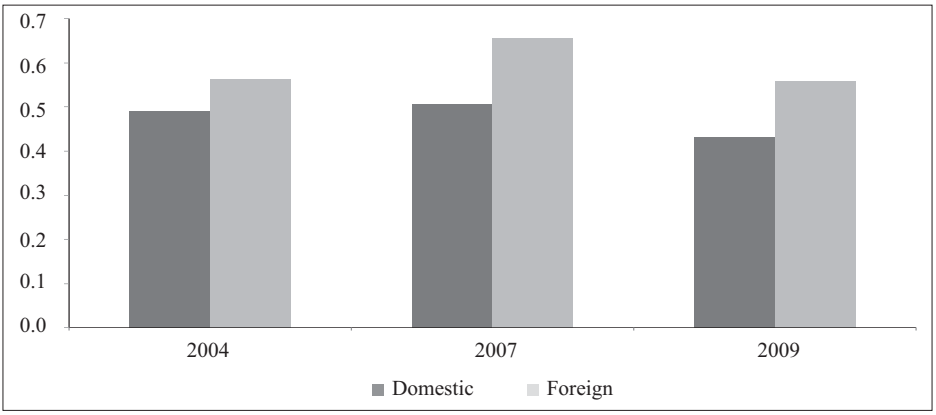
Source: Authors' calculations.

Figure A8: Average bank sector DEA by country in emerging Europe during the recent boom-and-bust cycle



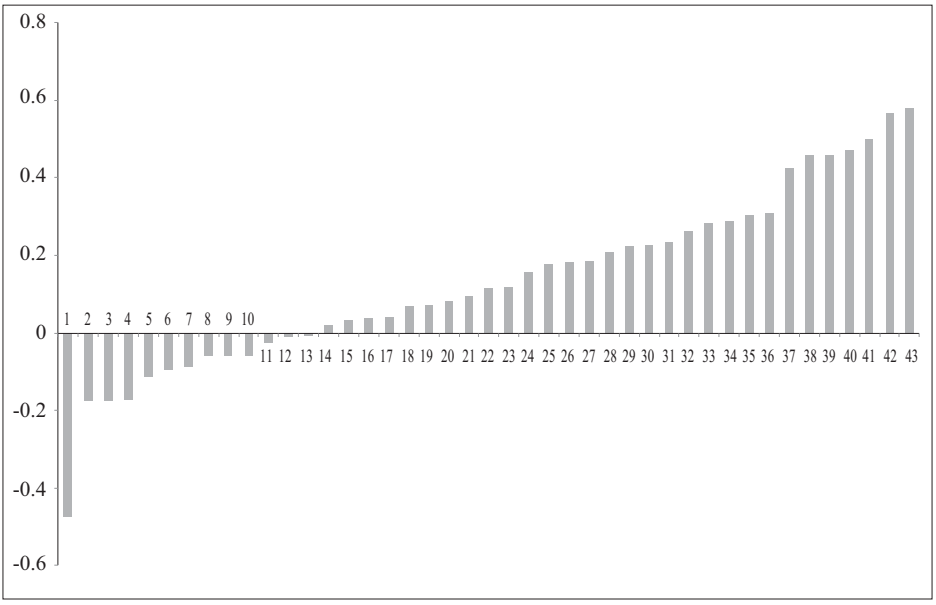
Source: Authors' calculations.

Figure A9: Average bank sector DEA by country in emerging Europe during the recent boom-and-bust cycle, foreign versus domestic banks



Source: Authors' calculations.

Figure A10: Difference in DEA scores, 2007: scores in mother banks – scores of their subsidiaries in emerging Europe



Note: Differences of DEA effeciency scores in 18 mother banks from the scores of their 43 subsidiaries operating in emerging Europe.

Source: Authors' calculations.

Table A1: Importance of factors for DEA efficiency scores (the higher the number, the more important the respective factor for the efficiency in each country)

Countries	Total capital	Interest expense	Total operating expense	Total loans - net	Pre-tax profit	Total securities
Albania	17.9	60.6	50.5	1.6	33.3	2.0
Bulgaria	20.5	617.0	150.2	17.4	40.8	11.5
Croatia	31.1	425.6	68.1	13.2	39.5	4.9
Czech Rep.	17.8	72.3	122.0	3.7	18.9	1.6
Estonia	7.4	148.6	236.1	1.9	95.0	0.9
Hungary	20.2	7.1	22.9	0.7	6.5	0.9
Latvia	30.9	278.0	48.0	9.7	31.5	2.8
Lithuania	17.5	192.3	25.6	6.3	14.6	2.2
Macedonia, FYR	79.5	3,089.6	813.5	76.2	321.9	71.0
Poland	9.2	56.7	58.4	2.4	17.9	0.4
Romania	6.4	63.7	7.8	2.2	4.0	0.3
Serbia	12.8	394.7	4.2	7.7	18.7	1.1
Slovakia	11.9	190.4	50.1	5.1	24.8	3.7
Ukraine	72.8	480.0	212.3	18.1	73.6	7.0

Source: Authors' calculations.

Table A2: Estimates of bank efficiency and other country economic indicators, 2007

	Average DEA	Log of PPP GDP per capita	Growth in last 5 years	Bank sector credit/ GDP	Financial openness	Interest rate spread	Non-performing loans	Credit market regulations	Stocks traded (% of GDP), 2003-07
Albania	0.5	8.8	5.8	61.3		8.4	3.4	7.1	
Bulgaria	0.8	9.3	6.1	59.2	243.2	6.3	2.1	9.2	5.4
Croatia	0.6	9.8	4.7	72.6	235.0	7.0	4.8	8.8	2.9
Czech Rep.	0.8	10.1	5.5	53.2	171.3	4.5	2.6	8.9	21.2
Estonia	0.7	9.9	8.3	95.1	298.9	2.1	0.5	10.0	9.2
Hungary	0.6	9.8	3.6	74.2	340.0	2.3	2.4	9.0	21.2
Latvia	0.7	9.8	9.7	89.5	264.1	4.8	0.4	9.7	0.7
Lithuania	0.7	9.8	8.4	60.2	159.1	1.5	1.0	9.6	3.1
Macedonia, FYR	0.8	9.1	4.2	34.4	140.9	5.4	9.1	8.9	2.4
Poland	0.7	9.7	5.2	46.3	130.6	n.a.	3.1	8.4	11.3
Romania	0.6	9.3	6.4	35.7	112.2	6.6	9.7	7.3	2.7
Serbia	0.4	9.2	5.7	30.8		7.1	3.8	9.1	3.5
Slovak Rep.	0.7	9.9	7.1	51.5	149.2	4.3	2.5	9.3	0.6
Ukraine	0.5	8.9	7.9	61.1	149.5	5.8	13.2	8.9	0.8
Correlation with DEA	1.0	0.5	0.0	0.1	-0.1	-0.4	-0.3	0.3	0.2
EU members	0.7								
Non EU countries	0.6								

Sources: IMF WEO; IMF IFS; World Bank World Development Indicators; and Index of Economic Freedom (Fraser Institute).

Table A3: DEA and bank and country characteristics in emerging Europe before the crisis (2007)

Initial PPP GDP per capita	0.20***	0.18***	0.13**	0.13**	0.13**	0.14**	0.15	0.13**
	(0.03)	(0.03)	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.06)
Foreign owned		0.08**	0.08**	0.08**	0.07**	0.07**	0.08**	0.08**
		(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.035)
EU membership			0.08	0.08	0.08	0.09	0.11	0.08
			(0.06)	(0.06)	(0.06)	(0.06)	(0.09)	(0.055)
Assets			-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
			(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Belongs to a group			0.005	0.004	0.01	0.01	0.005	
			(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	
Credit market regulations				0.004	0.04	0.05	0.09*	0,04
				(0.02)	(0.03)	(0.04)	(0.05)	(0.035)
Bank credit/ GDP					-0.003*	-0.003*	-0.003**	-0.003**
					(0.001)	(0.001)	(0.002)	(0.001)
Interest rate spread						0.01	0.01	
						(0.01)	(0.01)	
State owned						0.003	0.003	
						(0.09)	(0.10)	
Non-performing loans/total loans							0.003	
							(0.01)	
Stocks traded (% of GDP)							0.001	
							(0.003)	
Observations	125	125	125	125	125	125	123	125
Adjusted R squared	0.20	0.23	0.23	0.23	0.25	0.24	0.23	0.26

Note: The dependent variable is the DEA score of 125 banks in 14 emerging European economies. Heteroscedasticity-adjusted standard errors in parentheses. The last column includes estimates from a stepwise regression.

Source: Authors' calculations.

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DETERMINANTS OF SMALL AND MEDIUM SIZED FAST GROWING ENTERPRISES IN CENTRAL AND EASTERN EUROPE: A PANEL DATA ANALYSIS

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Article**
JEL: L25, L26, C23
UDC: 334.71

Abstract

The purpose of this paper is to explore the main determinants of growth in small and medium sized enterprises (SMEs) in central and eastern Europe. The important role played by SMEs in the economic development of central and eastern European (CEE) countries has attracted the recent attention of academics and policymakers but remains relatively unexplored. Empirical research has suggested that firm growth is determined not only by the traditional characteristics of size and age but also by other firm-specific factors such as indebtedness, internal financing, future growth opportunities, process and product innovation, and organisational changes. Although growth in manufacturing and service SMEs in transition economies is well explained by the traditional firm characteristics of size and age, there is no empirical evidence concerning what other specific factors may be associated with SME growth and performance in these countries. Using a panel dataset of 560 fast growing small and medium enterprises from six transition economies we find that firm size when measured by firm total assets can explain to a large extent the growth in SMEs in these countries. When size is proxied by a firm's number of employees the observed effect is marginal. Firm specific characteristics such as leverage, current liquidity, future growth opportunities, internally generated funds, and factor productivity

* The authors would like to thank two anonymous referees for their useful comments and suggestions.
** *Received:* April 1, 2010
Accepted: June 13, 2010

are found to be important factors in determining a firm's growth and performance. Age and ownership do not seem to be able to explain firm growth. The results of our empirical study have also some policy implications: we argue that governments in transition economies need to pay an increased attention to small and medium sized enterprises and try to create a business environment that will be beneficial for SME development.

Keywords: transition economy, small and medium enterprise, growth, panel data analysis

1 Introduction

The rapid growth of global markets observed over the last decade has stimulated competition in both developed and developing countries, forcing entrepreneurs and policy makers to adopt market-oriented policies. The fact that the share of SMEs has increased in these countries suggests that efficient SMEs have actually been able to deploy new strategies in order to maintain, or even enhance, their competitiveness in a globalised economy.[1] SMEs account for over 95 per cent of enterprises and 60-70 per cent of employment, and generate a large share of new jobs in OECD economies. In the European Union, they account for over 99 per cent of all enterprises. Furthermore, 91 percent of these enterprises are micro-firms with fewer than 10 workers (OECD, 2009). Given their importance in all economies, the growth of SMEs is essential for economic recovery and development.

Many different theories have attempted to identify the main factors underlying firm growth. They can be divided into two main schools: the first addresses the influence of firm size and age on growth, while the second deals with the influence of variables such as strategy, organization and the characteristics of the firm's owners/managers. In fact, a huge number of studies have been devoted to examining the relationship between growth and the firm's size and age.[2] For example, Evans (1987) examined the effects of firm size and age on growth using data on manufacturing firms in the United States. Although several previous studies had supported Gibrat's law that hypothesizes that growth is independent of size, Evans (1987) found that firm growth decreases with firm size and age. However, the empirical literature has suggested that firm growth is determined not only by the traditional characteristics of size and age but also by other firm-specific characteristics. For example, Heshmati (2001) found that the degree of indebtedness positively affects sales growth using data on Swedish micro and small firms, while Becchetti and Trovato (2002) documented the effect of external finance on firm growth in the Italian manufacturing industry, apart from the traditional determinants of age and size. Elston

[1] Many small and medium sized enterprises (SMEs) currently evolve in a complex business environment, characterized by globalization, the internationalization of markets, and the need for greater efficiency, effectiveness and competitiveness based on innovation and knowledge. This has put increasing pressure upon the management of these firms, especially the manufacturing SMEs that must now compete globally (Cagliano and Spina, 2002).

[2] Firms with growth ambitions require capital to fuel their growth. Regardless of size or age, access to capital is a matter of paramount importance. According to Timmons (1994) small, young firms tend to draw capital from internal sources, personal sources, and informal investment. As firms grow, they face additional capital requirements and must turn to external sources such as banks and public debt and equity markets. This is consistent with Myers and Majluf's (1984) assertion that SMEs have a "pecking order" of preferred capital sources in which retained earnings will be the first source accessed, followed by bank debt, private external equity and then public debt or equity.

(2002) provided evidence that cash flow has an impact on the growth of firms listed in the Neuer Market of Germany, even when controlling for firm size and age. In a recent study Morone and Testa (2008) using a sample of 2,600 Italian SMEs find that, on average, young firms are more likely to experience positive growth; moreover, turnover growth is positively associated with firms' size, process innovation, product innovation and organisational changes. In contrast, marketing innovation does not considerably affect Italian SME growth.

While a significant amount of research has been done on the determinants of growth in large firms, much less is known with respect to SMEs, especially manufacturing SMEs, given that their growth and prosperity are usually more often and potentially subjected to different constraints and contingencies related to their specificity as business organizations (Raymond, Bergeron and Blili, 2005). The specific characteristics that fundamentally distinguish SMEs from large enterprises relate to their environment, structure, strategy and decision making process, but also relate to their flexibility, proximity to markets, and quickness to react and reorient themselves.[3] Some recent studies (see Markovics, 2005; and Lesáková, 2009) emphasize also the role of innovations as a factor of the increased competitiveness of small and medium enterprises in transition economies on the European market.

The purpose of this paper is to analyze the main variables that allow us to explain the performance of fast growing SMEs in transition economies. Theoretically, we explain such growth through a combination of traditional (age and size) and firm specific (internal finance, capital structure, growth opportunities, liquidity and factor productivity) characteristics. Empirically, this paper is different to previous literature in two respects: (1) the primary goal of our study is not to provide an outright explanation of firm growth; rather, we aim to establish what internal characteristics determine the performance of fast growing SMEs in different CEE countries. This aspect determines the methodology used (fixed effects specification that allows growth to vary between sample countries, while the determinants of firm growth should have a similar effect on all economies); and (2) a firm is classified as a fast growing business entity if growth in its sales or assets is between 10 and 50 per cent on average for five subsequent years. Using a panel data set of 560 such firms in central and eastern Europe, we find that firm growth is related not only to the traditional determinants of age and size but also to other specific characteristics associated with financial structure and productivity. In line with previous research, we find evidence that firm size when proxied by its total assets tends to increase sales revenues. Another finding is that SMEs in transition economies rely heavily on internally generated funds to support their assets growth but need access to external capital to support their growth in sales. This result supports the notion that firms with large cash flows will grow faster.

These results come with some limitations. Firstly, we do not use a control group (e.g., slower growing or not growing firms) as a basis for comparison. Thus, we cannot say

[3] Wiboonchutikula (2002) finds that in normal times not all small- and medium-sized firms in Thailand are capable of generating more employment than large firms. Rather, it depends on the production techniques firms use. For labor-intensive export-oriented industries, firms will be able to generate high employment regardless of size. For capital-intensive industries, most small firms are less productive than large firms, and their expansion will not be able to generate high employment despite the large number of small firms.

explicitly whether the firm-specific characteristics that we find to explain SME growth are specific determinants of faster-growing SMEs only as opposed to the slower-growing ones, or whether it is about differences between the countries in the region and other countries that have been studied in previous research. This may lead to a selection bias problem which could require further econometric analysis. To deal with this problem we run the model specifications both for the entire sample and excluding our six countries one by one from the data set; in both cases we got very similar results. Secondly, we do not include younger firms (SMEs of less than five years of existence) in our data set in order to investigate the effect of growth determinants on both younger and older firms. As a result, age seems not to be able to explain firm growth.

The rest of the paper is organized as follows: the next section outlines our conceptual framework and summarises the findings of the research literature on the determinants of SME growth. The econometric model and the data panel analysis are presented in section three. Section four discusses the econometric results from the panel regressions. Some concluding remarks are offered in the final section.

2 Literature review

Small and medium sized enterprises have been of increasing interest for academics and policy makers in recent years since their role in both developed and developing economies has been established as being major. According to the European Union definition[4], small enterprises are those who have fewer than fifty employees and an annual turnover of less than 10,000,000 euro. Medium enterprises are defined as ones having fewer than 250 employees and a turnover of less than 50,000,000 euro. By annual turnover the European Commission (EC) means income from sales and services without VAT and other indirect taxes. SMEs contribute significantly to the economic growth of both developed and developing countries and insight into how they prosper is worthy of investigation. Small and medium firms have been the primary source of employment creation worldwide over the last two decades.[5] At the same time access to financing continues to be one of the most significant challenges for the creation, survival and growth of SMEs, especially innovative ones. Thus, increased attention has been paid to the key factors determining SME growth and success.

In the conventional framework of firm growth analysis, financing of growth is investigated through the growth-size-profitability relationships. A considerable body of literature deals with this question, analysing the relationship between the growth and the financial structure of the firm. If all firms had equal access to capital markets, external funds would provide a perfect substitute for internal capital, which implies that a firm's financial structure is irrelevant to investment and growth. It is often argued, however, that firms face difficulties in financing from external sources due to asymmetric information problems in capital markets. In fact, a number of studies on capital market imperfections have examined the impact of financial constraints on investment decisions and firm growth.

[4] See EU Commission Recommendation published in 2003 (OJ L 124 – 25 May 2003).

[5] According to data collected by Ayyagari, Beck and Demirgüç-Kunt (2007) for 76 developed and developing countries, SMEs, on average, account for over 60% of manufacturing employment.

For example, Fazzari et al. (1988) argue that financial constraints in capital markets affect investment, and emphasized that the link between financial constraints and investment varies by type of firm. Audretsch and Elston (2002) assert that financial constraints may be more binding as firm size decreases.[6]

In a more recent study, Wagenvoort (2003) uses financial data for more than 200,000 European manufacturing and construction firms, and finds that European SMEs suffer from a structural finance problem that hinders their growth. In particular, it is observed that financial constraints tend to hamper the growth of small and very small firms and to be less binding for medium sized enterprises. If compared with large enterprises, SMEs are more constrained by the availability of internal finance. Other empirical studies (e.g., Becchetti and Trovato, 2002; Carpenter and Petersen, 2002) have confirmed that the constrained availability of finance affect small firm growth. Even though smaller firms seek to achieve minimum efficient scale, they are more likely to be unable to obtain sufficient capital from external sources in order to expand their businesses. In particular, under the present dismal economic conditions, internal finance may have a greater impact on the growth of SMEs. Moreover, the intensive use of internal finance minimizes growth costs since internal resources cost less than external resources. This is due to the fact that access to financial markets and provision of external resources are more problematic for small firms (Sarno, 2008).[7]

It is often argued that SMEs are, in contrast to large firms, informationally more opaque, have on average higher growth rates, are financially more constrained, and are more dependent on bank loans when outside financing is needed. For a bank, the limited information available about the SME increases the risk associated with providing financing, which induces the bank to reduce loan maturity and increase the interest rate. To optimize loan conditions, SMEs have an incentive to build a relationship with their bank(s) in order to minimize the information asymmetry. The association between bank debt maturity and relationship lending is widely investigated (see Ortiz-Molina and Penas, 2004 for US firms; and Hernández-Cánovas and Koëter-Kant, 2008 for EU firms). For example, Hernández-Cánovas and Koëter-Kant (2008) find that, after controlling for firm-specific characteristics such as size, age, debt and financial situation, close firm-bank relationships increase the likelihood of obtaining longer-term bank loans. However, once they allow cross-country heterogeneity to influence the results, the empirical evidence shows that relationship lending and its effect on bank loan maturity for European SMEs is impacted by country-specific factors. On the basis of similar arguments, Ozkan and Ozkan (2004) argue that building relationships with financial institutions will improve

[6] Beck, Demirgüç-Kunt and Maksimovic (2005) investigate a rich set of obstacles reported by small, medium and large firms and directly test whether any of these reported obstacles are significantly correlated with firm growth rates. The results indicate that the extent to which financial and legal underdevelopment and corruption constrain a firm's growth depends very much on a firm's size. It is the smallest firms that are consistently the most adversely affected by all obstacles. Financial and institutional development weakens the constraining effects of financial, legal, and corruption obstacles and it is again the small firms that benefit the most.

[7] The empirical research dealing with SME growth and its financing finds that growth processes are significantly affected by the availability of a cash flow to finance them. As Sarno (2008) shows in his study on southern Italian SMEs, the reasons for the considerable sensitivity of growth to cash flow lie not only in the conditions of particular opacity in the firm's relationship with financial markets but also in property dilution effects which discourage financing through the issue of equity.

firms' ability to access external financing. This suggests that firms with a higher proportion of bank debt will be able to access external financing more easily. However, SMEs find it very difficult to obtain external finance. In this case, maintaining bank relationships helps them improve the availability of funds, since they suffer less credit rationing in the bank credit market.[8]

The research on firm growth finds that high growth tends to be associated with a firm's entrepreneurial behavior. Thus, growth tends to be considered a logical consequence of innovative, proactive and risk-taking behavior on the part of the firm, as these are the dimensions which define an entrepreneurial orientation (EO). The relationship between the EO of the firm and its performance has been thoroughly investigated from both a conceptual (see Lumpkin and Dess, 1996) and an empirical point of view (Lumpkin and Dess, 2001; Wiklund and Shepherd, 2005).[9] A recent study by Wiklund, Patzel and Shepherd (2009) claims that an entrepreneurial orientation in a company is essential for flexibility and quick decision making in a small company. They believe that the general tendency in today's business environment is the shortening of product and business model life cycles. Consequently, the future profit streams from existing operations are uncertain and businesses need constantly to seek out new opportunities. Therefore, they may benefit from adopting an "entrepreneurial strategic orientation".

Moreno and Casillas (2008) find that EO and growth are positively related, although their relationship is more complex. They assert that the propensity for innovation is the dimension of EO that exercises the greatest influence on the type of expansion strategy used by the firm, encouraging the development of new products-technologies relationship through a strategic behaviour; these strategic behaviors are the principal driving force behind growth. Along with them, the conditions of the environment (highly dynamic and not very hostile) and the availability of resources favor the rapid growth of the firm. Freel and Robson (2004) employ a large-sample of SMEs located in Scotland and in Northern England, and find a positive relationship between novel product innovation and growth in employment and, for manufacturing firms, at least in the short term, a negative relationship between product innovation (both incremental and novel) and growth in sales or productivity. By contrast, growing sales and productivity appear positively associated with incremental process introductions in service firms.

A large group of studies has focused on the main determinants of SMEs' capital structure and the extent to which variations in capital structure between industries are due to industry effects or variations in the determinants of capital structure from industry to industry (see Hall, Hutchinson and Michaelas, 2000 for UK; and Sogorb-Mira, 2005 for Spain). Thornhill, Gellatly and Riding (2004) find a strong correlation between capital structure and knowledge intensity. In contrast, growth histories are not obvious determi-

[8] Berger, Rosen and Udell (2007) argue that relationship lending is not the only way in which banks can extend financing to these firms. Different transactional technologies that facilitate arms-length lending (such as credit scoring and significantly standardized risk-rating tools and processes, as well as special products such as asset-based lending, factoring, fixed-asset lending, and leasing) are increasingly applied to SME financing.

[9] Several researchers have agreed that EO is a relevant conceptualization of entrepreneurship in existing firms. EO refers to a firm's strategic orientation, capturing specific entrepreneurial aspects of decision-making styles, methods, and practices. As such, it reflects how a firm operates rather than what it does (Lumpkin and Dess, 1996).

nants of financial structure. Results also suggest that leverage strategies are more apparent in low-knowledge industries, in firms with higher expectations of future performance, and in businesses with more balanced financial structures. More recent empirical studies (see Ozkan and Ozkan, 2004 for UK; and Garcıa-Teruel and Martınez-Solano, 2008 for Spain), test the determinants of firms' cash levels and find that smaller firms with more investment opportunities and risky activities possess a larger proportion of liquid financial assets.[10]

Some empirical studies associate SME growth with the personal characteristics of their owners and the environment in which they operate.[11] For example, an early study of Miller (1988) focuses on the effect of the environment in which a company operates on its strategy. He affirms that different external environments require different strategies matched with complementary internal environments and structures in order to promote success. For example, the strategy of innovative differentiation is most likely to be pursued in uncertain environments and correlates with the use of technocrats and liaison devices. The strategy of cost leadership is associated with stable and predictable environments and is correlated with the use of control. The right choice of both strategy and the environment in which to implement it predetermines firm growth. A study by Reuber and Fischer (1997) examines the effects of the management team's international experience on the international growth of an SME. They find that it is not for how long a firm has been selling in foreign markets, but rather, for how long the firm delayed before selling in foreign markets. SMEs that are managed by internationally experienced teams are likely to delay less. Experience with and knowledge of foreign markets make it more likely that decision makers will consider mechanisms to sell outside the domestic market early on and less likely that they will set up routines based on a purely domestic perspective.[12]

Two main conclusions for the choice of explanatory variables to be used in the empirical analysis emerge from the preceding discussion. First, in order to better understand the determinants of SMEs' growth in transition economies, it is crucial to specify an empirical model that allows for a combination of traditional firm characteristics (such as size and age) and more specific determining factors (e.g., total assets, leverage, internally generated funds, future growth opportunities, and factor productivity). All of these variables are closely related to the theoretical models that explain growth in SMEs. Second, CEE countries are far from being homogeneous and both the level of development and

[10] Garcıa-Teruel and Martınez-Solano (2008) find that firms usually pursue a target level for their cash holdings and their decisions are taken with the aim of achieving this. In addition, the evidence shows that the speed with which Spanish SMEs attempt to adjust their cash levels to the optimal level is higher than that found in previous studies for large firms. This can be explained by the fact that SMEs suffer more information asymmetries and more agency conflict arising from debt than larger companies, and therefore may indicate that the cost of being far from the optimal level is higher for them.

[11] To address this issue, Pelham and Wilson (1996) among others, suggest that it may be advantageous to describe the environment of small businesses by a number of dimensions reflecting subjective perceptions of small business owners. These dimensions of the small firm's task environment have been investigated including the environment's munificence, turbulence, heterogeneity, hostility, dynamics, customer structure, and competition.

[12] Some quite specific characteristics associated with SME growth have also been investigated. For example, Kotey and Folker (2007) examine the main and interaction effects of size and firm type on a variety of informal and formal training programs in Australian SMEs. Raymond, Bergeron and Blili (2005) affirm that, to the extent that e-business is assimilated by the SME, it can significantly affect the firm's key business processes and relationships such as servicing customers and collaborating with business partners.

growth of SMEs change from country to country. Hence, another key question searches for common determining factors that can explain SMEs' growth and performance in this group of countries as a whole. In order to address these questions we develop a set of hypotheses and employ both the generalized method of moments (GMM) and the fixed effects specifications to test them.

3 Empirical analysis and results

This study aims to fill in the gap in the current debate on the determinants of growth in SMEs in central and eastern Europe. Our analysis is based on cross-sectional, panel data analysis of a set of small and medium-sized enterprises from six transition economies (Bulgaria, Croatia, the Czech Republic, Poland, Romania and Serbia). In this paper we explore whether and to what extent the main finding of the research literature – that growth in SMEs can be explained by both traditional and firm-specific characteristics – holds also for transition economies. To answer this question we develop two research hypotheses:

Hypothesis 1: In line with previous research, we argue that growth in manufacturing and services SMEs in transition economies is strongly associated with the traditional firm characteristics of size and age.

Hypothesis 2: A number of other firm-specific characteristics related to SMEs in transition economies such as leverage, capital structure, internal finance and production efficiency should also play a major role in explaining the growth in these firms.

3.1 Data set

In this research we have adopted the European Commission's SME definition. The sample of SMEs considered in our study has been extracted from AMADEUS database[13] and includes 5,000 companies from six central and eastern European (CEE) countries.[14] Specifically, we have selected companies that meet the following criteria: (1) an annual growth rate in revenues (or assets) of at least 10 per cent averaged over the sample period (200-2005); (2) number of employees not less than 10, that is, micro enterprises are excluded from the sample; (3) at least 5 years of existence as a business entity, (4) positive net worth and/or positive net income in at least 3 years of the observation period; and (5) not included in a bankruptcy process. The information obtained was carefully screened, refined and cases with errors in the accounting data or missing values for some of the variables over the sample period were eliminated. Thus, the dataset has been restricted to the observations that embody all the essential variables available, and to those variables that have a complete record over the period of examination. As a result, the definitive number

[13] For more details see http://www.bvdep.com/en/AMADEUS.html. The AMADEUS database allows us to choose among a huge variety of public and private companies in 43 European countries. For the scope of our research we selected only small and medium sized companies.

[14] The original number of CEE countries included in the sample was 13: Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), the Czech Republic (CZ), Hungary (HU), Macedonia (FYROM) (MK), Montenegro (ME), Poland (PL), Romania (RO), Serbia (RS), Slovakia (SK), Slovenia (SI), and Ukraine (UA). In order to obtain non-spurious regression results we applied some filters to the data to remove companies with missing observations or lack of full data record; thus our sample was limited to companies from only six CEE countries.

of firms that makes up our sample amounts to 560 for which we have full accounting data over the period 2001-2005, resulting in 2,800 observations of balanced panel data.

Table 1: Geographical distribution of sample firms by size, age and sector

	Bulgaria	Croatia	Czech R.	Poland	Romania	Serbia	Total
Size							
Micro (< 10 employees)	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Small (< 50 employees)	3	39	20	1	0	0	63
Medium (< 250 employees)	22	110	337	19	6	3	497
Total	**25**	**149**	**357**	**20**	**6**	**3**	**560**
Age							
< 5 years	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5-10 years	7	30	45	0	2	0	84
10-20 years	13	92	297	8	4	2	416
> 20 years	5	27	15	12	0	1	60
Total	**25**	**149**	**357**	**20**	**6**	**3**	**560**
Sector							
Agriculture, fishing and mining	0	1	43	0	1	0	45
Construction	2	26	24	1	0	1	54
Financial intermediation	0	0	2	0	0	0	2
Hotels and restaurants	0	4	1	0	1	0	6
Manufacturing	8	26	180	7	4	2	227
Public administration, education, health and social work	0	1	6	0	0	0	7
Real estate, renting and business activities	3	11	17	10	0	0	41
Transport, storage and communication	2	8	13	0	0	0	23
Utilities	0	4	14	1	0	0	19
Wholesale and retail trade	7	65	48	1	0	0	121
Other	3	3	9	0	0	0	15
Total	**25**	**149**	**357**	**20**	**6**	**3**	**560**

Source: AMADEUS database (2008). Authors' calculations.

Geographical distribution of sample firms by age, size and sector is shown in table 1. The data show that 11.3 per cent of all firms in the sample are small enterprises and 88.8 per cent are medium enterprises. The largest share of small enterprises is observed in Croatia (39 out of 63), while medium sized firms prevail in the Czech Republic (337 out of 497). With regard to the age structure of our sample, we observe that nearly 15 per cent of all SMEs are younger enterprises (with 5 to 10 years of existence), while 10.7 per cent can be classified as older firms (with more than 20 years of existence). The average number of years of existence for the whole sample is 16. It is worth noting that the selected firms are representative of SMEs from different transition economies and their eco-

nomic sectors. As can be observed, manufacturing, wholesale and retail trade, and construction prevail over other industries (40.5 per cent, 21.6 per cent and 9.6 per cent, respectively), whereas companies from services sector such as financial intermediation and hotels and restaurants, account for less than 1 per cent of the whole sample of small and medium firms. If we refer to the geographical location of the selected firms that match the criteria listed above, the data in table 1 show that 63.8 per cent of all firms are located in the Czech Republic, followed by Croatia (26.6 per cent) and Bulgaria (4.5 per cent), and only 0.5 per cent in Serbia.

Dependent variable

There is little agreement in the existing literature on how to measure growth, and scholars have used a variety of different measures. These measures include, for example, growth of sales, employees, assets, profit, equity, and others (see Davidsson and Wiklund, 2000). Moreover, the time span over which growth is analyzed in the literature varies considerably, ranging from one to several years. Also, growth has been measured in absolute or relative terms. Perhaps the most common means of operationalizing firm growth is through relatively objective and measurable characteristics – such as growth in sales turnover, total assets and employment growth. These measures are relatively uncontroversial (methodologically) and data tend to be easily available, increasing the scope for cross-study comparability (Freel and Robson, 2004). In this study we use three growth models to examine more accurately the effect of the explanatory variables on a firm's growth and performance – growth in sales revenues, employment and total assets.[15]

Explanatory variables

In this study we have selected several variables that the empirical literature (see Honjo and Haranda, 2006; Wiboonchutikula, 2002; Wiklund, Patzelt and Shepherd, 2009; Sogorb-Mira, 2005; Hall, Hutchinson and Michaelas, 2000, 2006; Garcıa-Teruel and Martınez-Solano, 2008) suggests are important growth determinants. Table 2 shows summarized description of the dependant and explanatory variables used in the empirical analysis and their expected impact on firm growth.

As explained in section two a number of firm specific characteristics such as internal finance, capital structure, leverage, production efficiency, future growth opportunities, age and size, may help explain the growth in small and medium sized enterprises. Our approach in this paper is to relate firm growth not only with the traditional determinants of *age and size* but also to other specific determinants associated with a firm's financial, organizational and managerial characteristics. As already discussed, it is difficult for SMEs to access capital markets, and financial constraints are more binding for SMEs. Therefore, *internal finance* plays an important role in achieving the growth of SMEs by overcoming financial constraints. In order to capture the influence of internally genera-

[15] Storey (1994) posits three overlapping subsets of variables which he concludes to show "consistent" evidence of an influence upon firm growth – broadly, characteristics of the entrepreneur, of the firm and of the firm's strategy. Unfortunately, the database used in this study provides no data on characteristics of the entrepreneur. As a result, the influence of factors such as educational background or entrepreneurial experience cannot be controlled for. In addition, certain "characteristics of the firm", such as legal status are also beyond the scope of the data available.

ted capital on firm growth a variable (CASH FLOW) is constructed. According to hierarchy theory (Myers and Majluf, 1984) firms prefer to fund themselves with resources generated internally before resorting to the market. In these circumstances, firms with large cash flows will grow faster, and thus a positive correlation between cash flow and firm growth is expected.

Table 2: Dependent and explanatory variables

Variable	Definition	Explanation	Expected sign
Dependant variables			
OP_REVEN	Change in operating revenues, proxy for growth, (in euro, thousands)	Difference between the logarithms of firm's revenues in periods *t* and *t – 1*	
TOT_ASSETS	Change in book value of total assets, proxy for growth (in euro, thousands)	Difference between the logarithms of firm's total assets in periods *t* and *t – 1*	
Explanatory variables			
TOT_ASSETS	Total assets, proxy for firm size (in euro, thousands)	Difference between the logarithms of firm's total assets in periods *t* and *t – 1*	+
INTA_ASSETS	Intangible assets/total assets, proxy for future growth opportunities	Difference between the ratio of intangible to total assets in periods *t* and *t – 1*	–
CUR_RATIO	Current assets/current liabilities, proxy for short-term liquidity	Difference between the ratio of current assets to current liabilities in periods *t* and *t – 1*	+/–
LEVER	Total debt/total asset, proxy for a firm's degree of leverage	Difference between the ratio of total debt to total assets in periods *t* and *t – 1*	+
CAP_PROD	Operating revenues/tangible assets, proxy for capital productivity	Difference between the ratio of operating revenues to tangible assets in periods *t* and *t – 1*	+
LAB_PROD	Operating revenues/number of employees, proxy for labor productivity	Difference between the ratio of operating revenues to no. of employees in periods *t* and *t – 1*	+
CASH_FLOW	(Pre-tax income + depreciation)/ total assets, proxy for internally generated capital	Difference between the firm's cash flow in periods *t* and *t – 1*	+/–
EMPLOYE	Number of employees, proxy for a firm size	Difference between the logarithms of firm's size in periods *t* and *t – 1*	+
AGE	Number of years of existence	Logarithm of firm's age (number of years of existence) in period *t*	–
OWNER	The type of the ownership of a firm – public or private	A dummy variable that takes on value of 1 for firms which are public entities or 0 otherwise	+
SECTOR	The type of sector a firm operates in (manufacturing or services)	A dummy variable that takes on value of 1 for firms from services sector or 0 otherwise	+

In addition, capital structure is different among SMEs, and *leverage* may be related to firm growth. In fact, Leung and Yu (1996) found that there is a negative relationship between growth and leverage. In our study the variable that proxies for a firm's capital structure (LEVERAGE) is taken as the ratio of total debt to total assets and the expected relation to growth is positive. Since small firms usually have a higher proportion of current liabilities in their capital structure than large firms, a firm's capability to sustain short-term *liquidity* is another relevant determinant of its growth. In order to capture this relation a variable (CUR_RATIO) is constructed by taking the ratio of current assets to current liabilities. It might be expected that firms that are able to maintain higher liquidity levels will face less severe financing constraints. So, we expect current liquidity to be positively associated with growth.

Following Hall, Hutchinson and Michaelas (2006) a variable that captures the effect of future *growth opportunities* (INT_ASSETS) is constructed by taking the ratio of intangible assets to total assets. Intangible assets include research and development expenditure, trademarks, patents and copyrights. As these are investments with long-term payoffs one may expect that the greater the share of intangible assets in a firm's total assets, the smaller the growth in its operating revenues. So, the expected relation between these two variables should be negative. Two well known determinants – the absolute value of *total assets* (TOT_ASSETS) and *number of employees* (EMPLOYE) – are included as *size* variables in order to test for scale effects in the relation to growth and firm size. The empirical evidence shows that the larger the firm (in terms of assets or number of employees) the greater its potential to grow (Wiklund and Shepherd, 2005). Thus, we expect the firm's size to be positively correlated with its performance. Following Wiboonchutikula (2002) we estimate SME growth using different *productivity factors* as incremental explanatory variables – capital productivity (output/capital) and labor productivity (output/labor).[16] These two variables (CAP_PRODUCT and LAB_PRODUCT) not only present the basic operational structure of a firm but also allow us to examine the association between the efficiency of a firm's operations and its growth potential. In both cases we expect a positive relation between a firm's production efficiency and its performance.

Businesses of different sizes and ages may exhibit different organizational and environmental characteristics, which in turn may influence performance. The same is true for firms in different industries. Therefore, additional firm-specific characteristics are included as explanatory variables in our analysis to capture these effects. A dummy variable (OWNER) to proxy for the *ownership* (that is, public-traded vs. privately held) allows us examine the effect of ownership on SME's performance. It is argued that publicly-traded firms tend to access external funds more easily than privately-held firms. Therefore, firm growth may be different between private and public firms. *Age* is defined as the number of years a firm has been operating in the market (since the date of incorporation) and is expected to have a negative relation with firm growth. Thus, we suggest that younger firms are more likely to grow faster than older ones. Finally, in order to represent the *business environment* in which a firm operates – manufacturing or services sector in

[16] Wiboonchutikula (2002) explains the difference in growth in SMEs with their different operating structures. The results show that the faster growing companies are less capital intensive and their labor productivity is higher compared to slow growing SMEs. These qualities give them the flexibility that is crucial to SME development.

our case – a dummy variable (SECTOR) that takes on value of 1 for firms from services sector or 0 otherwise is used. We expect firms operating in services sector to have larger growth potential than those in the manufacturing sector.

Table 3: Correlation matrix of the model variables[1]

	OP_ REVEN	TOT_ ASSETS	LEVER	CUR_ RATIO	INTA_ ASSETS	CAP_ PROD	LAB_ PROD	CF_ RATIO	EMPLOYE	AGE
OP_REVEN	1.0000									
TOT_ASSETS	0.5485***	1.0000								
LEVER	0.1256***	-0.1406***	1.0000							
CUR_RATIO	-0.0291	-0.0202	-0.0861***	1.0000						
INTA_ASSETS	-0.1365***	-0.1187***	-0.0831***	-0.0850***	1.0000					
CAP_PROD	0.2670***	0.0255	0.2134***	-0.0273	-0.0491**	1.0000				
LAB_PROD	0.7328***	0.4307***	0.1687***	-0.0367*	-0.0998***	0.3179***	1.0000			
CF_RATIO	-0.0729***	-0.0809***	0.1118***	-0.1029***	0.0668***	-0.0305	-0.0529***	1.0000		
EMPLOYE	-0.0379**	0.0301	-0.2369***	0.0586***	-0.0010	-0.2038***	-0.3704***	-0.1103***	1.0000	
AGE	-0.0526***	0.1467***	0.0015	-0.0341*	0.0062	-0.0463*	-0.0668***	-0.0356*	0.1231***	1.0000

[1] *The dependant and explanatory variables included in the model are: operating revenues (OP_ REVEN), total assets (TOT_ASSETS), leverage (LEVER), current ratio (CUR_RATIO), growth opportunities (INTA_ASSETS), capital productivity (CAP_PROD), labor productivity (LAB_PROD), cash flow (CF_RATIO), number of employees (EMPLOYE), and age (AGE). Dummy variables for ownerships and sector are not included in the correlation matrix.*

* *Indicates that correlation is significant at the 10 percent level.*
** *Indicates that correlation is significant at the 5 percent level.*
*** *Indicates that correlation is significant at the 1 percent level.*

The correlation matrix of dependent and explanatory variables is presented in table 3 and is used to examine the possible degree of collinearity among variables. The table shows that the two most highly correlated variables are operating revenues and labor productivity (a coefficient of 0.7328). As we observe in table 3, the correlation coefficients are not large enough to cause collinearity problems in the regressions and are statistically significant at the usual levels of significance. To mitigate the problem with possible multicollinearity we gradually exclude the variables that are expected to be highly correlated with the rest (in this case, TOT_ASSETS and LAB_PROD). Table 4 presents summary statistics for the whole sample of 560 firms. We can see that the sample is made up of small and medium firms with average assets of 7.97 million euro and average sales revenues of 9.61 million euro. They exhibit a low degree of leverage, with a debt of 0.19 times their total assets. Short-term liquidity as proxied by the current ratio (a median of 1.41) is relatively high and shows that the average firm in our sample has no problem with meeting its current obligations. In addition, the firm operating efficiency, as measured by capital productivity ratio, is relatively high (1 euro invested in tangible assets generates 9.21 euro in sales revenues on average). Labor productivity in fast growing SMEs is also high (a median of 43.31). At the same time the future growth opportunities (as measured by the share of intangible assets in total assets) associated with these firms are relatively

low (a median of 0.0011). The reason may be that small and medium firms invest fewer funds in RandD, patents and copyrights than large firms. The statistics for internally generated capital by the firms in our sample shows that 1 euro invested in total assets generates only 0.4632 euro in free cash flow on average.

Table 4: Summary statistics (total sample)[1]

Variable	Obs.	Mean	Median	St. Dev.	Minimum	Maximum
OP_REVEN	2,800	9,614.92	6,159.0	15,474.61	0	295,404
TOT_ASSETS	2,800	7,969.02	4,716.5	11,310.25	32	133,779
LEVER	2,800	0.1921	0.1509	.1754	0	0.9635037
CUR_RATIO	2,800	1.8109	1.4076	1.5104	0	10.0
INTA_ASSETS	2,656	0.0344	0.0011	.1215	0	.9740
CAP_PROD	2,651	9.21	3.4336	27.34	0	489.93
LAB_PROD	2,800	121.88	43.312	265.11	0	6,713.72
CF_RATIO	2,653	0.4632	0.1264	2.77	-0.315	106.01
EMPLOYE	2,800	126.09	150	58.62	10	250
AGE	2,800	15.82	13.2	11.11	5.8	99.1

[1]*The dependant and explanatory variables included in the model are: operating revenues (OP_REVEN), total assets (TOT_ASSETS), leverage (LEVER), current ratio (CUR_RATIO), growth opportunities (INTA_ASSETS), capital productivity (CAP_PROD), labor productivity (LAB_PROD), cash flow (CF_RATIO), number of employees (EMPLOY), and age (AGE). Dummy variables for ownerships and sector are not included in the summary statistics.*

All variables are taken as ratios, except for total assets and operating revenues (in euro, thousands) and number of employees.

3.2 Econometric model and empirical results

The structure of our dataset allows us to use a panel data methodology for our empirical research.[17] This type of analysis can control firm heterogeneity, and reduce collinearity among the variables that are contemplated (Arellano and Bover, 1990). Likewise, this technique enables us to eliminate the potential biases in the resulting estimates due to correlation between unobservable individual effects and the explanatory variables included in the model. Our panel data model may be represented as follows:

$$Growth_{it} = \alpha_0 + \beta_1(Tot\_Assets_{it}) + \beta_2(Lever_{it}) + \beta_3(Cur\_Ratio_{it}) + \beta_4(Inta\_Assets_{it}) + \beta_5(Cap\_Prod_{it}) + \beta_6(Lab\_Prod_{it}) + \beta_7(CF\_Ratio_{it}) + \beta_8(Employe_{it}) + \beta_9(Age_{it}) + \beta_{10}(Dummy_i) + \varepsilon_{it} \quad (1)$$

[17] Panel data methodology is useful in that it allows us to relax and test assumptions that are implicit in cross-sectional analyses. In particular, we might mention two relevant aspects. Firstly, it is possible to control for unobservable heterogeneity, since the methodology provides us with more than one cross section. This allows us to eliminate biases deriving from the existence of individual effects. Secondly, the panel data methodology also makes it possible to model dynamic responses with micro data.

where $Growth_{it}$ is defined as the difference between the logarithms of a firm's sales revenues in periods *t* and *t – 1* (see Honjo and Haranda, 2006). The other two measures of growth used in the regression model (1) are the percentage change in total assets and in number of employees. Variables Tot_Assets_{it}, CF_Ratio_{it} and $Employe_{it}$ represent firm *i*'s size, cash flow (normalized by total assets) and number of employees in period *t*, respectively. Variables $Lever_{it}$, Cur_Ratio_{it}, $Inta\_Assets_{it}$, Cap_Prod_{it} and Lab_Prod_{it}, represent capital structure, short-term liquidity, future growth opportunities, and capital and labor productivity of firm *i* in period *t*, respectively. Variable Age_{it} is the logarithm of the number of years of existence of firm *i* in period *t*. Variables for ownership and sector are proxied by dummy variables that take on a value of 1 if the stated condition holds or 0 otherwise. We estimate the parameters in equation (1) using the fixed effects estimator. To test the hypothesis regarding the absence of correlation between the unobservable country-specific effects and the explanatory variables, and thereby, to consider the individual effects as random or fixed[18], we use Hausman's (1978) specification test. Its outcome enables us to reject the hypothesis regarding the absence of correlation between the unobservable effects and the explanatory variables and, thereby, we consider the individual effects as fixed.

In addition to the fixed and random effects models we employ identical specifications using the generalized method of moments (GMM), proposed by Arellano and Bond (1991). The results for panel regressions are presented in tables 5 through 8. We run the benchmark model (1) for six different specifications (see table 5). Both TOT_ASSETS and EMPLOYE variables are used as proxy for firm size; thus, a collinearity problem may occur between these two, although the correlation coefficient is low and statistically insignificant at the usual levels (see table 3). A variable that is highly correlated with the rest of the explanatory variables is LAB_PROD. To mitigate the problem with possible multicollinearity each of these variables is dropped from the rest of our model specifications. The explanatory power of model (1) is very high (the within R^2 is between 40 and 62 per cent for all model specifications) taking into account the fact that we use panel data. The results in table 5 show that, in line with previous empirical studies, the impact of firm size as measured by the absolute value of total assets (TOT_ASSETS) on growth is positive and statistically significant at 1 per cent, for all model specifications. We also support the Wiklund and Shepherd (2005) finding that firm size as proxied by the number of employees (EMPLOYE) has also a strong explanatory power (see models 1, 3 and 5).

As expected, the estimated coefficient of liquidity variable (CUR_RATIO) is positive and statistically significant at 1 per cent level of significance. Thus, our hypothesis that there exists a strong, positive relation between short-term liquidity and a firm's growth is confirmed at that stage of the analysis. In line with Honjo and Haranda (2006) we find that the degree of leverage (LEVER) a firm uses has a strong, positive impact on its growth in sales revenues. When the size variable (TOT_ASSETS) is dropped from our model

[18] The country-specific effects may be either fixed parameters that can be estimated ("fixed effects") or random disturbances characterizing the *i*th country ("random effects"). In the first case, the intercept is allowed to vary between countries but does not vary over time while the slope coefficients are assumed to be constant across countries. Such a fixed effects specification allows growth to vary between sample countries, while the determinants of firm growth should have a similar effect on all economies.

the effect of firm's capital structure (as measured by debt to total assets ratio) turns out to be insignificant (see model 3). In general, our finding suggests that SMEs in transition economies rely on internal financing sources for sales growth but need access to external capital to support their assets growth (see table 6). The empirical results in table 5 show that the estimated coefficients of the growth opportunities variable (INTA_ASSETS) are negative and strongly significant at 1 per cent, for all model specifications. This finding confirms our hypothesis that the expected impact of future growth opportunities on a firm' current growth is negative as these are investments with long-term payoffs.

The two variables (CAP_PROD and LAB_PROD) that proxy for a firm's production efficiency show a strong explanatory power in all model specifications. As we expected, the relation between labor productivity (output/labor) and growth is strongly positive and significant at 1 per cent (see models 1 and 3). We have to read this result with caution as the LAB_PROD variable is significantly correlated with both sales revenues and capital productivity variables (see table 3). In relation to a firm's capability to generate internal capital Audretsch and Elston (2002) finds that small and medium sized firms appear to be more financially constrained using data on German firms, while Honjo and Haranda (2006) find no such evidence using a sample of Japanese firms.[19] In our study we find evidence for a strong, positive relation between a firm's cash flow and its sales growth, for all model specifications. This result provides further evidence in support of the hypothesis that internal finance has strong influence on sales growth, particularly of younger SMEs, that are more financially constrained. If it is true, more funds and support are required for the growth of younger firms (Honjo and Haranda, 2006).

When both TOT_ASSETS and LEVER variables are dropped from model (1) the data in table 5 show that the rest of the explanatory variables are statistically significant at 1 per cent and with the expected signs, except the EMPLOYE variable (see model 6). The two dummies used as proxies for ownership and the sector a firm operates in drop from all the fixed effect specifications but seem to be statistically insignificant in other (random effects) specifications. Also, we do not find evidence in support of the hypothesis that growth in manufacturing and service SMEs in transition economies is strongly associated with the traditional firm characteristic of age.

[19] Whereas it is not found that cash flow is significantly related to firm growth in their model, Honjo and Haranda (2006) argue that internal finance has less influence on firm growth, particularly of older SMEs that have already passed the early stages after establishment. Rather, internal finance may have more influence on the growth of younger SMEs.

Table 5: Operating revenues panel regressions (2001-2005), total sample[1, 2, 3, 4, 5]

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 4a	Model 5	Model 6	Model 6a
	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Random effects	Fixed effects	Fixed effects	Random effects
TOT_ASSETS	1.716***	1.795***		1.796***	1.629***			
	(0.000)	(0.000)		(0.000)	(0.000)			
LEVER	0.326**	0.356**	0.003	0.352**	0.285**			
	(0.048)	(0.033)	(0.987)	(0.034)	(0.057)			
CUR_RATIO	0.154***	0.152***	0.274***	0.152***	0.165***	0.274***	0.282***	0.275***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
INTA_ASSETS	-2.090***	-2.131***	-4.397***	-2.135***	-2.208***	-4.397***	-4.711***	-4.295***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAP_PROD	0.001	0.003***	0.003**	0.003***	0.003***	0.003**	0.008***	0.007***
	(0.222)	(0.006)	(0.032)	(0.006)	(0.002)	(0.031)	(0.000)	(0.000)
LAB_PROD	0.001***		0.002***			0.002***		
	(0.000)		(0.000)			(0.000)		
CF_RATIO	0.042***	0.044***	0.062***	0.044***	0.037***	0.062***	0.068***	0.067***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EMPLOYE	0.210**	0.043	0.411***			0.411***	0.045	0.041
	(0.053)	(0.666)	(0.002)			(0.002)	(0.656)	(0.647)
AGE	(dropped)	(dropped)	(dropped)			(dropped)		
SECTOR	(dropped)	(dropped)	(dropped)			(dropped)		
OWNER	(dropped)	(dropped)	(dropped)			(dropped)		
R-squared (within)	0.6225	0.6136	0.4369	0.6135	0.6127	0.4369	0.4010	0.4006
Number of observations	1,999	1,999	1,999	1,999	1,999	1,999	1,999	1,999
P-value for Hausman test[5]					0.0000			0.0018

[1]Model 1 – general model; Model 2 – excluding LAB_PROD variable; Model 3 – excluding TOT_ASSETS variable; Model 4 – excluding LAB_PROD and EMPLOYE variables; Model 5 – excluding TOT_ASSETS and LEVER variables; Model 6 – excluding TOT_ASSETS, LEVER and LAB_PROD variables. Models 4a and 6a – Random effects.

[2]All variables except dummies and ratios are in logs.

[3], **, and *** represent significance at 10, 5, and 1 per cent, respectively. All regressions include source country dummies to control for source country effects.*

[4]P-values in brackets.

[5]The null hypothesis for the Hausman test is that the difference in coefficients between fixed effects and random effects specifications is not systematic. Thus a small p-value (<0.05) suggests the rejection of the random effects specification.

Table 6: Total assets panel regressions (2001-2005), total sample[1, 2, 3, 4, 5]

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 4a	Model 5	Model 6	Model 6a
	Fixed effects	Fixed effects	Fixed effects	Fixed effects	Random effects	Fixed effects	Fixed effects	Random effects
OP_REVEN	0.192***	0.197***		0.197***	0.190***			
	(0.000)	(0.000)		(0.000)	(0.000)			
LEVER	0.189***	0.186***	0.208***	0.187***	0.155***	0.200***	0.206***	0.170***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.005)	(0.004)	(0.008)
CUR_RATIO	0.017***	0.016***	0.082***	0.016***	0.015***	0.085***	0.085***	0.080***
	(0.001)	(0.002)	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
INTA_ASSETS	-0.499***	-0.500***	-1.341***	-0.501***	-0.459***	-1.420***	-1.428***	-1.281***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CAP_PROD	0.001	0.001*	0.001**	0.001*	0.001**	0.002***	0.002***	0.003***
	(0.351)	(0.079)	(0.021)	(0.080)	(0.016)	(0.000)	(0.000)	(0.000)
LAB_PROD	0.001***		0.001***					
	(0.002)		(0.000)					
CF_RATIO	-0.049***	-0.049***	-0.072***	-0.049***	-0.051***	-0.075***	-0.075***	-0.075***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EMPLOYE	0.038	-0.007	0.089*			-0.061		
	(0.291)	(0.832)	(0.057)			(0.162)		
AGE	(dropped)	(dropped)	(dropped)			(dropped)		
SECTOR	(dropped)	(dropped)	(dropped)			(dropped)		
OWNER	(dropped)	(dropped)	(dropped)			(dropped)		
R-squared (overall)	0.6514	0.6490	0.5417	0.6490	0.6483	0.5214	0.5208	0.5208
Number of observations	1,999	1,999	2,059	1,999	1,999	2,059	2,059	2,059
P-value for Hausman test[5]					0.0002			0.0001

[1]*Model 1 – general model; Model 2 – excluding LAB_PROD variable; Model 3 – excluding OP_REVEN variable; Model 4 – excluding LAB_PROD and EMPLOYE variables; Model 5 – excluding OP_REVEN and LAB_PROD variables; Model 6 – excluding OP_REVEN, LAB_PROD and EMPLOYE variables. Models 4a and 6a – Random effects.*

[2]*All variables, expect dummies and ratios are in logs.*

[3]**, **, and *** represent significance at 10, 5, and 1 per cent, respectively. All regressions include source country dummies to control for source country effects.*

[4]*P-values in brackets.*

[5]*The null hypothesis for the Hausman test is that the difference in coefficients between fixed effects and random effects specifications is not systematic. Thus a small p-value (<0.05) suggests the rejection of the random effects specification.*

To account for unobservable country-specific effects in our model we run also random effects specification (see models 4a and 6a). The random effects specification would allow us to estimate the impact of time-invariant variables on growth and actually provide more efficient estimates if the country-specific effects are not correlated with the other explanatory variables. The Hausman test shows that we have to reject the random effects specifications (*p*-value is less than 0.05 in both cases). Thereby, we consider the individual effects as fixed. In order to check the model variables for stationary we use Fisher test for panel unit root based on an augmented Dickey-Fuller test. The goal is to show that the variables in the model we use are time invariant, i.e. there is no dependence of their values on the time trend. The *P*-values of the Fisher tests show that all the variables are independent of time and we can conclude that the panel data is stationary.

Next, we run our model specifications using growth in firm's total assets as dependant variable and sales revenues as explanatory variable.[20] The results are shown in table 6. Whereas it is not found that size variable (EMPLOYE) is significantly related to firm growth, it is obvious that a firm capacity to generate capital internally (as measured by its cash flow ratio) plays an important role in explaining the growth in its assets; the estimated coefficients of CF_RATIO variable are negative and strongly significant at 1 per cent, for all model specifications. This result is, at least, to some extent, supported by the fact that the relation between a firm's growth in assets and the degree of leverage it uses is strongly positive, which confirms our hypothesis that faster growing SMEs in transition economies rely more on external financing sources to support their growth in assets than on internally generated funds. Again, the effect of short-term liquidity (CUR_RATIO) on firm growth is very strong and positive, for all model specifications. Both CAP_PROD and LAB_PROD variables show a positive, statistically significant effect, in all model specifications, but this result should be treated with caution because of possible multicollinearity between the two variables. In general, we may conclude that improved factor productivity is associated with larger growth in firm assets. The other two variables (OP_REVEN and INTA_ASSETS) have the expected signs and are statistically significant at the usual level of 1 and 5 per cent, for all model specifications. Again, the data in table 6 show that ownership, age and the sector a firm operates in have no explanatory power in our model. The Hausman test (see models 4a and 6a) shows that we have to reject the random effects specifications (*p*-value is less than 0.05 in both cases). Thereby, we consider the individual effects as fixed.

In previous models we have observed and corrected for a correlation between residuals of order one. Yet, this does not exclude the possibility of a higher order correlation, which would be evidence of some dynamic relationship between the variables in the model. For that purpose, we need a linear dynamic panel-data model that includes lag of the dependent variable as explanatory variable and that contains unobserved panel-level effects, fixed or random. The generalized method of moments (GMM) is a suitable choice for that kind of models, which yields consistent estimators. GMM is a generalization of the

[20] We run the same model specifications using growth in number of employees as dependant variable but the panel regressions yield unsatisfactory results – most of the variables in model (1) show no explanatory power in this case. Thus, we are unable to support or reject the findings of previous empirical studies that traditional firm characteristics may well explain firm growth when size is proxied by the number of firm employees.

classical method of moments[21]. Given the observations we have on our variables GMM helps us to find estimates for the model coefficients such that the expected values from the sample are satisfied as closely as possible. We employ one-step GMM estimator regression to our model specifications.

The results are presented in tables 7 and 8. As expected, the time-lagged value of the dependant variable (OP_REVEN) is negative and statistically significant for all model specifications. The data in table 7 show that leverage (as measured by that ratio of total debt to total assets) has no significant effect on a firm's growth in sales; the estimated coefficients of the LEVER variable are positive and statistically insignificant for all model specifications. This result doesn't support the findings of some recent empirical studies that SMEs rely on internally generated funds for assets growth but need access to external capital to support their growth in sales (see Honjo and Haranda, 2006). Internally generated funds (as measured by cash flow ratio) show a strong, positive correlation with firm growth (see models 1 through 7). This result supports our hypothesis that firms with large cash flows will grow faster. Contrary to our expectations, short-term liquidity is found to have a significant but negative impact on growth in sales revenues. When the size variable (TOT_ASSETS) is dropped from model (1) because of possible multicollinearity with other variables, this effect becomes even stronger (all estimated coefficients except for model 4 are statistically significant at 1 per cent). Thus, we have to reject the hypothesis that firms with more growth opportunities will keep higher liquidity levels and thus will face less severe financing constraints.

Both TOT_ASSETS and EMPLOYE variables show strong explanatory power in all model specifications. The estimated results are consistent with those of recent empirical studies (see e.g., Wiklund and Shepherd, 2005) that show a positive relationship between firm growth and size (as measured by its total assets or number of employees). As expected, productivity factors (as proxied by CAP_PROD and LAB_PROD variables) demonstrate strong explanatory power in all model specifications. Again, we have to read this result with caution as LAB_PROD variable is significantly correlated with both sales revenues and capital productivity (see table 3).

The only two variables that seem to have no significant effect on firm growth are intangible assets as proxy for future growth opportunities, and age. The coefficients of the AGE variable are positive but statistically insignificant in all model specifications. This result does not support our hypothesis that younger firms are more likely to grow faster than older ones but it seems logical as we do not have start-ups or firms younger than five years old, included in the sample. The two dummies used as proxies for ownership and the sector a firm operates seem to be insignificant determinants of SME growth. Thus, we cannot provide evidence in support of the hypothesis that growth in manufacturing and service SMEs in transition economies is strongly associated with these two firm-specific characteristics. The results of the Arellano-Bond and Sargan tests (shown at the bottom of the table) confirm that all models are well specified.

[21] Generalized method of moments (GMM) is based on Arellano and Bond (1991)'s one-step robust estimates. The presence of first-order autocorrelation in the differenced errors does not imply that the estimates are inconsistent, but the presence of second-order autocorrelation would imply that the estimates are inconsistent.

Table 7: Operating revenues GMM panel regressions (2001-2005), total sample[1, 2, 3, 4, 5, 6]

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
OP_REVEN (lagged)	-0.017***	-0.018***	-0.021***	-0.017***	-0.023***	-0.023***	-0.023***
	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TOT_ASSETS	0.295***	0.294***		0.429***			
	(0.000)	(0.000)		(0.000)			
LEVER	0.023	0.021	-0.049	0.009			
	(0.702)	(0.726)	(0.441)	(0.896)			
CUR_RATIO	-0.011*	-0.011*	-0.021***	-0.008	-0.021***	-0.022***	-0.021***
	(0.097)	(0.098)	(0.003)	(0.310)	(0.003)	(0.008)	(0.009)
INTA_ASSETS	0.349	0.346	0.349	0.449	0.342	0.458	
	(0.255)	(0.257)	(0.268)	(0.208)	(0.275)	(0.219)	
CAP_PROD	0.001**	0.001**	0.001*	0.003*	0.001**	0.003***	0.003***
	(0.016)	(0.015)	(0.067)	(0.000)	(0.054)	(0.000)	(0.000)
LAB_PROD	0.001***	0.001***	0.001***		0.001***		
	(0.000)	(0.000)	(0.000)		(0.000)		
CF_RATIO	0.901***	0.899***	0.846***	1.142***	0.849***	1.095***	1.080***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EMPLOYE	0.406***	0.404***	0.432***	0.189***	0.430***	0.201***	0.201***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AGE	0.003		0.004				
	(0.755)		(0.652)				
SECTOR	(dropped)		(dropped)				
OWNER	(dropped)		(dropped)				
Number of observations	1,011	1,011	1,011	1,011	1,011	1,011	1,011
Arellano-Bond test - Prob > z		0.0370		0.0672	0.0221	0.0612	0.0604
Sargan test - Prob > χ^2		0.6690		0.5046	0.8568	0.6612	0.6689

[1]*Model 1 – general model; Model 2 – excluding AGE variable; Model 3 – excluding TOT_ASSETS variable; Model 4 – excluding AGE and LAB_PROD variables; Model 5 – excluding TOT_ASSETS and LEVER variables; Model 6 – excluding LAB_PROD variable; and Model 7 – excluding INTA_ASSETS variable.*

[2]*All variables except dummies and ratios are in logs.*

[3]**, **, and *** represent significance at 10, 5, and 1 per cent, respectively. All regressions include source country dummies to control for source country effects.*

[4]*P-values in brackets.*

[5]*For Arellano-Bond test Ho is: no autocorrelation. Rejecting the null hypothesis (p-value <0.05) of no serial correlation at order one in the first-differenced errors does not imply that the model is misspecified. Rejecting the null hypothesis at higher orders implies that the moment conditions are not valid.*

[6]*For Sargan test Ho is: overidentifying restrictions are valid. If p-value >0.05, we confirm the null hypothesis that the overidentifying restrictions are valid. Rejecting the null hypothesis implies that we need to reconsider our model or our instruments.*

Table 8: Total assets GMM panel regressions (2001-2005), total sample[1, 2, 3, 4, 5, 6]

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
TOT_ASSETS (lagged)	-0.038***	-0.043***	-0.037***	-0.043***	-0.048***	-0.048***	-0.047***	-0.046***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
OP_REVEN	0.203***	0.199***		0.219***				
	(0.000)	(0.000)		(0.000)				
LEVER	0.076	0.076	0.098**	0.075	0.092*	0.097*	0.091*	0.093*
	(0.115)	(0.112)	(0.051)	(0.116)	(0.060)	(0.054)	(0.069)	(0.065)
CUR_RATIO	-0.030***	-0.030***	-0.034***	-0.029***	-0.034***	-0.035***	-0.035***	-0.035***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
INTA_ASSETS	-0.064	-0.060	0.001	-0.062	-0.006	0.032	0.021	
	(0.808)	(0.819)	(0.994)	(0.813)	(0.980)	(0.908)	(0.937)	
CAP_PROD	0.001***	0.001***	0.001**	0.001***	0.001**	-0.000		
	(0.003)	(0.003)	(0.017)	(0.006)	(0.015)	(0.377)		
LAB_PROD	0.000	0.000	0.001***		0.001***			
	(0.198)	(0.181)	(0.000)		(0.000)			
CF_RATIO	-0.342***	-0.339***	-.177**	-0.342***	-0.177**	-0.108	-0.114*	-0.117*
	(0.000)	(0.000)	(0.013)	(0.000)	(0.013)	(0.132)	(0.101)	(0.100)
EMPLOYE	-0.010	-0.011	0.085***	-0.031	0.079***	0.017	0.016	0.016
	(0.718)	(0.701)	(0.002)	(0.213)	(0.004)	(0.496)	(0.524)	(0.520)
AGE	0.004		0.011					
	(0.530)		(0.117)					
SECTOR	(dropped)		(dropped)					
OWNER	(dropped)		(dropped)					
Number of observations	1,097	1,097	1,097	1,097	1,097	1,097	1,097	1,011
Arellano-Bond test - Prob > z		0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test - Prob > χ^2		0.0225		0.0214	0.0491	0.0548	0.0658	0.0619

[1]*Model 1 – general model; Model 2 – excluding AGE variable; Model 3 – excluding TOT_ASSETS variable; Model 4 – excluding AGE and LAB_PROD variables; Model 5 – excluding TOT_ASSETS and LEVER variables; Model 6 – excluding LAB_PROD variable; and Model 7 – excluding INTA_ASSETS variable.*

[2]*All variables, expect dummies and ratios are in logs.*

[3]**, **, and *** represent significance at 10, 5, and 1 per cent, respectively. All regressions include source country dummies to control for source country effects.*

[4]*P-values in brackets.*

[5]*For Arellano-Bond test Ho is: no autocorrelation. Rejecting the null hypothesis (p-value <0.05) of no serial correlation at order one in the first-differenced errors does not imply that the model is misspecified. Rejecting the null hypothesis at higher orders implies that the moment conditions are not valid.*

[6]*For Sargan test Ho is: overidentifying restrictions are valid. If p-value >0.05, we confirm the null hypothesis that the overidentifying restrictions are valid. Rejecting the null hypothesis implies that we need to reconsider our model or our instruments.*

When total assets are used as dependant variable in our regression analysis we obtain similar results to those in table 6. Most of the firm-specific variables are statistically significant at 1 per cent and have the expected signs. The relation between a firm's degree of leverage and it growth is weak (all estimated coefficients of LEVER variable are marginally significant at 10 per cent and positive), which result is almost consistent with our hypothesis that SMEs in transition economies use predominantly external sources to support their growth in assets. When we analyze the effect of short-term liquidity on firm assets growth, the results reported in table 8 suggest that firms with better investment opportunities will choose to maintain lower liquidity in order to support their current growth. The data in table 8 support the notion that a firm's capability to generate capital internally (as measured by its cash flow ratio) plays an important role in explaining its growth; there is a strong but negative relation between INT_ASSETS variable and firm growth. This result supposes that SMEs in transition economies may rely less on internal capital to support the growth in their assets, especially in older firms that are less financially constrained. Although the EMPLOYE variable shows a statistically significant impact on firm growth (see models 3 and 5) this result should be treated with caution as there is a high degree of collinearity between it and the LAB_PROD variable (see table 3). When the latter is dropped from the rest of our model specifications, the EMPLOYE variable becomes statistically insignificant. Contrary to previous research AGE is found to have no significant effect on firm growth. The time-lagged value of dependant variable (TOT_ASSETS) is negative and statistically significant for all model specifications. The results of the Arellano-Bond and Sargan tests (shown at the bottom of the table) confirm that all model specifications (expect 2 and 4) are well specified.

4 Conclusion

This paper investigated the impact of firm-specific characteristics (age, size, internal finance, capital structure, growth opportunities, liquidity and factor productivity) on the growth of small and medium-sized enterprises. Using a panel data analysis for a set of 560 fast-growing SMEs in central and eastern Europe, we find that a firm's growth is related not only to the traditional determinant of size but also to other specific characteristics associated with its financial structure and productivity. In line with previous research, we find that firm size as measured by its total assets tends to increase sales revenues. At the same time, the growth in the number of employees in these firms shows a marginal impact on their growth in assets. Further, we find that the relation between future growth opportunities as proxied by the share of intangible assets in a firm's total assets and its growth is week (or even negative for some model specifications); this result can be explained by the fact that SMEs invest in RandD and other intangible assets but their impact on current growth is negligible as these are investments with no immediate but long term payoffs. Another important finding is that SMEs in transition economies rely predominantly on internally generated funds to support their sales growth but need access to external capital to support growth in their assets. Thus, we may conclude that firms with large cash flows will grow faster.

Contrary to our expectations, short-term liquidity is found to have a negative impact on growth in both sales revenues and assets. This finding suggests that firms with better investment opportunities will choose to maintain lower liquidity in order to support their current growth. The empirical results show that both capital and labor productivity are positively related to firm growth (both in sales and assets). This means that improved factor productivity will generate larger growth in these firms. In contrast to some previous empirical studies we find that age (that is, the number of years a firm exists as a business entity) and the sector a firm operates in (in our case, manufacturing or services) have no significant impact on firm growth. Also, we find no evidence that ownership (that is, whether a firm is publicly-traded or privately-held) is strongly associated with firm growth.

Our results are relevant for policy makers and firm managers of SMEs in transition economies. The evidence shows that small- and medium-sized firms in these countries still rely on internally generated sources to support their growth and find it very difficult to obtain external finance. Thus, the governments in transition economies need to pay increased attention to small- and medium-sized enterprises and try to create an environment that will be beneficial for SME development. Further, a better understanding of how firm-specific characteristics impact local firms' growth can help managers engage in more efficient decisions related to their capital structure in order to lower the cost of capital. Increasing the capital and labor productivity and investing more funds in research and development (or making a more efficient use of them) will help SMEs in transition economies improve their competitiveness on the EU market and thus, enhance their growth potential.

Unfortunately, the research does have some limitations. The most notable one is related to the lack of complete data for some proxy variables (e.g., short- and long-term debt) or variables that provide information for the educational background and international experience of SME managers. These variables are not included in the analysis. In addition, the empirical results are derived from a sample of transition economies, which includes a limited number of countries from central and eastern Europe. The study will improve if more SMEs with full data record from different CEE countries are included in the sample as firm characteristics vary from country to country. In order to address the other limitations discussed in the introductory part of the paper we need to introduce a control group (slower-growing firms in this case) and also run the analysis separately for each country in the sample. The analysis will benefit if the smallest (micro) and youngest (less than 5 years of existence) firms are included in the dataset in order to examine whether the impact of the identified determinants of growth differ between the different groups of SMEs. We may also investigate the effect of different macroeconomic variables (such as GDP per capita, inflation and tax rates) known to be relevant growth determinants or use time dummies instead of macro variables. This will improve our future research.

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THE EFFECT OF MARKET POWER ON BANK RISK TAKING IN TURKEY

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Review article**
JEL: D49, G21
UDC: 336.7

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Abstract

The aim of this paper is to understand the role of market power on the loan risk and overall bank risk measures for Turkish banks during 2001-2009. Testing for this question is particularly important for the Turkish banking system, which experienced an intense regulation process after 2000 leading to a significant decrease in the number of banks and thereby possibly reducing competition. The results of the study provide some evidence regarding the competition-stability hypothesis.

Keywords: competition, banking

1 Introduction

Given the high costs of banking crises in general and the role of competition in the recent U.S. subprime crisis, determining the reasons for banking system fragility and characterizing the role of competition in financial stability are important issues. Howe-

* The authors thank two anonymous referees, participants of Barcelona Empirical Banking Summer School and *Finance and Growth in Central and Eastern Europe* conference for their helpful comments.
** *Received:* May 31, 2010
Accepted: August 11, 2010

ver, there is no theoretical and empirical consensus on the role of competition on stability in banking.

There are two main hypotheses that are found in the literature about the relationship between competition and stability in banking: competition-fragility and competition-stability. The competition-fragility hypothesis argues that smaller banks, in more competitive environments, are more likely to take excessive risks and therefore competitive systems are more fragile than less competitive systems (see Keeley, 1990; Matutes and Vives, 2000; Caminal and Matutes, 2002; Martinez-Miera and Repullo, 2009 for further discussion). In contrast, the competition-stability hypothesis of Boyd and De Nicolo (2005) suggests that less competitive banking environment may cause fragility. Because a less competitive banking environments allow banks to increase the interest rate charged to firms (borrowers), which thus become more likely to have difficulties in repaying their loans, resulting in a higher probability of nonperforming loan ratios (NPL), more competitive environments are considered to be permit greater stability in banking systems (Beck, 2008)[1].

Empirical studies consider the fragility issue from different points of views. Some studies consider bank fragility from a macro perspective and take into account systemic banking crises (e.g. Beck, Demirguc-Kunt and Levine, 2006; and Schaeck and Čihak, 2006). Other studies consider bank fragility from a micro or managerial perspective and define it as the failure of an individual bank (e.g. Fungacova and Weill, 2009; and Bordo, Redish and Rockoff, 1993). There are also studies that consider fragility to be related to the risk-taking behavior of banks. These studies use the Z-index (e.g. Boyd and De Nicolo, 2006; and Berger, Klapper and Turk-Ariss, 2009) or the NPL ratios to measure risk (Jimenez, Lopez and Saurina, 2008). Macro studies mainly provide evidence for the competition-stability hypothesis while micro-based studies generally support the competition-fragility hypothesis. There is also no consensus about the methods for measuring competition. Some studies simply take the concentration ratios, while others use indices such as the Herfihndahl-Hirschman Index (HHI), Lerner, Tobin's q, and Panzar and Rosse's (1987) H-statistic. The empirical literature does not provide conclusive evidence in favor of either of the two hypotheses and the results of the individual studies are highly sensitive to the definition of fragility.

The relationship between competition and stability in banking has been investigated in many studies for the U.S. and mostly other advanced economies. However, little research has been carried out on this issue for developing economies, and previously there has been only one related study for Turkey: Tunay (2009). This is why our study is important. Tunay (2009) uses the NPL ratio as a measure of fragility and the three-bank concentration ratio, the ratio of privately owned bank assets to total assets of the system, and the ratio of foreign bank assets to total assets of the system as measures of competition for Turkish banking. Employing fixed and random effects models, he estimates the relationship between competition and fragility for the years between 1988 and 2007. The findings of Tunay (2009) indicate that there is no statistically significant relationship between concentration and fragility. Moreover the existence of foreign banks was found to decrease and domestic banks were found to increase fragility. The study provides some evi-

[1] See Boyd and De Nicolo (2009) for further discussion.

dence in favor of the competition-stability hypothesis for Turkey. However, the measurement of competition by concentration indices – as suggested by the structure conduct hypothesis in industrial organization literature – is a controversial issue. This is because competition and concentration refer to different concepts, and previous studies show that a concentrated banking system can be more competitive than a less concentrated one but also that a less concentrated banking system can be less competitive than a concentrated system (Claessens and Laeven, 2003; and Abbasoglu, Aysan and Gunes, 2007).

The aim of this paper is to understand whether competition promotes stability or fragility for Turkish banks. This question is particularly important for the Turkish banking system since it has experienced intensive regulation processes that have led to a decline in the number of banks and, possibly to changes in the competitive structure especially after the year 2000, an important turning point for Turkish banking. This paper employs mainly two different risk measures to account for loan risk and overall risk measures as dependent variables: the nonperforming loans to total loans and the Z-index to measure the risk taking behaviors of banks. Firstly, we employ the Lerner index and secondly the ratio of the difference between the total revenues and total cost to the total revenues (that does not specify any restriction on inputs and outputs) as proxies for the market power of individual banks during 2001-2009. To summarize, this paper contributes to the existing literature in different ways. Primarily, it is the first study to calculate the Lerner index for Turkish banks. Second, it is the first paper that considers competition as the ability to sell products above the marginal cost and then employs this to see the effect of competition on the risk-taking behaviors of banks in Turkey.

The paper is organized as follows. The next section describes the methodology that is used to calculate the Lerner index, and the risk taking variables are introduced. Later, sample and data used in the study are presented along with the descriptive statistics. This is followed by a discussion of the empirical results, and the final section concludes the paper.

2 Methodology

Many studies consider competition as a structural phenomenon and accordingly employ concentration ratios to measure competition. These studies argue that a greater concentration creates a less competitive banking environment that leads to higher profitability (Fungacova and Weill, 2009). Accordingly, competition can be measured by concentration indices such as the market share of the largest banks or by the HHI, which is defined as the sum of the squares of the market shares of the largest banks (Bikker and Haaf, 2000). However, it should be kept in mind that concentration and competition do not refer to the same thing.

Market power can be considered as the ability to sell products above the marginal cost. The Lerner index is one of the earliest and most popular indices for measuring market power as the difference between the price and marginal cost over the price (see Jimenez et al., 2008; Hainz et al., 2008; and Fungacova and Weill, 2009 for use of Lerner index in banking). The value of the index ranges from zero to one. In case of perfect competition, the price equals marginal cost and the value of the index becomes zero, and as the price

is determined above the marginal cost the value of the Lerner index increases. That is the more market power there is, the bigger is Lerner index.

In summary, we need two things to calculate the Lerner index: the price of bank production and the marginal cost. In this study, the price of bank production is calculated as the total revenues over the total assets. The disadvantage of the Lerner index is that the marginal cost function needs to be estimated. In this paper, the information related to marginal cost is obtained from the total cost function[2].

A cost function specifies the relationship between cost, input prices and output level. However Berger and Humphrey (1997) state that there is no consensus on input and output measures in banking. Nonetheless, there are two dominant approaches on this issue: the intermediation and production approaches. The production approach evaluates banks as production units that produce services to the depositors and borrowers. In this approach, the production factors such as land, labor and capital are used as inputs to produce banking services and the production is measured via the number of transactions or documents processed over a given time period. However, since this data is not easy to obtain the number of accounts have often been used as a proxy for banks' production in the previous literature (Denizer et al., 2000; and Berger et al., 1997). The intermediation approach on the other hand, considers deposit banks as financial intermediaries that collect deposits from the depositors and lend to borrowers and assumes that banks collect deposits and other purchased funds with the assistance of labor and physical capital and as intermediaries turn these sources of funds into loans (Kasman, 2002).

However, Turkish deposit banks have not fulfilled their intermediation duty during the studied period and it is difficult to obtain data on the number of transactions; hence, the total loans are considered as outputs, while labor, physical capital, and borrowed funds are used as inputs.

The price of labor represents the unit price of labor and it is obtained by dividing the personnel expenses (including severance payments) by the total assets. The price of physical capital is the ratio of other noninterest expenses (excluding personnel expenses and severance payments) to fixed assets. Finally, the price of funds represents the unit price of the funds and it is constructed as the ratio of interest expenses to borrowed funds and the deposit sum (Podpiera and Podpiera, 2005).

Under the cost function specification, the total cost (the sum of personnel expenses, other noninterest expenses and interest expenses) is estimated as a function of the output sum (total deposits, total securities, and total loans) and the three input prices. Table A1 gives the estimation results of the total cost function that is built in order to obtain the marginal cost.

Calculating a Lerner index to be used as a proxy of market power is not an easy process and can possibly be subject to many misspecification biases. Firstly, it requires many assumptions on inputs and outputs, and secondly, it requires many assumptions on the calculation methods of input prices and output quantity, and finally it requires assumpti-

[2] See Christensen and Greene (1976), Ray (1982), Jimenez et al. (2008), Hainz et al. (2008), Carbo et al. (2009), and Fungacova and Weill (2009) for a detailed discussion of cost functions and application to the banking sector.

ons on the functional form of the cost function. Mountain and Thomas (1998) show that it is better to include no factor prices than to include miss-specified factor prices. Thus, in order to calculate the market power of the individual banks in Turkey, we use an *MP* ratio that does not specify any inputs and outputs, as well as a functional form that is simply of the difference between the total revenues and total cost to the total revenues.

Since, the aim of this paper is to understand whether competition leads to taking higher risks or not, the general empirical model for this question is:

$$\text{Risk taking of banks} = f(\text{market power, control variables}).$$

In order to measure the risk taking behaviors of banks, nonperforming loans, and Z-index are employed. The Z-index can be computed as $Z = (NPA+EA) / \sigma(NPA)$, where *NPA* is the net profit to the assets, *EA* is the equity to assets ratio and $\sigma(NPA)$ is the standard deviation of the Net Profits to the Assets. The Z-index goes up as the profitability and capitalization increase, and decreases as the variability of the earnings increases. Thus, there is a tradeoff between the Z-index and the bank's probability of failure (Berger et al., 2009: 106). The Z-index increases with higher profitability and capitalization levels, and decreases with unstable earnings that are reflected by a higher standard deviation of return on assets. In other words, it can be regarded as an inverse proxy of the bank's risk-taking.

3 Data and descriptive statistics

The period 1999-2001 can be considered years of transformation for Turkish banks. Within these three years, the Turkish economy was hit by two severe economic crises and a destructive earthquake in the most industrialized region of the country. Furthermore, the parliament approved the new banking law (no 4389) in 1999. The Government guarantee on deposits, which had been set at 100 % for the year 1994 was restricted to 100,000 Turkish liras in 2000 and was further restricted to 50,000 Turkish liras in 2001.

The Turkish Banking Restructuring Program was started in 2001. To build a stronger banking system after the two severe crises, this program was conducted under the control of the IMF. The aim of these actions was to create a more efficient banking system. However, the restructuring program has turned out to be one of the most costly restructuring programs in the world (Banks in Turkey, 2001).

In Turkey, there were 81 banks operating in 1999. Over the next decade this number fell drastically and as of April 2010 there are only 45 banks operating in Turkey. Of these, 32 are deposit banks and 13 are development and investment banks. Of the deposit banks, 3 are state-owned banks, 11 are privately-owned, 11 are foreign banks founded in Turkey, 6 are foreign banks having branches in Turkey, and there is one Saving and Deposit Insurance Fund[3].

[3] SDIF is a state institution that insures saving deposits and participation funds and resolves the banks and assets transferred to it in a proper way.

Banking has a distinctive place in the Turkish financial system and plays an important role in achieving financial stability in Turkey.[4] Although there has been a recent increase in the number and size of non-banking financial institutions, the system is still dominated by the deposit banks.

Data was drawn from the banks' balance sheets and income statements as reported to the Banks Association of Turkey (BAT) and covers 30 deposit banks operating during the 2001-2009 period[5], and the IPI data were obtained from the Turkish Central Bank (TCMB). As a measure of loan risk, the non-performing loans ratio (gross) and as a measure of overall bank risk Z-index are used. Table A3 gives the definitions and summary statistics of the variables employed in the empirical part of the study. The summary statistics show that our sample consists of very heterogeneous observations.

Two variables are employed in the study as proxies for market power. First, the Lerner index is derived from the marginal cost function and the price of the bank's production as explained in methodology section. Second, (*MP)* is calculated as the difference between the total revenue and total cost divided by the total revenue. Higher values of market power correspond to lower competition levels. Thus a negative coefficient is expected according to the competition-fragility view. On the other hand, the competition-stability view expects a positive relation. The *ASSETSHARE* variable measures the asset share of the individual bank in the sector. Total shareholders' equity divided by the total assets *(EA)* is the indicator of capital adequacy. Net profits (losses) divided by the total assets *(NPA)* is employed to control the effect of profitability on risk variables. Total revenues divided by the total expenses *(TRTE)* variable is employed to control for managerial efficiency.

In this study, the industrial production index *(IPI)* is used to control for the changes in the economic environment. When *IPI* is increasing, borrowers (firms and consumers) are considered to be earning more and to be able to repay loans more easily, thus the *IPI* has a negative expected relationship for *NPLG,* and has a positive expected sign for the empirical model for which the Z-index is the dependent variable.

4 Empirical results

The average Lerner index is calculated as 0.9674. This indicator implies that the banks in Turkey do not operate in a competitive environment, and enjoy monopoly rents. This result is consistent with Abbasoglu et al. (2007) who provide evidences for a monopolistic competitive structure in the Turkish banking system from 2001 to 2005. With this calculation of market power, it is seen that Turkey has a less competitive banking sector than, particularly, the EU economies. In a recent study Carbo et al. (2009) calculate the average Lerner index for EU countries as 0.16.

An interesting result observed from the correlation matrix is the correlation between *LERNER, MP* and *ASSETSHARE* variables. There is a weak correlation between *ASSETS-*

[4] Total assets of the banking system account for nearly 90 percent of the total assets of the financial sector and deposit banks held 97 percent of the total banking system assets in 2008 (Banks Association of Turkey, 2008).

[5] See table A2 for the list of banks included in the study.

HARE and the *LERNER* 0.08 and a 0.1 correlation between *ASSETSHARE* and *MP*. This preliminary result contradicts the structure-conduct-performance hypothesis used in industrial organization theory. This hypothesis argues that as concentration increases, the banking environment becomes less competitive, which results in higher monopoly rents; accordingly, competition can be measured by the concentration indices. However, the number of studies challenging this hypothesis increased recently (Claessens and Laeven, 2003; and Abbasoglu et al., 2007).

Tables A5-A8 summarize the results of the static and dynamic empirical models. Under the static models fixed-effects, random-effects and GMM models are estimated. The first two techniques assume the market power variable is exogeneous. However market power can be endogeneously determined. That is to say market power can also be a function of level of risk. The Durbin Wu Hausman test is conducted to test for endogeneity. Except for the first group of estimations (table A5) *LERNER* is found to be exogeneously determined. For all the other remaining regressions *LERNER* and *MP* are endogeneous. In order to avoid the biased coefficient estimations caused by endogeneity, 2SLS or GMM techniques are applied in the literature (Berger et al., 2009; and Shaeck and Cihak, 2007). However, Baum and Schaffer (2003) indicate that if the errors are heteroscedastic, the GMM technique will give more efficient estimates than the 2SLS. In order to test for the homoscedasticity assumption the Breusch-Pagan test employed and the errors are found to be heterosedastic. Consequently, the GMM technique can be considered superior to the other static estimation techniques when endogeneity of market power proxies is present.

Under the dynamic models, two specifications of the GMM method proposed by Arellano-Bond (1991) are used: in the first, market power variables are exogenously determined, and endogeneously in the second model. In the models where the market power variables are endogenously determined, one-period lagged values of the market power variables are used as instruments. However, coefficients of the lagged dependent variables are insignificant in all specifications in tables A5-A8, which indicate the superiority of the static models.

To sum, among the static models, since the market power variables are endogeneous and heteroscedasticity is present, the GMM technique is superior to the other specifications of tables A6, A7 and A8. For models in table A5, where *NPLG* is the dependent and *LERNER* is the independent variable, the Durbin Wu Hausman endogeneity test indicates the absence of endogeneity. Thus random or fixed effects models are superior to static GMM. However the Hausman test is indifferent between the random and the fixed effects model at 5%. Moreover the results of the fixed and random effects models are quite similar.

Fixed and random effects estimations of table A5 indicate no significant relationship between *NPLG* and *LERNER.* In contrast to this finding, in table A6 where *NPLG* is the dependent and *MP* is employed as the independent variable, a positive and statistically significant relationship is found in the static GMM specification of the model. Both static and dynamic GMM estimations where *LERNER* is treated endogeneous in table A7 indicate the presence of a negative and statistically significant relationship between *LERNER*

and *Z.* Since *Z* can be regarded as an inverse measure of risk, these results suggest that as the market power of a bank increases the risk level of that bank increases. Thus, as market power decreases, competition creates less risky banks, and following this, the stability of the whole system can be realized. However in table A8 the static GMM model fails to find a significant relationship between *MP* and *Z.*

The positive and significant coefficient estimates of *EA* in random and fixed effects models of table A5 and in the static GMM model of table A6 reveal the effect of capitalization for risk levels of banks. As shareholder equity to total assets ratio grows banks become more likely to take excessive risk. This may be due to offsetting risk by higher capitalization levels.

The negative and significant (10%) coefficient estimates of *NPA* in the random effects model of table A5 and the static GMM model of table A6 reveals that as profitability increases banks are less likely to have higher loan risk levels. However this finding should not be considered very important since the fixed effects estimate of the coefficient in table A5 is insignificant.

As for the effects of ownership structure on loan and overall risk levels of banks, the three state-owned banks are found to be more likely to have higher risk levels than private banks in all superior specifications of tables A5-A8. As for the effect of the foreign ownership, foreign banks are found less risky in the models of table A5, A6 and A7. Finally, the *IPI* variable has no explanatory power in any of the models, which indicates loan and overall risk levels of banks are not affected by the macro economic conditions.

5 Conclusion

The aim of this paper was to examine the relationship between the market power and risk-taking behaviors of banks in Turkey between 2001 and 2009. As dependent variables, non-performing loans and Z-index are employed as measures of loan and overall risk levels respectively, and the market power is first measured by the Lerner index. However, calculation of the Lerner index can be subject to many misspecification biases in banking. Thus secondly, in addition to the standard Lerner index, the difference between the total revenues and total cost over the total revenues (which does not specify any restriction on inputs and outputs or a cost function to estimate the marginal cost) is used as another proxy for the market power.

Employing both static and dynamic panel data estimation techniques, some evidence supporting the competition-stability hypothesis is found in the empirical part. However the findings of the study indicate that the effect of the market power on the risk-taking behaviors of banks is not crystal clear in Turkey after the year 2000. Another finding is related to the negative relationship between profitability and fragility. This finding suggests that a fall in profitability – measured by the ratio of net profit (loss) to assets – leads to increases in loan risk levels of banks. Capitalization measured by the shareholders' equity divided by the total assets plays a positive role on the risk-taking of banks. This can be due to banks' attempts to offset risk by higher capitalization levels. That is

to say, the loan risk and the overall risk levels tend to be higher in better capitalized and less profitable banks.

As a proxy for macroeconomic environment, the industrial production index does not have any explanatory power on the risk-taking behaviors of banks in Turkey. Regarding the ownership structure and risk taking behaviors of banks, the three state-owned banks are found to be more likely to have higher risk levels than private banks. Additionally there is some little evidence supporting the idea that the foreign banks are less risky than the domestic ones. To sum up, our main result of the competition-stability hypothesis is in line with findings of the previous study of Tunay (2009) on Turkish banking.

Some policy suggestions can be derived from the results of the study. First of all there is a huge gap between the average market powers of EU and Turkish banking systems. Banks in Turkey operate nearly in a non-competitive environment compared to the EU economies. In addition to this fact, the disadvantages of having less competition and "too big to fail" policies in banking are especially important for an emerging economy like Turkey. Thus competition should be fostered in the sector in order to have a system composed of less risky banks and a consequent lower probability of financial crisis. The current system is composed of powerful banks (with higher price-cost margins), and the entrance of smaller banks (lower price-cost margin) should be encouraged. In this way, a more competitive banking system can be created and the investment level of the economy might be increased with lower prices on the loan side.

This paper can be extended by employing the banking crises as fragility indicator, moreover other competition measures such as the Panzar and Rosse's H-stat, the Herfihndahl–Hirschmann, and Boone indices can be used to analyze the competitive structure of Turkish banking.

APPENDIX

Table A1: Total cost function estimation results Dep. Var.: log(TC)

Variables	Coefficient (std. errors)
Constant	-2.09 (.72)***
Output	.216 (.035)***
Pk	.453 (.064)***
Pl	.193 (.144)
Pf	.353 (.124)***
½(output)^2	-.027 (.003)***
Pk*Pl	-.077 (.046)*
Pk*Pf	-.085 (.022)***
Pl*Pf	.007 (.036)
Pl*output	-.058 (.015)***
Pk*output	-.017 (.11)
Pf*output	.075 (.013)***
Overall significance	Wald chi2(8) = 1492.35 Prob > chi2 = 0.00
Number of observations	262

*Notes: (a) *, ** and *** denote statistical significance at 10%, 5% and 1% respectively.*
(b) Output implies the log of total loans.
(c) Pk, Pl and Pf stand for logs of the prices of capital, labor and funds respectively.

Table A2: List of banks used in the study

Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	Arap Türk Bankası A.Ş.
Türkiye Halk Bankası A.Ş.	Citibank A.Ş.
Türkiye Vakıflar Bankası T.A.O.	Denizbank A.Ş.
Adabank A.Ş.	Deutsche Bank A.Ş.
Akbank T.A.Ş.	Eurobank Tekfen A.Ş.
Alternatif Bank A.Ş.	Finans Bank A.Ş.
Anadolubank A.Ş.	Fortis Bank A.Ş.
Şekerbank T.A.Ş.	HSBC Bank A.Ş.
Tekstil Bankası A.Ş.	ING Bank A.Ş.
Turkish Bank A.Ş.	Millennium Bank A.Ş.
Türk Ekonomi Bankası A.Ş.	Turkland Bank A.Ş.
Türkiye Garanti Bankası A.Ş.	ABN AMRO Bank N.V.
Türkiye İş Bankası A.Ş.	Bank Mellat
Yapı ve Kredi Bankası A.Ş.	Société Générale (SA)
Birleşik Fon Bankası A.Ş.	WestLB AG

Table A3: Summary statistics

Variable	Definition	Obs	Mean	Std. dev	Min	Max
Nplg	Loans under follow-up (gross) / Total loans (%)	265	35.62	241.6	0	3759
Z	(NPA+ EA) / std. dev(NPA)	270	2.78	2.59	-3.06	15.07
Lerner	Lerner index (Price-Marginal Cost) / Price	262	0.9674	0.096	0.021	0.995
Mp	(Total Revenues-Total Cost) / Total revenues (%)	269	0.9921	0.0025	0.971	0.9992
Assetshare	Asset share in the sector (%)	270	3.214	4.78	0.0001	19.4
Npa	Net profit (losses) / Total assets (%)	270	0.983	6.84	63.2	32.2
Ea	Shareholders' equity / Total assets (%)	270	18.07	16.36	-2.67	84.9
Trte	Total revenues / Total expenses (%)	269	144.2	91.1	34.63	1290.8
Ipi	Industrial production index	270	125	17.2	94.43	146.32

Table A4: Correlations

	Nplg	Z	Lerner	Mp	Assetshare	Npa	Ea	Trte	Ipi
Nplg	1								
Z	0.21	1							
Lerner	-0.25	-0.23	1						
Mp	-0.06	0.51	0.21	1					
Assetshare	-0.07	-0.15	0.08	0.1	1				
Npa	-0.49	0.44	0.26	0.67	0.07	1			
Ea	0.49	0.89	-0.39	0.23	-0.21	-0.004	1		
Trte	0.17	0.73	0.03	0.57	-0.05	0.52	0.56	1	
Ipi	-0.009	0.11	0.21	0.16	0.03	0.23	0.01	0.08	1

Table A5: Estimation results: dep var=nplg and market power=Lerner

Dep var: NPLG	**Static models**			**Dynamic models**	
	Fixed effects (a)#	**Random effects (a)#**	**GMM (b)**	**GMM (c)**	**GMM (d)**
Lag.nplg				.37 (1.16)	1.87 (1.22)
Lerner	95.59 (233.5)	-18.58 (257.2)	-923.3 (736.6)	-585.8 (488.3)	-128.1 (295.35)
Assetshare	4.25 (10.1)	-.44 (1.78)	.38 (.96)	55.3 (37.0)	26.5 (33.76)
Trte	.86 (.56)	1.01 (.54)*	1.19 (.32)	1.13 (.34)***	.88 (.23)***
Ea	4.23 (2.21)*	4.81 (1.62)***	4.93 (2.25)**	-.37 (4.14)	-4.90 (4.45)
Npa	-25.73 (16.6)	-26.76 (14.7)*	-35.21 (10.2)***	-49.9 (13.35)	-48.4 (12.4)***
Ipi	2.1 (1.43)	1.95 (1.25)	.061 (.50)	.12 (.96)	.24 (.79)
Foreign		-48.8 (24.5)**	-25.6 (16.8)		
State		28.67 (13.7)**	30.6 (14.7)**		
Constant	-504.6 (196.4)**	-368.1 (291.9)	746.2 (699.8)	322.8 (511.9)	36.3 (364.6)
Number of obs	261	261	229	201	201
Overall significance	F(6,29) = 7.23***	Wald chi2(9) = 492.8***	F(8, 220) = 6.20***	Wald chi2(7) = 109.7***	Wald chi2(7) = 61.6***
R-squared	within = .43 between = .88 overall = .53	within = .42 between = .90 overall = .55	Centered = .77 Uncentered = .78		
Hansen J statistic			1.69 Chi-sq(1) P-val = .192		
Hausman test	chi2(6) = 12.45 Prob>chi2 = 0.05				

*Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% respectively.*
Wooldridge test for the serial correlation indicates absence of serial correlation.
Heteroscedasticity robust std. errors are presented in parentheses.
(a) FE and RE estimators that assume Lerner exogeneous.
(b) GMM estimators that assumes Lerner endogeneous.
(c) differenced GMM estimator that assumes all independent variables except the lagged dependent variable are exogeneous.
(d) differenced GMM estimator that assumes Lerner and lagged dependent variable are endogeneous.
(e) # denotes the preferred models according to results of Durbin Wu Hausman endogeneity test, Hausman specification test.

Table A6: Estimation results: dep var=nplg and market power=MP

Dep var: NPLG	**Static models**			**Dynamic models**	
	Fixed effects (a)	**Random effects (a)**	**#GMM (b)#**	**GMM (c)**	**GMM (d)**
Lag.nplg				.05 (1.40)	1.48 (1.21)
Mp	17569.3 (14419.7)	18486.1 (12616.7)	18428.4 (7948.6)**	16528.3 (15264.4)	28139.3 (13612.2)
Assetshare	1.67 (10.19)	-1.76 (1.48)	-1.22 (1.04)	51.1 (32.8)	34.3 (29.08)
Trte	.78 (.43)*	.80 (.35)**	.99 (.26)***	1.03 (.40)**	.80 (.31)**
Ea	3.31 (2.65)	4.93 (1.72)***	5.82 (2.29)**	2.64 (4.45)	-3.36 (4.25)
Npa	-28.02 (18.3)	-29.1 (15.7)*	-37.3 (10.4)***	-50.41 (17.7)***	-51.4 (16.4)***
Ipi	2.01 (1.24)	1.81 (1.09)*	-.13 (.51)	-.091 (.97)	.22 (.66)
Foreign		-51.8 (20.8)**	-25.6 (18.1)		
State		31.04 (15.3)**	42.8 (14.9)***		
Constant	-18670.8 (12599.6)	-18670.8 (12659.4)	-18395.8 (7902.3)**	-16629.6 (15190.4)	-28028.81 (13514.9)**
Number of obs	264	264	234	205	205
R-squared	within = .43 between = .89 overall = .54	within = .42 between = .92 overall = .56	Centered = .76 Uncentered = .77		
Overall significance	F(6,29) = 10.98	Wald chi2(8) = 260.1***	F(8, 225) = 14.18***	Wald chi2(7) = 147.14***	Wald chi2(7) = 33.7***
Hansen J statistic			1.361 Chi-sq(1) P-val = 0.243		

*Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% respectively.*
Wooldridge test for the serial correlation indicates absence of serial correlation.
Heteroscedasticity robust std. errors are presented in parentheses.
(a) FE and RE estimators that assume MP exogeneous.
(b) GMM estimator assume MP endogeneous.
(c) differenced GMM estimator that assumes all independent variables except the lagged dependent variable are exogeneous.
(d) differenced GMM estimator that assumes MP and lagged dependent variable are endogeneous.
(e) # denotes the preferred model according to results of the Durbin Wu Hausman endogeneity test.

Table A7: Estimation results: dep var=z and market power=Lerner

Dep var: z	**Static models**			**Dynamic models**	
	Fixed effects (a)	**Random effects (a)**	**#GMM (b)#**	**GMM (c)**	**GMM (d)**
Lag.z				-.007 (.12)	-.004 (.088)
Lerner	-5.08 (3.08)	-6.23 (2.24)***	-7.93 (3.56)**	-4.37 (3.92)	-7.16 (3.11)**
Assetshare	-.15 (.13)	-.055 (.046)	-.043 (.016)***	-.044 (.24)	-.01 (.21)
Trte	.01 (.002)***	.013 (.002)***	.014 (.003)***	.003 (.0009)***	.004 (.001)
Ea					
Npa					
Ipi	.014 (.007)*	.013 (.006)**	.002 (.006)	-.01 (.01)	-.001 (.009)
Foreign		.11 (.58)	.064 (.21)		
State		-.31 (.19)	-.33 (.108)***		
Constant	4.67 (3.09)	5.13 (2.19)**	8.06 (3.42)**	7.89 (3.74)	9.23 2.91)***
Number of obs	262	262	229	201	201
R-squared	within = .33 between = .58 overall = .48	within = .32 between =.79 overall = .57	Centered = .58 Uncentered = .83		
Overall significance	F(4,29) = 23.98***	Wald chi2(6) = 590.4***	F(6, 222) = 11.77***	Wald chi2(5) = 54.32***	Wald chi2(5) = 52.09***
Hansen J statistic			3.463 Chi-sq(1) P-val = 0.062		

*Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% respectively.*

Wooldridge test for the serial correlation indicates absence of serial correlation.

Heteroscedasticity robust std. errors are presented in parentheses.

(a) FE and RE estimators that assumes Lerner exogeneous.

(b) GMM estimator that assume Lerner endogeneous.

(c) differenced GMM estimator that assumes all independent variables except the lagged dependent variable are exogenous.

(d) differenced GMM estimator that assumes Lerner and lagged dependent variable are endogeneous.

(e) # denotes the preferred models according to results of Durbin Wu Hausman endogeneity test.

Table A8: Estimation results: dep var=z and market power=MP

Dep var: z	**Static models**			**Dynamic models**	
	Fixed effects (a)	**Random effects (a)**	**#GMM (b)#**	**GMM (c)**	**GMM (d)**
Lag.z				-.045 (.24)	.16 (.16)
Mp	331.5 (138.5)**	315.8 (137.2)**	152.6 (118.2)	255.1 (75.5)***	211.8 (84.2)**
Assetshare	-.26 (.16)	-.17 (.09)*	-.128 (.032)***	-.26 (.18)	-.21 (.19)
Trte	.007 (.001)***	.007 (.001)***	.013 (.004)***	.0028 (.0009)***	.0026 (.0007)***
Ea					
Npa					
Ipi	.010 (.008)	.010 (.007)	.007 (.008)	-.0008 (.02)	.001 (.012)
Foreign		-.68 (.96)	-.61 (.37)*		
State		-.13 (.42)	-.33 (.14)**		
Constant	-327.6 (137.6)**	-312.06 (136.1)**	-150.8 (117.06)	-249.5 (75.9)***	-207.5 (84.1)**
Number of obs	269	269	239	210	210
R-squared	within = .38 between = .30 overall = .33	within = .38 between = .40 overall = .40	Centered = .43 Uncentered = .75		
Overall significance		Wald chi2(6) = 331.34***	F(6, 232) = 11.91***	Wald chi2(5) = 81.02***	Wald chi2(5) = 73.09***
Hansen J statistic			0.235 Chi-sq(1) P-val = 0.628		

*Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% respectively.*

Wooldridge test for the serial correlation indicates absence of serial correlation.

Heteroscedasticity robust std. errors are presented in parentheses.

(a) FE and RE estimators that assume MP exogeneous.

(b) GMM estimators that assumes MP endogeneous.

(c) differenced GMM estimator that assumes all independent variables except the lagged dependent variable are exogenous.

(d) differenced GMM estimator that assumes MP and lagged dependent variable are endogeneous.

(e) # denotes the preferred models according to results of Durbin Wu Hausman endogeneity test.

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EMPLOYMENT POLICY IN THE EUROPEAN UNION

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Glossary*

Important principles, objectives and activities of the employment policy of the Union include promotion of a high level of employment throughout the Community by developing a coordinated strategy, particularly with regard to the creation of a skilled, trained and adaptable workforce and labour markets responsive to economic change.

The Union's responsibilities with regard to employment are complementary to those of the member states, the main aim being to create a European Employment Strategy (EES). The EES is intended as the main instrument to provide direction and to coordinate the employment policy priorities supported by member states at a European level.

Towards a more comprehensive employment policy

1 The White Paper on Growth, Competitiveness and Employment (1993)

The high level of unemployment in most EU countries contributed to the release of the White Paper on Growth, Competitiveness and Employment. It launched the debate on the European economic and employment strategy by bringing the issue of employment to the top of the European agenda for the first time.

2 The Essen Process (1994)

In order to fight unemployment, the European Council of Essen in December 1994 agreed on five key objectives to be pursued by member states: (1) to invest in vocational training, (2) increase employment by intensive growth, (3) reduce non-wage labour costs, (4) increase active labour market policies, and (5) fight youth and long-term unemployment. Member states were charged with translating these recommendations into multi-annual programmes monitored by the Commission and the Council. The European Council was informed annually on the result of the Commission's and the Council's review. The Essen Process helped to raise awareness of the high unemployment in the member states at EU level.

* *Received*: August 31, 2010
Accepted: September 2, 2010

3 The contribution of the Amsterdam Treaty (1997)

The new Employment Title in the Amsterdam Treaty set up the European Employment Strategy and the permanent, Treaty-based Employment Committee with advisory status to promote coordination of the member states' employment and labour market policies.

The Treaty has not changed the basic principle of the member states having the sole competence for employment policy but the member states have committed themselves to co-ordinating their employment policies at Community level. The Treaty entrusts the Council and the Commission with a much stronger role and with new tasks and tools. The European Parliament has been brought more closely into the decision making process, too. The responsibilities of social partners and their abilities to contribute are also enhanced through the inclusion of the Social Protocol into the Treaty.

The European Employment Strategy 1997-2004

The extraordinary Luxembourg Job Summit in November 1997 anticipated the entry into force of the Amsterdam Treaty in 1998 and launched the European Employment Strategy, the so-called Luxembourg Process.

It created the framework for the annual cycle for coordinating and monitoring national employment policies. The coordination of national employment policies at EU level is based on the commitment of the member states to establishing a set of common objectives and targets. The strategy was built around the following components:

- Employment guidelines: based on a proposal from the Commission, the Council agreed every year on a series of guidelines setting out common priorities for member states' employment policies;
- National action plans: each member state drew up an annual national action plan describing how these guidelines are implemented in practice at the national level;
- Joint Employment Report: the Commission and the Council jointly examined the national action plans and presented a joint employment report to the European Council. Based on this analysis, the Commission presented a proposal for the employment guidelines for the following year;
- Recommendations: the Council may decide, by a qualified majority, to issue country-specific recommendations upon a proposal by the Commission.

In 2000, the Lisbon European Council agreed on the new strategic goal of making the EU "the most competitive and dynamic knowledge-based economy in the world", capable of sustaining economic growth with more and better jobs and greater social cohesion. It embraced full employment as an overarching objective of employment and social policy and set concrete targets to be achieved in 2010, i.e. increase the overall employment rate to 70% and the women's employment rate to more than 60%. In 2001, another target was added to raise the employment rate for older workers (55 to 64 years) to 50% by 2010.

To reflect these conclusions, five new "horizontal objectives" were introduced in the 2001 guidelines: realising full employment, stimulating lifelong learning, promoting the role of social partners, ensuring a proper policy mix between the four pillars, and developing common indicators in order to assess progress. The improvement of the quality in work was added in 2002.

The Employment Guidelines 2005-2008 and 2008-2010

The Integrated Guidelines 2005-2008 and 2008-2010 contain a total of 23 guidelines, of which 8 are devoted specifically to employment to boost the Lisbon strategy. The eight employment guidelines are essential to reach the three priorities for action in the field of employment (1) attract and retain more people in employment, increase labour supply and modernise social protection systems, (2) improve adaptability of workers and enterprises, (3) increase investment in human capital through better education and skills. The main target is to increase the employment rate to 70% by 2010.

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THE ASCENT OF MONEY: A FINANCIAL HISTORY OF THE WORLD

Niall Ferguson, 2008, Penguin Books Ltd., London, UK, pp. 350

Review*

Niall Ferguson is considered one of the most influential of economic historians. In his latest book *The ascent of money: a financial history of the world* he boldly argues that finance is behind every major event in history. But if financial history is one of the key elements in interpreting history, then surely it deserves more attention than 350 pages. The proper subtitle of his book might as well be *A very concise financial history of the world*. The reason why this book is relatively short, especially when the title is so ambitious, is that it was written as a script for a TV show of the same name, and I guess Ferguson failed to obtain funding for more than four episodes. The fact that this book is also a TV show is important in understanding its structure of arguments. The book is full of historical examples, biographies of people who have shaped finance in their times, which makes this book very enjoyable to read (and watch), but which does not necessary contribute to rigorous analysis or strengthen its arguments. In fact, the target group of this book seems to be "ordinary" people and not economic historians or finance experts.

Even if this book is not an epitome of rigorous scientific analysis, its conclusions clearly make it a part of the liberal camp of economic thought. Possibly one of the boldest claims of this book is that in spite of the recent crisis, the direction of development of finance is clearly upwards. Regardless of current setbacks, hedge funds are a way of managing risk superior to the welfare state, and Ferguson cites the example of Pinochet's Chile. Here Ferguson shows that he is not just an economic but also a political liberal. He clearly separates his support for Pinochet's economic policies from his dislike of the brutal dictatorship, and he even poses a question, which he rejects later, that it may be the case that radical pro-market reforms during Pinochet were possible only under dictatorship, where the opposition to these reforms is silenced by bullets. One issue where Ferguson dissaligns himself from his fellow liberals is his opposition to obsession with property ownership, especially owning houses. His reasoning is that future risks are better reduced by diversification than by putting all eggs into one house. The main objective of

* *Received:* May 3, 2010
Accepted: May 5, 2010

this book is to follow the historical development of financial markets and how the development of financial markets has influenced the development of human civilization. The book is divided into introduction, six chapters and an afterword.

In the introduction, Ferguson highlights the importance of the financial sector in modern economies. For instance, it accounts for 7.7 per cent of GDP in the US and 9.4 per cent in the UK, with these numbers likely to grow in future. The chapter concludes with three things Ferguson learned about financial markets while writing this book. The first thing is that the financial sector and banks can cause poverty. But, contrary to what one might expect, especially in the light of the current financial crisis, Ferguson argues that banks can create poverty not through greed but by their absence, combined with that of other "formal" financial institutions. In other words, the existence of banks is a prerequisite for poverty reduction. Second, the financial system is not perfect because it is just the "mirror of mankind" – it reflects both our virtues and our faults. Third, it is very difficult to predict the next financial crisis because the future always contains a degree of risk and uncertainty.

Chapter one gives a short history of the first step in the ascent of money, and that is the creation of banks. Before banks could be created, the true nature of value of money had to be discovered. Spanish believed that the value of money was inhered in the metal of coins. Hence, they believed all they needed to do to get richer was to bring more gold and silver coins from American colonies to Spain. The influx of gold and silver did not make Spain richer; it only increased its prices. The Spanish did not realize that money is worth only as much as others are prepared to give for it. In essence, the value of money is the trust we have in its worth, rather than the metal or paper it is made out of. Extra money is not created by printing more money, but through the financial system. In fact, "hard currency" is just a small part of today's money supply. Still, it took a long time to develop even the simplest forms of financial institutions like banks. Lending money and asking interest in return was considered immoral in the Christian world. According to the Gospel of Luke (6:35) one should "lend, [and] expect nothing in return". Dante even set up a special place in the 7th circle of hell just for usurers. Regardless of the importance of finance for the proper functioning of the economy, early money-lenders were frowned upon. The family that changed it was the Medici. The Medici came up with a way around strict Christian anti-usury laws. Instead of calling it interest, they referred to it as commission for changing currencies. Still, anti-usury laws were not the only problem of money-lenders. Equally important was a proper way to safe-guard against the risk of default. The Medicis were successful bankers because they managed to diversify their lending. By lending to many, the risk of a default that would ruin them was smaller. Hence, they could charge lower interest, or commission as they called it, making them the leading bankers of the Renaissance.

Chapter two is devoted to the second step in the ascent of money – the bond market. The first bonds were issued by Italian city-states in order to finance their wars. And from that time, wars were decided on the financial markets as much as on the battlefield. Maybe the clearest example were the Napoleonic wars, which saw Britain, financing these wars through issuing bonds, eventually overcoming France, whose war efforts were financed through higher taxes. Similarly, the North beat the South in the US civil war because no one wanted to buy Southern bonds. Empires were crushed if they could not keep their fi-

nances in order. Then again, the chapter ends with a "mystery". Why did markets not punish deficit-loving George W. Bush, instead of rewarding him? The answer to that question is in the stock markets.

The third step in the ascent of money – stock markets, is the theme of Chapter three. Stock markets bring on average higher return than bond markets. Yet, the stock markets are also more prone to boom-and-bust cycles. The first market bubble was created by John Law, a convicted murderer who managed to become French minister of finance, economy and the head of the central bank at the same time. John Law was the head of a company which had monopoly over all economic activities in the Mississippi area. In addition, he controlled a private bank which also had ability to print money. Printing money led to a surge in share prices because of increased purchasing power. But, it also led to inflation and eventually the bubble exploded, sending the French economy into the doldrums. For Ferguson, an overly expansive monetary policy was the main cause of financial bubble in the 1920s and during the current financial crisis, just as it was in France during John Law. Still, even with sound monetary policy, share prices are always going to be volatile because they are determined by current realities and future expectations, which are unpredictable. Since the future cannot be predicted, the question is how we can insure ourselves against the risks of future.

Chapter four is devoted to answering that question. There are two ways we can insure against calamities in the future. The first option is to leave it to the individual and the second option is for society to take this risk upon itself through the welfare state. Even though the welfare state had a lot of appeal in the decades following World War II, it is quite clear Ferguson's sympathies lie with individual responsibility. Ferguson argues that the welfare state has certain mechanisms through which it undermines itself. These mechanisms are work disincentives and population aging. While the former operates only in certain countries (e.g. in the more individualistic UK and not in the more egalitarian Japan), the latter operates in all countries. The aging of population increases the share of people who live off the welfare state and decreases the share of people who fund it. Therefore, the future of insurance against risk for Ferguson is in the dismantling of the welfare state. An especially prominent place in the story of the successful dismantling of the welfare state is reserved for relatively new mechanisms of risk insurance – hedge funds. Ferguson wrote his book in mid 2008, and it seems that subsequent events have put a huge question mark over the long-term benefits of complicated derivatives, which are operated by hedge funds.

Chapter five provides a criticism of the common belief that house is the best and safest investment. By expression "safe as houses", Ferguson not only means that people should save to own their own houses, but also that banks should give loans to homeowners. In case they cannot pay their debt, the bank can confiscate their house instead. This is a principal idea of homeowning democracy in which all parts of the society become petit capitalists. As a part of this drive, a number of governments, mostly right-wing, have made it an imperative to create as many homeowners as possible. George W. Bush even introduced a law which demanded that banks give loans to people with lower credit worthiness. As a result, even people with no stable job were given loans, also known as sub-prime loans. This policy became unsustainable after Fed increased interest rates from 1 to 5.25 per cent, which led to massive defaults and ultimately started the current financial crisis.

The moral of the story is that "safe as houses" is ultimately wrong, and that people should diversify their investment, instead of throwing everything into residential property.

The recurrent theme in Ferguson's work is how empires mishandle their finances, which ultimately results in their fall. Chapter six is devoted to the current empire, which he calls Chimerica, i.e. the US and China. On first sight, this is a wonderful symbiosis – the US consumes and China produces. In order to increase employment, the Chinese relied on cheap exports. But, in order to keep their exports cheap, the Chinese had to buy US dollars in order to keep the dollar strong and their currency weak. And Chinese willingness to finance US debt made pursuit of the American dream so much easier. But, there is a catch. By buying US government bonds, China has injected massive amounts of money into the American economy, and this extra money was then used to provide loans to not-so-creditworthy clients, which ultimately resulted in a financial meltdown. Ferguson asks a good question when he wonders how long this symbiosis can be maintained. He refers to a similar situation which involved the financial capital of the world at the time (Britain) and Europe's most dynamic industrialist economy (Germany). The collapse of their symbiosis and the first wave of globalization ended in large scale war.

In the afterword, entitled *The descent of money*, Ferguson again highlights his belief that in spite of the current crisis, the ascent of money has been one of the main drivers of human progress, and will continue to be so in the future. Still, this does not mean that it will not be a bumpy ride. Occasional booms and busts will be inevitable for the following reasons. No matter how sophisticated our tools became, the future will always remain uncertain. Next, human behaviour is prone to excesses, ranging from euphoria in good times to depression in bad times. Simply put, people are not entirely rational, and this degree of irrationality can be exploited to create booms. Finally, Ferguson compares financial markets to evolution. Destruction is a natural part of any market, and financial markets are no exception. As Joseph Schumpeter put it, the main characteristic of capitalism is creative destruction. Capitalism is not a straight drive but a very bumpy ride, but we are still driving forwards and not backwards.

The overall impression is that if this book is understood as a laymen's short guide to finances, then the book is brilliant. It is a very easy read with numerous historical digressions. Yet, these strengths are also the book's weaknesses. Numerous details from history and from biographies of persons that shaped finance, regardless of how interesting they are, do not contribute much to Ferguson's arguments. In fact, the book lacks strict scientific analysis, which can be seen in a lack of references to empirical research and ideological bias. It is not a problem that Ferguson is a liberal and that conclusions of this book clearly show it, but it does not seem appropriate to almost completely disregard opposing ideologies. In light of capitalism's greatest crisis in 80 years, it seems odd that capitalism's greatest critics – the Marxists – are barely mentioned. If there is one field of economics where Marxists continued to be perceived as "serious scientists", it is economic history, above all Eric Hobsbawm. I am not suggesting Ferguson turns Marxist, but an academic "discussion" with Marxist economic historians, who love to emphasize capitalist/banker greed, would contribute a lot to this book, even if the Marxist's claims are rejected. This way, the book is too one-sided and fails to meet the goals of its ambitious subtitle *A financial history of the world*.

Ivan Grgurić

THE MYTH OF THE RATIONAL MARKET

Justin Fox, 2009, HarperCollins, New York, USA, pp. 382

Review*

In view of the collapse of Wall Street giants that brought the world economy to its knees, it does not seem strange to find so many books devoted to the current financial crisis. Justin Fox's *The myth of the rational market* is one of these books. But, even though the book touches on Wall Street, it is not about mishandlings on Wall Street, but about faults of University of Chicago, the bastion of the dominant theory of finance – efficient market theory. In other words, Justin Fox does not have a quarrel with the practice of finance but with its theory. The book does not criticize complex mathematical and statistical models, but the assumptions on which these models are based. As a result, the book is accessible to the wider public, and not just to finance/math geeks. It presents a historical development of the dominant theory of finance, how it came to dominate Wall Street, its flaws and ultimately its fall. The book is divided into five parts with 16 chapters, along with introduction and epilogue.

The introduction begins with Alan Greenspan's Congressional hearing about the financial crisis. When asked why the Federal Reserve (the US central bank) did not prevent the financial crisis, the Fed Chairmen at the time replied that the financial crisis had proven to him that his understanding of how the world operates, his ideology, was wrong. And his ideology was that markets always got things right. One should be fair to Greenspan though, for he was not the only one. In fact, it is safe to say that the mainstream of economic thought agreed with him. The rest of the book analyzes the development of efficient markets theory, its criticism and ultimately the reasons for its fall.

Part one describes the early days of the development of finance and is divided into two chapters. The first chapter is devoted to Irving Fisher, who argued that markets were rational, meaning markets knew best. Still, Fisher himself would find out that markets might work well much of the time, but they stop acting "rationally" at some point. This point came in 1929, when the Great Depression started with the meltdown on Wall Street, and Irving Fisher was among those losing a lot of money. Rational markets theory drew its conclusions from the properties of Gauss distribution, which entered economics from

* *Received:* May 25, 2010
Accepted: May 28, 2010

natural sciences through the works of French mathematician Louis Bachelier. Yet, even his mentor Henri Poincaré pointed out the shortcomings of applying Gauss distribution to human behaviour, since Gauss distribution is the product of countless random and independent events; while men do not act independently, rather react to each other.

Chapter two describes the first criticisms of rational or efficient market theory. Fred Macaulay believed that errors are an inseparable part of financial markets because investors make their decisions based on emotions, lack of logic and insufficient knowledge. But probably the strongest criticism came from Holbrook Working, who argued that market prices cannot reflect all the available information. If markets really were perfect, it would eliminate profit making opportunities. Investors have to have some information which the rest of the market is unfamiliar with in order to beat the market and make a profit.

The second part of the book describes the rise of the rational market theory and is divided into four chapters. Chapter three explores the problem of risk. The question investors are faced with is how much return one wants to sacrifice in order to increase the probability that one will get what he/she planned. The answer was provided by two Central European mathematicians and economists, John von Neumann and Oskar Morgenstern, who argued that one should think probabilistically. First, one should assign a numerical value, i.e. utility. Second, one needs to decide the probability of the event occurring. Third, one just needs to multiply utility with probability, and select which ever option scores highest. Harry Markowitz went one step further by approximating risk with variance, or how spread out the distribution is. Markowitz's great insight was that risk depended not only on the variance of individual stock but also on the covariance or correlation among random stocks. In other words, risk was not tied only to stock A, but also to the fact that all stocks tend to move up or down together. The problem is how to assign numerical probabilities to uncertain future events. The answer is there is no uniform way, but rules could be devised in order to adjust those assessments in the face of new evidence.

Chapter four explains the random walk theory. Predecessors of random walk theory, like Bachelier, were wrong when they claimed that the mathematical expectation of the speculator was zero. Instead, the mathematical expectation of the speculator was the expected return of the stock or of the overall market, around which the actual return would fluctuate randomly. The ringleader of random walk theoreticians was Paul Cootner. The basic idea of random walk theory was that previous changes in prices cannot explain future changes in prices. Since one cannot predict the movement of the market, it is very hard to beat it.

Chapter five tries to answer the question of whether it is reasonable to assume that simple folks reason according to complex statistical rules. This assumption clearly does not match reality. But Milton Friedman came to rescue. He argued that it does not matter how unrealistic the assumptions are. In fact, all assumptions are unrealistic, a simplification of reality. What matters is how well the results of the models based on these assumptions match the reality. Economics as a science was already based on a rational man, and Franco Modigliani and Merton Miller placed rational man as a groundstone in the theory of finance as well. Their biggest contribution was the introduction of deductive logic into the study of finance, along with placing theoretical over empirical examinations of corporations.

Chapter six describes the leap from claiming it is hard to beat the market (random walk theory) to asserting that markets are perfect. This leap was made by Eugene Fama. He gave probably the strongest explanation of random walk. He argued that sophisticated traders will attack all non-random price movements and by making money on any predictable price movements help markets return to its random state. But, before one could say markets are right all the time, one needed a theory of how prices were determined, and that theory was the capital asset pricing model (CAPM). This model was developed by a group of authors including future Nobel Prize winners William Sharpe and Merton Miller. But it was Eugene Fama who tested this model. The results showed that risk-reward trade off was more complicated than envisaged by theory; but it came close enough. Later, Fama would triumphantly proclaim that there was no other proposition in economics that had more solid empirical evidence supporting it than the efficient market hypothesis, according to which markets got the prices right.

The third part provides a three-chapter overview of how the theory of efficient markets conquered Wall Street. Chapter seven discusses possible strategies for making money on Wall Street. On the one side, Benjamin Graham believed markets do not always get the prices right. He focused on investing in companies whose market capitalization (i.e. value of their shares) was less than the value of company's assets. In essence, his approach is about beating the market. Yet, Graham was quickly becoming a minority with the advent of the efficient market theory. If markets really got prices right, there is no point in trying to beat the market. Instead, the idea is to share in its fruits. No longer should an investor look for shares which markets mispriced and instead simply buy "the market", i.e. stocks according to their weights in stock exchange indexes like Dow Jones or Footsie.

Chapter eight elaborates how Wall Street tried to control the risk. In essence, it was by creating a completely new market for derivatives or options, which are created by transforming "primitives" (e.g. stocks or bonds). Options allow investors a chance to bet on the future prices. The main idea is that derivatives or options allow infinite number of ways to protect oneself against future calamities. Limiting these possibilities, e.g. through regulation, brings us further away from the perfect world of efficient market theory. Thus, regulation of derivatives is bad.

Chapter nine tries to solve the agency problem. Pro-market economists have forcefully argued that regulators cannot be trusted to act in society's interest because they have an agenda and interests of their own, and these might go against society's best interests. Yet, managers and investors were also agents with their specific interest. How can we rely on them to act in the interests of their clients and shareholders and not in their own interest? Michael Jensen came up with a way of using the market to keep managers in order. Managers fear getting fired, and one way of getting fired is if your company is bought or overtaken. Those managers who do not keep the interests of their shareholders in the first place will be punished by lower stock prices. And these companies are prone to being taken over. Yet, in order for this theory to work, certain laws had to be loosened or abolished, and these are anti-trust laws and regulations. Before, mergers were frowned upon because they reduce customer choice and create oligopolies and monopolies. But now mergers were praised because they increase competition between managers, which ultimately makes them more accountable to shareholders' interests.

Part four, which is divided into four chapters, is devoted to critics of efficient market theory. Chapter ten presents a "weak" form of the efficient market theory. Joseph Stiglitz and Sanford Grossman start from an obvious point – obtaining new information is time consuming and costly. Yet, efficient market theory claims that when someone acquires new knowledge, it instantaneously becomes common knowledge. But, if this is so, why would anyone look for new information if others will free ride on his/her effort? Therefore, prices cannot reflect all information. One has to be able to use new information for market gains, otherwise knowledge creation will simply stop. Still, the goal of Stiglitz and Grossman was not to destroy efficient market theory, but to redefine it in its "weak" form.

Chapter eleven exposes one of the greatest errors in efficient market theory, which is a leap from saying it is *hard to beat the market* to *markets get the prices right*. It is even not impossible to beat the market. Contrary to random walk theory some random patterns exist and investors can make money off it. For instance, cheap stocks have outperformed expensive stocks. In addition, stocks generally did exceptionally well in January. Even the biggest supporters of efficient market theory, like Eugene Fama, had to admit that something was wrong. Eugene Fama and Kenneth French tested CAPM on data from 1940s to 1990s. Their results showed that it could not explain price changes. But, instead of abandoning CAPM altogether, they redefined risk and introduced new variables. Still, their work became "data mining", since their modifications of CAPM did not have backing in economic theory.

Chapter twelve is devoted to two living proofs that markets can be beaten – Warren Buffet and Ed Thorpe. Both investors had a tremendous record when it comes to outperforming stock exchange indexes. Yet, these two investors followed different strategies. Warren Buffet was a typical rational investor. Following his mentor, George Graham, he was trying to find companies that were seriously undervalued by financial markets. More specifically, he was searching for companies that had a long term growth ability not recognized by the market. On the other hand, Ed Thorpe was a classical arbitrageur. He jumped on mispricings, earned money off them and made them go away in the process. He used a "secret" formula to choose when mispricings occur, which is why his style of investing is sometimes called black-box investing. Both Thorpe and Buffet believed it took time for markets to get prices right. Finance professors believed this to be instantaneous process.

Chapter thirteen analyzes the stock market crash in 1987 and why it did not lead to redefinition of rational market theory. In 1987, three finance geeks, following the advice of their portfolio management formulas, started selling their stocks. In one day, Dow Jones lost over 20 per cent of its value, making it the worst single day performance in its history. What was striking about it was that only three investors were enough to cause massive panic. It looked like investors ere not as rational as previously thought. Still, Eugene Fama found a way to praise markets for crashing. He argued that the crash just showed how quickly prices adapted to new information. But the crash did highlight some flaws in efficient market theory. Derivatives can make the world a safer place, but when everyone ascribes to the same method of taming risk, it becomes a source of new risks. In addition, measuring immeasurable future risks can be harmful because it provides a false sense of security. But a full review of efficient market theory was not performed, and a lot had to do with the fact that the crisis was quickly diverted by Fed's new chairman Alan Greenspan.

The last part, consisting of three chapters, is devoted to the fall of efficient market theory. Chapter fourteen explains how irregularities in efficient market theory were turned into a theory. Many researchers found irrational behaviour in the financial markets. One of these was "window dressing", which refers to managers selling badly performing stocks near the end of the year, when they might be asked embarrassing questions on why they hold poorly performing stocks. Yet, what was often missing was the economic logic behind these market flaws, but not this time. Now a new assumption was being made. Managers, like other agents, had complex incentives structures and cannot be relied to always act rationally. Even better, this sounds like an assumption straight out of University of Chicago, a hotbed of the rational market theory.

Chapter fifteen describes how Michael Jensen, once a champion of finance market centered corporations changed his mind. Jensen now believed that markets can create booms, and the overvaluation of corporations can lead to value-destroying policies. He compared obsession with rising share prices to taking heroin, good in the short run, but with bad long run consequences. Jensen also became very critical of the massive wages and bonuses managers were giving themselves. In research work carried out with Kevin Murphy, Jensen found no link between corporate performance and manager's pay among the CEOs of 250 big companies over a period of fifteen years.

Chapter sixteen provides a new common ground between proponents and critics of efficient market theory. The idea that it is hard to beat the market was never questioned, but proponents of efficient market theory had to abandon their belief that markets got prices right. It was also never an issue that prices might be wrong, but efficient market theory claimed that markets will correct prices very quickly. Now it seems there is a consensus that in some cases markets could get prices wrong for a longer period. Smart arbitrageurs can undo some of the damage to the market done by misinformed investors, but not all of it. In essence, what we are left with now is a watered down version of efficient market theory.

In his epilogue the author tries to provide some ideas about how to reform financial markets in the light of the current financial crisis. The author does not provide specific measures but gives guidelines for reform. We should find a way to temper speculative excess while acknowledging that we will not necessarily be able to distinguish speculative excess from an entirely sustainable boom. A major part in this story will be played by regulation and hopefully a rediscovery of ethics and integrity among managers and Wall Street investors.

The main strength of the book is its clear and forceful destruction of the "myth" of the rational markets. The book attacks this myth at its root, in its assumptions. People are not entirely rational. Full stop! Let us work from that instead. And even though the book devotes a significant number of pages to behavioural finance, which believes people can be irrational in a predictable way, the book is short on clear proposals on how to get out of this crisis and prevent future ones. In other words, the book does a good job of dethroning the myth of the rational markets, but it also keep to throne wide open. And unless we find a better suited candidate, the rational market theory is bound to be back at the top of the world of economic theory.

Ivan Grgurić