

BANKING AND FINANCE IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

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by

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If there is one thing that I have learned during my PhD studies, it can be wrapped up as following: you need a good research question, solid data, and the tools to obtain some results which hopefully have acceptable policy implications. So let me apply these notions and check if I got them right. The research question is how one can skip school during the war years and still make it to the doctor degree. As it appears, only data I needed to plug in are the wonderful colleagues and personalities that were surrounding me on my path. Tools boil down to perseverance, hard work and some intellect. Results are satisfying enough for some decent policy proposals: just when you think you had enough and the road leads to nowhere, make a few more steps uphill- there is a big chance a mountain lake or a meadow will open up in front of you. Next, easy paths lead to crowded picnic areas, the difficult ones to the astonishing spaces. And lastly, just as you think you are all alone bearing the burden, there is always a good soul who notices you are stumbling and readily picks you up.

As appendix, let me describe my variables. Maybe it is best to start with the core ones that have shown to be reliable in the previous research. My grandparents were the steady roots on which I could develop my branches. My parents were the tree that equipped me with water and mineral nutrients so that I can grow leaves and develop. Oliver is a dew drop that makes me shine and start each new day full of energy.

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I dedicate this PhD to my Mum Branka Rumora, whose support in every sense of the word was indispensable for the success of this project...and everything else in my life.

苦尽甘来

Water is muddy when you start digging a well, but it gets clearer as the time passes by.

Nederlandstalige samenvatting

Motivatie

De ontwikkelingen in de Midden- en Oost-Europese (CEE) landen zijn een erg populair onderzoeksonderwerp in bijna elk aspect van de economische theorie. Hervormingen die in de laatste twee decennia plaatsvonden in de regio bieden overvloed van hypothesen die kunnen getest worden, en bijna een natuurlijk experiment *set-up* die onderzoekers kunnen gebruiken om de moderne theorieën tegen de nieuwe gegevens te beoordelen. In dit opzicht, thesis ontwikkelt nieuwe benaderingen van de bestaande praktijken, maar pakt ook sommige bestaande thema's in de nieuwe instelling.

Algemene economische omstandigheden in de regio

De regio Centraal- en Oost-Europa wandelde een lange weg, beginnend met de macro-economische onevenwichtigheden, beleid onzekerheid en crisis in het laatste decennium van de 20ste eeuw. Daarna een periode van groei, en in de laatste periode soortgelijke problemen als de rest van de Europa. De weg naar het EU-lidmaatschap werd vergezeld door vele hervormingen in zowel economische als politieke systemen. Zij de initiële voorwaarden verschilden, het uitgangspunt was meestal centraal geleide economie en de weg naar marktgerichtheid was niet altijd gemakkelijk. Transformatie hat grondige *remake* van de instellingen en regels nodig, vergezeld van processen van liberalisering van de markt en de prijzen, decentralisatie, liberalisering van de handel en uitwisseling systeem, privatisering, herstructurering van bedrijven, eigendomsrechten verbetering en een groot aantal bijbehorende voorzieningen.

Centrale autoriteiten en planning waren overgestapt voor krachten van de markt en nieuwe verordeningen zijn ingevoerd. *Streaming* van de buitenlandse investeringen was impliciet geconditioneerd op de eigenschap rechtshandhaving, waarbij een concurrentiële omgeving met een gemakkelijker toegang tot de markt en afrit moest ook worden vastgesteld. Staat eigendom werd vervolgens geprivatiseerd, met verschillende privatisering programma's en met een verschillend succes, variërend van een geval-per-geval verkoopmethode tot massale voucher privatisering. Resterende staatsbedrijven werden geherstructureerd en het bestuur heeft verbeterd.

In de loop van de transformatie, de prijs en de markten waren ook geliberaliseerd, en lijken op systemen van het "oude Europa". De uitwisseling en handel systeem liberalisering vergezelt de uitwisseling van kapitaal. De ontwikkeling van kapitaalmarkten en andere niet-bancaire financiële instellingen bleef echter enigszins smal in de meeste van de landen van de regio.

Het is ook belangrijk om op te merken dat de heterogeniteit in de regio gebleven is, zodat we niet altijd alle landen onder de dezelfde noemer kunnen stellen. Economische prestaties, financiële voorwaarden en andere indicatoren verschillen tussen de CEE landen, net zoals er verschillen tussen de West-Europese landen bestaan.

Financiën en bankieren in de CEE landen

Genoemde economische groei kwam in wisselwerking met de ontwikkeling in de financiële sector van de regio. Financiële sector bezorgde diensten die handel, risicobeheer, mobiliseren van spaargelden en toezicht vergemakkelijkt.

De overgang van mono-bank systeem naar commerciële bankieren die we nu observeren is getuige geweest van vele proeven en fouten. De eerste liberalisering met soepele toegangsvoorwaarden, zwakke toezicht en het gebrek aan know-how bracht mee probleem van de slechte leningen, bank mislukkingen en ernstige financiële crisis in sommige landen. Golf van consolidatie en harde budgettaire beperkingen voor banken, samen met optreden van de buitenlandse banken bracht bankieren in de regio tot een meer duurzame niveau zij het met een hoge groei van de kredietverlening. Onderzoek heeft aangetoond dat buitenlandse banken kunnen de toegang tot de internationale kapitaalmarkten verbeteren, concurrentie stimuleren en efficiëntie verbeteren, geavanceerde bancaire technologie en risicobeheer introduceren, en kunnen zelfs tot de betere financiële infrastructuur en regelgeving brengen.

Ondanks de genoemde mogelijke voordelen van buitenlandse bank *entry*, sterke aanwezigheid van buitenlandse banken in de CEE regio bezorgde over de hogere besmetting risico's tijdens de meest recente crisis. Dit heeft geleid tot de vorming van het Vienna initiatief waarin publieke en private sector: toezichthouders, centrale banken en fiscale autoriteiten uit host en binnenlandse landen van belangrijkste grensoverschrijdende banken en ambtenaren van de EU en de internationale financiële instellingen samenkomt om de wanordelijke deleveraging en *credit crunch* te voorkomen.

Ontwikkelingen op de financiële markten waren meer heterogeen dan in het bankwezen. In de afgelopen decennia ontwikkelden sommige landen van de regio concurrerende, gereguleerde en verfijnde beurzen die op internationaal niveau aantrekkelijk zijn en deel namen aan fusies en overnames, overwegende dat andere landen helemaal geen aandelenmarkten creëert hebben. Daartussen staan de landen die aandelenmarkten in de vroege stadia van de overgang ontwikkelden, maar na verloop van tijd worden die niet-liquide en veel bedrijven waren *delisted*. Hun duurzaamheid is twijfelachtig, hoewel er veel potentiële voordelen voor hun continuïteit bestaan.

Tot slot, financiële systemen in de regio blijven bank gebaseerd, en activa van de banken vormt een meerderheid van de activa van de totaal financiële sector. Financiële markten tonen meestal hoge volatiliteit en illiquiditeit, overwegende dat de bedrijven toevlucht tot de intern gegenereerde *funding*, leningen en handelskrediet als financieringsbronnen nemen.

Overzicht van het proefschrift

Deze thesis behandelt verschillende aspecten van financiële markten en het bankwezen in de Midden- en Oost-Europese landen. We bekijken eerst een opvallend kenmerk van de regio die veel belang eist, en dat is de groei van de kredietverlening. Het onderwerp verdient terdege aandacht vanwege het effect ervan op de macro-economische stabiliteit. Bovendien, als gevolg van de hoge deelname van buitenlandse banken op deze markten, bezorgdheid over de mogelijke spillovers zijn redelijk. We gaan door hetzelfde fenomeen te onderzoeken tijdens de meest recente crisis, op zoek naar de *leads* op waar beleid zou het meest efficiënt kunnen zijn als zij versnellen of vertragen van de groei van de kredietverlening wil. We doen dit door te onderzoeken in welke mate kredietgroei en determinanten daarvan verschillen in de tijden van crisis, en voor verschillende types van banken. Naast de bancaire kredietverlening hebben de ondernemingen andere financiering bronnen die ze kiezen kunnen. Daarom onderzoeken wij wat zijn de meest voorkomende keuzes en wat is de relatie tussen kapitaalstructuur, of financiering mix, en bedrijf kenmerken. Ook, bedrijfsspecifieke determinanten hebben invloed op de soort van de banken relatie die het bedrijf zal vestigen. Tot slot, we nakijken wat is het belang van de instellingen voor de economische welvaart, naar een voorbeeld van kleine, open economie.

We pakken de onderwerpen van de kredietverlening groei, financiële structuur, bank relaties en belang van de instellingen met een brede reeks technieken. Complexiteit van problemen verschilt, evenals de gegevenssets. We passen de schatting methodologie naar het onderwerp en tewerkstellen modellen die het meest geschikt zijn voor het testen van onze onderzoekshypothesen na de literatuur. Voor het onderzoek van determinanten van de kredietverlening groei hanteren wij cointegration aanpak samen met lineaire en niet-lineaire error correctie model. Voor de determinanten van de kapitaalstructuur gebruiken wij panel schattingstechnieken, en voor de impact van instellingen op de economische ontwikkeling kiezen we cliometrie.

Voor de analyses gebruiken we gegevens samengesteld uit verschillende bronnen - sommige openbare, andere *private* of anoniem gemaakt. Het onderzoek naar de groei van de kredietverlening maakt gebruik van brede gegevensset, in de eerste plaats op het landenniveau en vervolgens op het niveau van de bank. We analyseren van zowel vraag- en aanbodzijde

determinanten van kredietverlening groei op het macro-niveau, en vervolgens op micro-niveau. Wanneer we de relaties tussen de kenmerken van het bedrijf en de financiering keuzes, samen met de bank relaties die worden gemaakt analyseren, gebruiken we balansen van ondernemingen en gegevens op leningen van het krediet register. Gegevens voor het testen van de hypothesen over het belang van de instellingen was meestal uit secundaire bronnen, die op hun beurt afhankelijk zijn van de archieven onderzoek.

In het tweede hoofdstuk analyseren we de determinanten van kredietverlening groei in de elf CEE landen. Onze aanpak maakt een verschil tussen het aanbod - en vraagzijde determinanten, scheidt van de analyse van de kredietverlening aan bedrijven en huishoudens en identificeert subperioden met een verschillende impact van krediet groei determinanten. Dit draagt bij tot de literatuur aangezien studies op dit niveau van aggregatieniveau waren nog steeds zeldzaam. Analyseren van de variabelen die bepalend zijn voor kredietverlening groei in de korte termijn en met name de uiteenlopende gevolgen daarvan na verloop van tijd is belangrijk om risico's de financiële sector te beoordelen en past in de literatuur over de macrofinanciële stabiliteit in de CEE regio. Wij vinden dat economische activiteit de meest significante op lange termijn determinant is van binnenlandse bancaire kredietverlening aan de particuliere sector. Op de korte termijn passen we zowel lineaire en Markov-switching *error* correctie model en vinden dat bankdeposito's en eigen vermogen een groot deel van de variatie in de kredietverlening groei verklaren. Met behulp van het niet-lineaire model, vinden we dat het effect van korte termijn determinanten verschilt van de geïdentificeerde regimes. Het regime switches zijn tweede, meestal door verschillen in de korte termijn krediet levering factoren in plaats van de aanpassing gedreven om het krediet evenwicht. Ten derde, zij het lineaire model suggereert dat er een zeer langzaam of geen correctie naar het krediet evenwicht als het krediet niveau vanaf de onderliggende macro-economische fundamentals vertrekt, vanuit de Markov-switching *error* correctie model blijkt dat, in sommige landen correctie plaats in het bijzonder subperioden vindt en is gecorreleerd met de herstructurering van banken of lage groei fasen. Hoewel de meerderheid van de regime switches lijkt land-specifieke bepaald te zijn, vinden we voor de meeste van de landen gemarkeerd regime switch net vóór of tijdens de huidige wereldwijde crisis.

Het derde hoofdstuk volgt het idee van de vorige, overwegende dat we nu expliciet kijken hoe de determinanten van kredietverlening groei veranderd hebben tijdens de wereldwijde crisis. Onze onderzoeksvraag bestaat uit drie delen. Ten eerste onderzoeken we of het micro- of macro-economische factoren die de kredietverlening groei beïnvloeden, en is er sprake van een verandering in de determinanten van de kredietverlening tijdens de meest recente crisis. Ten tweede, we controleren of kredietverlening in dezelfde mate voor buitenlandse en binnenlandse banken gewijzigd is. In de laatste stap onderscheiden we tussen verschillende soorten eigendom / modus van binnenkomst, om mogelijke verschillen in leningen

determinanten tussen binnenlandse staats, binnenlandse privé-eigendom, buitenlandse greenfield en buitenlandse brownfield banken op te sporen. We passen *fixed effects estimator* om onze hypothesen op de paneel data set (bestaande uit balans bankgegevens en macro-economische variabelen voor de elf landen CEE) te testen. De belangrijkste bijdrage is die verder gaan dan de analyse van de ontwikkelingen van de kredietverlening groei en de verschillen tussen binnenlandse en buitenlandse banken te ontleden de wisselwerking tussen macro - en micro-economische factoren, en we vinden dat ze allebei op een andere manier van belang zijn. Namelijk, tot zekere mate, was er een verschuiving van macro - tot micro-economische determinanten tijdens de laatste crisis. In deze instelling vinden we dat de economische activiteit drijft leningen in normale tijden, terwijl bankliquiditeit als een belangrijkste determinant tijdens de crisis neemt. Vandaar, de maatregelen die de bancaire kredietverlening tijdens de crisis herstellen moeten eigenlijk minder op macro-economische variabelen gericht zijn, en meer op liquiditeit.

In het vierde hoofdstuk gebruiken wij de kapitaalstructuur literatuur als een beginpunt en onderzoeken schuld structuur en bancaire relaties op een brede gegevensset die het hele universum van Kroatische bedrijven en kredieten omvat. We pakken drie belangrijke vragen, met behulp van bedrijf kenmerken als de verklarende tool. Eerst onderzoeken wij of bepaalde bedrijf kenmerken betrekking op de waargenomen schuld kunnen hebben. Ten tweede, onderzoeken we of ze betrekking hebben op de verschillen in de passiva mix, en ten slotte onderzoeken we of er verbanden bestaan tussen specifieke variabelen en de bank relatie die ondernemingen tot stand brengen. Onze bijdrage ligt in het gebruik van een gedetailleerde gegevensverzameling die het testen van een brede set van hypothesen mogelijk maakt, meestal niet getest of afzonderlijk getest in de vorige literatuur als gevolg van de beperkte gegevens. Als wij drie verschillende kwesties onderzoeken, splitsen we de schatting deel in drie sets van afhankelijke variabelen. Bedrijfsspecifieke variabelen zijn gekozen op basis van de meest robuuste bevindingen in het vorige onderzoek. Laten we zien dat industrie kenmerken een belangrijke determinant van vennootschappelijk kapitaal, leningen en leningen relatie zijn. Ook vinden we aanwijzingen van *maturity matching*, waarin staat dat bedrijven met meer lange termijn activa voor langere termijn passiva kiezen, overwegende dat bedrijven met korte termijn activa zijn lange termijn verplichtingen niet intensief gebruiken. Winstgevendheid is positief gerelateerd met eigen vermogen en negatief naar andere financieringsbronnen, die bevestigt theorie volgens welke ondernemingen passief winst doorheen de tijd accumuleren. Onderzoek van de bank relaties wijst op de grootte als de belangrijkste determinant, waar grotere bedrijven de neiging om hun leningen verspreiden tussen vele banken. In de loop van het onderzoek hebben we daarnaast geanalyseerd het belang van het handelskrediet, zoals later bleek dat ondernemingen vaak als financiële tussenpersonen optreden. Daarom is een sterke juridische handhaving van betaling overeenkomsten van cruciaal belang voor een gezonde liquiditeit van de Kroatische economie.

Aangezien de onderzochte CEE regio door een moeizaam proces van hervorming van de instellingen en van de economische omstandigheden in de laatste twee decennia ging, concluderen we met het vijfde hoofdstuk waarin wij een vroeg voorbeeld van een kleine open economie die een aanzienlijk succes op goede instellingen en gunstige bedrijfsklimaat opgebouwd hebt. We testen een aantal hypothesen over de economische prestaties en hun onderbouwing, om aan te tonen hoe ondanks geen landbouw of andere middelen, een economie veel groter en sterker concurrenten kan overtreffen als gunstige instellingen, commerciële know-how en wijs overheidsfinanciën in plaats zijn.

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CHAPTER 1 Introduction

1 Motivation

The developments in the Central and Eastern European (CEE) countries are a very popular research topic in almost every aspect of the economics theory. Reforms that took place in the region in the last two decades offer abundance of hypotheses to be tested, and almost a natural experiment setting which researchers use to assess the modern theories against the new data and facts. In this respect, thesis develops new approaches and ideas to examine the observed practices, but also tackles some existing topics within the new setting.

1.1 General economic conditions in the region

The Central and Eastern European region has come a long way, starting with macroeconomic imbalances, policy uncertainty and crisis in the last decade of the 20th century, enjoying a period of sustained growth afterwards and experiencing similar difficulties in the most recent crisis as the rest of the Europe. The path toward the EU membership was accompanied by many reforms in both political and economic systems. Albeit the initial conditions differed, the starting point was mostly centrally planned economy and the way towards market orientation was not always smooth. Transformation needed thorough remake of the institutions and regulations, accompanied by processes of decentralization, market and prices liberalization together with the liberalization of the trade and exchange system, privatization, restructuring of companies, property rights enhancement and a myriad of associated developments.

Central authorities and planning were switched for market forces and new regulations have been put in place. Streaming of the foreign investments was implicitly conditioned on the property rights enforcement, whereby a competitive environment with easier market entry and exit had to be established as well. State owned companies were subsequently privatized, under different privatization schemes and with a different success, ranging from a case-by-case sales method to mass voucher privatization scheme. Remaining state companies were restructured and the governance has improved substantially.

In the course of the transformation, price and markets liberalized as well, resembling more the systems of the “old Europe”. The exchange and trading system liberalization accompanied the emergence of capital markets and securities exchanges. However, the development of capital markets and other non-bank finance institutions remained somewhat narrow in most of the countries of the region.

It is also important to notice that the initial heterogeneity in the region persisted, so that we cannot always put all of the countries under the same denominator. Economic performance,

financial conditions and other indicators differ among the CEE countries, just as there are differences among the Western European countries.

1.2 Finance and banking in CEE countries

Mentioned economic growth interacted with the development in the financial industry of the region. Financial sector provided services that facilitate trade, risk management, mobilize savings and enhance monitoring, i.e. corporate governance.

The transition from mono-bank system to commercial banking we are observing now witnessed many trials and failures. After the initial liberalization, lenient entry conditions together with weak supervisory capabilities and the lack of know-how yielded bad loans problem, bank failures and severe banking crisis in some countries. Afterwards, a wave of consolidation and hard budget constraints for banks, coupled with foreign bank entry brought banking in the region to a more sustainable level albeit with a high rates of credit growth.

Research has shown that foreign banks can improve access to international capital markets, stimulate competition and improve efficiency, introduce sophisticated banking technology and risk management, and can even stimulate improvements in financial infrastructure and regulation (e.g. adhering to the European legislation). In spite of the mentioned possible benefits of foreign bank entry, strong presence of foreign banks in the CEE region has raised concerns on the higher contagion risks during the most recent crisis. This has led to the forming of the Vienna initiative which brings together public and private sector: supervisors, central banks and fiscal authorities from host and home countries of major cross-border banks, as well as officials from the EU and international financial institutions in order to prevent disorderly deleveraging and credit crunch.

Developments on the financial markets were more heterogeneous than in the banking industry. During the past decades, some countries of the region developed competitive, regulated and sophisticated stock exchanges which became attractive on the international level and participated mergers and acquisitions, whereas other countries did not create stock markets at all. In-between are the countries which developed stock markets in the early stages of transition but became illiquid over time and delisted many companies. Their sustainability is questionable, although there are many potential benefits of their survival.

Overall, financial systems in the region remain bank based, with bank assets making up a majority of financial sector assets. Financial markets mostly witness high volatility and illiquidity,

whereas the companies resort to internally generated funds, loans and trade credit as sources of finance.

2 Overview of the dissertation

This thesis deals with different aspects of financial markets and banking in the Central and Eastern European countries. First we examine one remarkable feature of the region which raised a lot of interest, and that is expansion of the credit growth. The topic deserves due attention because of its impact on macroeconomic stability. Furthermore, due to the high participation of foreign banks on these markets, concerns about the possible spillovers were reasonable. We proceed by examining the same phenomenon during the most recent crisis, looking for the leads on where policies could be the most efficient when accelerating or decelerating the credit growth. We do this by examining what drives the credit growth and do these determinants differ in the times of crisis, and for different types of banks. Besides the bank credit, enterprises have abundance of financing choices they can choose from. Therefore we examine what are the most common choices and what is the relation between capital structure i.e. financing mix and company characteristics. Also, firm-specific determinants have impact on the kind of lending relationship the company will establish with banks. Lastly, we check for the importance of the institutions and economic prosperity, following an example of small open economy at the times that Venice was master of maritime trade and Italian banks were setting the standards.

We tackle the topics of credit growth, capital structure, banking relationships and importance of the institutions employing a wide set of techniques. Complexity of issues differs, as well as the data sets. We adjust the estimation methodology to the topic and employ models which are the most appropriate for testing our research hypotheses, following the literature in particular field. For the investigation of the drivers of credit growth we employ cointegration approach together with linear and non-linear error correction model. When examining whether these drivers differ between periods and types of banks, we employ panel estimation techniques. For the determinants of capital structure we also resort to panel estimation techniques, and for the impact of institutions on the economic development we choose cliometrics.

For the analyses we use data assembled from different sources- some public, other proprietary and anonymized. The research on credit growth makes use of broad data set, firstly on the aggregate country level, then on the bank level. We analyze both demand and supply side determinants of credit growth on the macro- level, and then expand the analysis to the micro-level data. When establishing the relations between the company characteristics and funding choices it makes, together with banking relationships it creates, we use balance sheets of

companies and firm-level data on loans from the credit register. Data for testing the hypotheses on the importance of the institutions was mostly culled from secondary sources, which in turn rely on the archival research.

In the second Chapter we analyze the determinants of private sector credit growth in eleven CEE countries. Our approach distinguishes between supply- and demand-side determinants, separates analysis of lending to firms and to households and identifies subperiods with a different impact of credit growth determinants contributes to the literature since studies at this level of disaggregation were still rare. Analyzing the variables that determine credit growth in the short run and especially their varying impact over time is important to assess financial sector risks and fits into literature on the macrofinancial stability in the CEE region. We find that economic activity is the most significant long-term determinant of domestic bank lending to the private sector. In the short run, we apply both linear and Markov-switching error correction model and find that bank deposits and equity explain a main part of the variation in the credit growth rates. Using the non-linear model, we find that the impact of short-run determinants differs across the identified regimes. Second, the regime switches are mostly driven by differences in the short-run credit supply factors rather than by the adjustment to the credit equilibrium. Third, albeit the linear model suggests that there is either a very slow or no correction toward the credit equilibrium if the credit level departs from its underlying macroeconomic fundamentals, the Markov-switching error correction model reveals that, in some of the countries, correction does take place in particular subperiods and is correlated with bank restructuring or low growth phases. While the majority of regime switches seems to be country-specific rather than determined by the global environment, we find for most of the countries marked regime switch just before or during the current global crisis.

The third Chapter follows the idea of the previous one, whereas now we explicitly look at how the determinants of credit growth changed during the global crisis. Our research question consists of three parts. First, we investigate whether it is micro- or macroeconomic factors that drive credit growth, and whether there was a change in determinants of the bank lending during the most recent crisis. Second, we check if bank lending drivers changed to the same extent for foreign and domestic banks. In the last step we distinguish between different types of ownership/ mode of entry, in order to detect possible differences in lending determinants between domestic state-owned, domestic private-owned, foreign greenfield and foreign brownfield banks. We apply fixed effects estimator to test our hypotheses on the panel data set consisting of bank balance sheet data and macroeconomic variables for the eleven CEE countries. The main contribution is going beyond the analysis of developments of credit growth and differences between domestic and foreign banks, to dissect the interplay of macro- and micro-economic factors, and we find that both matter in a different way. Namely, to a certain extent, there was a shift from macro- to microeconomic determinants during the last crisis. In

this setting, we find that economic activity drives lending in normal times, whereas bank liquidity takes over as a main determinant during the crisis. Hence, the measures aiming at the recovery of bank lending during the crisis which are geared toward macroeconomic variables might not have as positive effects as measures directed to liquidity enhancements.

In the fourth Chapter we use the capital structure literature as a starting point and examine debt structure and banking relationships on a broad data set encompassing the whole universe of Croatian companies and credit register data. We address three important questions, using company characteristics as the explanatory tool. First we check if we can relate certain company characteristics to the observed debt maturity. Second, we relate them to the differences in the liabilities' mix, and finally we examine if there are links between firm specific variables and the bank relationship that firms establish. Our contribution lies in using a detailed data set which allows for testing of a wide set of hypotheses, usually not tested or tested separately in the previous literature due to the limited data. As we examine three different issues, we split the estimation part in three sets of dependent variables- broad or narrow liabilities categories for the first two questions and the concentration of borrowing within the single biggest lender for the last question. Firm-specific variables are chosen based on the most robust findings in the previous research. We show that industry characteristics are an important determinant of company's equity, loans and relationship lending. We also find evidence of maturity matching, which states that firms with more long term assets opt for longer term liabilities, whereas firms with short term assets are not using long term liabilities intensively. Profitability is positively related with equity and negatively to all other financing sources, which confirms theory according to which firms passively accumulate profits over time. Examination of the bank relationships points to the size as the most important determinant, where bigger firms tend to disperse their borrowing due to many possible reasons. We find that the foreign owned companies concentrate credits within one lender, just like the more creditworthy enterprises. In the course of the research we have additionally analyzed the importance of the trade credit in our sample, as it turned out that firms often act as financial intermediaries and a strong legal enforcement of payment agreements is crucial for a sound liquidity of Croatian economy.

Since the CEE region went through a laborious process of institutions and economic conditions reformation in the last two decades, we conclude with a fifth Chapter in which we take an early example of a small open economy which built up a considerable success upon good institutions and favorable business climate. We test a couple of hypotheses on the economic achievements and their underpinning, in order to show how in spite of having virtually no agricultural or other resources such an economy can outperform much bigger and stronger competitors if favorable institutions, commercial know-how and prudent public finance are in place.

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CHAPTER 2 Private Sector Credit in Central and Eastern European Countries: Long-Run Relationships and Short-Run Dynamics

Private Sector Credit in CESEE: Long-Run Relationships and Short-Run Dynamics¹

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Abstract

This paper provides an analysis of the long- and short-run determinants of domestic bank lending to the private sector in eleven Central, Eastern and Southeastern European (CESEE) countries. We identify regime shifts for the observation period of 1997 to 2009, and the resulting subperiods are characterized by a different impact of the credit growth determinants. Estimating a credit demand equation as the long-term relation, we find – for most countries – a cointegration relationship with economic activity. We then examine the short-run dynamics by applying both a linear and a nonlinear (Markov-switching) error correction model. While there is a significant correlation between credit growth and supply factors, namely bank deposits and banks' equity, its impact differs across the subperiods. Identified regime switches in the short-run relation are driven primarily by differences in the credit supply factors rather than by the adjustment toward the credit equilibrium as the error correction coefficients show only slight cross-regime differences. In terms of regime switching, we distinguish between two groups of countries: those with one dominant regime, which is only briefly interrupted by a second one, and those with two equally pronounced regimes. In the latter group, a marked switch occurred just before or when the global crisis hit the CESEE region in the latter part of 2008. This regime shift is associated with a decreased correlation between deposit and credit growth.

Keywords: Bank lending to the private sector, transition economies, credit dynamics, Markov-switching error correction model

JEL: C3, E4, E5

1 Introduction

Analyzing credit growth in Central, Eastern, and Southeastern Europe (CESEE) has become very popular in the past few years, especially during the period of rapid credit expansion that was observed in most countries of this region before they were hit by the global crisis in the latter part of 2008. In this paper, we add to this literature by studying the long-run (demand-side) *and* short-run (supply-side) determinants of domestic private sector credit developments in eleven CESEE countries (CESEE-11⁴) from January 1997 to April 2009.

Based on the notion that lending evolves in the long run in line with macroeconomic fundamentals (behavioral definition of equilibrium credit levels; for a respective literature overview, see section 2), we test for a cointegration relation between credit levels and demand-side macroeconomic determinants. To examine the short-run credit dynamics, we apply both a linear and a nonlinear error correction model.

We contribute to, and go beyond, the existing literature by (1) conducting our analysis not only for total domestic private sector credit, but in several cases also separately for lending to firms and to households to get more information on how credit dynamics are determined depending on different target groups, (2) including in the error correction equation new supply-side explanatory variables that are expected to be directly linked to credit dynamics in the short run, and (3) examining whether short-run determinants show a nonlinear behavior over time (i.e. whether their impact differs across particular subperiods). To capture these nonlinearities, which can be interpreted as frictions in the adjustment of credit toward its equilibrium, we apply a Markov-switching error correction model (MS-ECM).

The MS-ECM relies on the idea that there is a cointegration relation, albeit not during each specific subperiod (or “regime” in the diction of this methodology). This approach reveals subperiod-specific particularities in the examined relationships. For instance, it is of interest whether we can separate episodes with adjustment toward the credit equilibrium (stable regime) from episodes where a departure of credit from the underlying macroeconomic fundamentals is not corrected (unstable regime). Moreover, regime switches that separate such subperiods are endogenously identified from the sample data for each country. A particular regime switch can obviously be expected for the current global crisis that resulted in sharply decelerating credit growth rates in the countries under review (see chart 1 in section 4).

⁴ The ten CESEE countries that joined the EU in 2004 and 2007, respectively, and Croatia. In the following, CEE-5 refers to the Czech Republic, Hungary, Poland, Slovakia and Slovenia, SEE-3 to Bulgaria, Croatia and Romania and “Baltic countries” to Estonia, Latvia and Lithuania.

The paper is structured as follows: Section 2 gives an overview on related research. Section 3 introduces our methodological setting with a special focus on the Markov-switching error correction model. Section 4 provides descriptive statistics for the evolvement and structure of credit markets in the CESEE-11 as from 1996. The estimation results are described in section 5, and section 6 is a summary. Basic data issues and a description of the variables are covered in the annex.

2 Literature Overview

In this section, we distinguish three strands of related literature: we refer to (1) the existing evidence for the (predominantly long-run) drivers of credit development, (2) the evidence for “excessive” credit growth in terms of a deviation of credit from its equilibrium in CESEE countries and (3) related applications of the Markov-switching methodology.

2.1 Findings on Long-Run Determinants of Credit Development

Real GDP as well as the short- and long-run real interest rates are commonly used as explanatory variables for estimating the long-run determinants of credit developments (see e.g. Calza, Gartner and Sousa, 2003, or Brzoza-Brzezina, 2005). Alternative specifications may include PPP-based GDP per capita instead of real GDP, other interest rates, such as the nominal lending interest rate, or additional variables like government credit, inflation, house prices and financial sector liberalization (as e.g. in Backé, Égert and Zumer, 2006). The latter variables incorporate both the demand for and the supply of credit. Demand for credit in CESEE countries has been driven by the expectation of increased income and growth. Supply of credit, on the other hand, has grown due to the entry of foreign banks and their funding support to CESEE subsidiaries. In addition, new banking products became more broadly available (with households emerging as a new market segment in the mid- to late 1990s), which went hand in hand with higher competition. Most of the previous research shows, however, that in the long run bank lending is mainly driven by demand (see Bernanke and Blinder, 1988; Fase, 1995; Calza, Gartner and Sousa, 2003; Frömmel and Schmidt, 2006).

Using the cointegration methodology for data from the euro area, Calza, Gartner and Sousa (2003) find that, in the long run, real loans are positively related to real GDP and negatively

related to real short- and long-term interest rates. Backé, Égert and Zumer (2006) apply a dynamic panel cointegration framework and find that from 1996 to 2004, the private credit-to-GDP ratio was associated positively with GDP per capita (yet not always significant for the CEE-5 and the Baltic countries) and financial market liberalization. The findings for the nominal lending rate (negative sign in the CEE-5 and the Baltic countries; positive sign in the SEE-3), for PPI inflation (negative sign in the SEE-3; inconclusive for the CEE-5 and the Baltics), and for government credit (negative sign for the CEE-5 and the Baltics; inconclusive for the SEE-3) are rather mixed. Kraft (2007) examines the determinants of bank lending to households (the ratio of household loans to GDP being the dependent variable) in a panel of 23 transition countries, and shows that GDP per capita has a strong positive influence, whereas CPI inflation inhibits household lending and has a negative sign.

2.2 Findings on Deviations of Credit from Its Equilibrium in CESEE

Although there is no general measure of “excessive” credit growth, the literature tends to define a credit boom as a period of significant deviation of the observed credit level from its long-run equilibrium that is in turn determined by the macroeconomic fundamentals as discussed in the previous subsection. The most recent related investigation is that of Zumer, Égert and Backé (2009), who applied an out-of-sample approach and estimated the cointegration equation (similar to equation (1) below) for a panel of 14 small OECD benchmark countries. They used the estimated coefficients (country-specific intercepts and panel-wide slope coefficients) together with realized values for the fundamentals from the CESEE countries to calculate fitted values for the credit-to-GDP ratio in CESEE: $\hat{Y}_{CESEE} = \hat{\kappa}_{i,OECD} + \hat{\beta}'_{OECD} X_{CESEE}$. This fit defines the equilibrium credit levels. Evidence for overshooting credit levels is given if there is a clear indication that observed credit-to-GDP ratios deviated from the fitted equilibrium levels, i.e. $Y_{CESEE} - \hat{Y}_{CESEE} > 0, \forall \hat{\kappa}_{i,OECD}$. Applying this conception, they found that in the first quarter of 2009, domestic private sector credit levels were rather high in Estonia, Latvia, Bulgaria, and Croatia given the underlying fundamentals (to a somewhat lesser extent also in Lithuania and Hungary), which indicates that private sector credit had possibly grown beyond the equilibrium path in these countries.

Earlier papers came to similar conclusions, though the country-specific assessments and the methodological approaches differed. Boissay, Calvo-Gonzalez and Koźluk (2005) estimated the elasticity of credit with regard to three main macroeconomic determinants: GDP growth, the interest rate, and the gap between the observed and the equilibrium credit-to-GDP ratio. From these elasticities they derived estimates of expected credit growth and considered credit

growth to be excessive if the observed values were significantly higher than the expected ones. Accordingly, they found evidence for excessive credit growth in Bulgaria, Latvia and – to a lesser extent – in Lithuania, Estonia, Hungary and Croatia. Kiss, Nagy and Vonnák (2006) define a credit boom as follows: Either (1) the observed credit growth exceeds the one implied by the long-run equilibrium relationship on the basis of macroeconomic fundamentals, or (2) the observed credit growth rate is higher than the speed of adjustment to the credit equilibrium in the error correction model (i.e. $\Delta \log(c_t) > \hat{b}_1$ when referring to equation (2) below). They detected excessive credit growth only for Estonia and Latvia.

Policy challenges of and responses to lending booms were widely discussed in Kraft and Jankov (2004) for Croatia, in Duenwald, Gueorguiev and Schaechter (2005) for Bulgaria, Romania and Ukraine, or in Backé, Égert and Walko (2007) for the whole European emerging market region. Hilbers, Ötoker-Robe and Pazarbasioglu (2007) elaborated how prudential and supervisory policies could be used in strengthening the resistance of the financial system to adverse consequences of rapid credit expansion in CESEE.

2.3 Related Markov-Switching Applications

For first applications of switching error correction models, one can go back to Hall, Psaradakis and Sola (1997), who use them to identify periods in which real house prices differ from what is implied by economic fundamentals in the U.K. Markov-switching models have only recently been used in the analysis of bank lending. For instance, Frömmel and Schmidt (2006) look for overshooting bank lending (related to stock market bubbles) in countries of the euro area. Kaufmann and Valderrama (2008) use a Markov-switching VAR model to investigate differences between bank lending in Germany and the U.K. Their model is not based on error correction, however.

Frömmel and Karagyzova (2008), whose method is closest to our analysis, examine the relation between bank lending and asset prices in Bulgaria, using a Markov-switching error correction model to control for regime changes. They find a positive relationship between real estate prices and banks' lending to households. Moreover, they find evidence for the existence of regime switches linked to administrative measures for curbing credit expansion. In line with their methodology, they take a different view on the stability of credit growth: They no longer look at "excessive" growth in terms of the distance to equilibrium, but instead examine the adjustment process toward equilibrium levels (i.e. the error correction coefficients). A regime is then interpreted as unstable if cointegration between credit growth and its determinants is not

given for particular subperiods, which does not necessarily coincide with the error exceeding a particular threshold.

Regime switches in credit equations are usually interpreted as a deviation from equilibrium (e.g. Psaradakis, Sola and Spagnolo, 2004). Their model does not require the deviation to be of any sign, however. It may thus model both lending restrictions, such as a credit crunch, and lending booms. Furthermore, the use of the MS-ECM model for credit equations can be derived from theoretical models, based on the interaction between banks and borrowers. This interaction has been analyzed in theoretical studies, e.g. in Kiyotaki and Moore (1997) or in Chen (2001), where the borrower's net worth serves as collateral for lending. This net worth is highly affected by the value of the borrower's assets and expectations about their future evolution. Consequently, if the price of assets rises (falls), the borrower's capacity for lending will rise (fall), too. Other models that explicitly lead to switches between different equilibria in the credit market are presented by Scheinkman and Weiss (1986) or Azariadis and Smith (1998). The latter is based on constraints in borrowing and asymmetric information and leads to transitions between a Walrasian regime and a regime of credit rationing with slowing economic activity, falling interest rates and binding credit constraints. Linking theoretical models and empirical studies of credit markets, this model thus serves as a theoretical foundation for using the MS-ECM.

3 The Empirical Model

In the analysis of credit volume, it has become common to apply the cointegration approach (see the previous section), since the credit volume itself and most of its determinants empirically turn out to be integrated of order one. However, while in econometric analysis it is often assumed that the adjustment of the credit volume toward its equilibrium is linear, this need not necessarily be the case in reality. First, there may be periods during which unusual events cause credit markets to be temporarily in a disequilibrium. Second, determinants of credit growth may be subject to shifts, i.e. the impact of economic variables may change over time. Accordingly, the Markov-switching error correction model applied in this paper allows the coefficients to switch between different regimes.

Psaradakis, Sola and Spagnolo (2004) suggest proceeding in two steps: checking the long-term, equilibrium-defining relation for cointegration and then investigating the short-term dynamics for Markov-switching. As a result, one may find a stable long-term equation, but more complex dynamics in the short run. In our setting, we follow this two-step procedure and use a credit demand equation as the long-term relation, which is common in the empirical literature

(Pazarbasioglu, 1997; Ghosh and Ghosh, 1999; Barajas and Steiner, 2002; Calza, Gartner and Sousa, 2003):

$$\log(c_t) = a_0 + \underbrace{a_1}_{(+)} \log(IP_t) + \underbrace{a_2}_{(-)} LR_t + \underbrace{a_3}_{(-)} \pi_t^{CPI} + \varepsilon_t, \quad (1)$$

where the dependent variable is the logarithm of the real (CPI-deflated) domestic private credit stock c_t (in the empirical analysis we differentiate between total domestic private sector credits, firm credits, and household credits), a_0 is a constant, IP_t represents real industrial production (proxy of economic activity, as we work with monthly data), LR_t denotes the (nominal) lending rate, and π_t^{CPI} is the CPI-based inflation rate (year-on-year changes). For details on the data, see section 4 and the annex.

The signs below the coefficients indicate the theoretically predicted sign. Higher economic activity is expected to increase the demand for loans and thus credit volumes should expand ($a_1 > 0$). A higher lending rate, in turn, is expected to reduce the demand for credit, as debt servicing costs increase ($a_2 < 0$). The expected negative correlation of inflation and credit demand ($a_3 < 0$) may be attributed to two reasons (in line with Kiss, Nagy and Vonnák, 2006): First, once inflation has exceeded a certain threshold, it is associated with greater inflation volatility that can significantly hinder the functioning of financial markets through increased uncertainty. Second, if nominal rates are high, and even if the real interest rate is low, private agents can primarily get loans with shorter duration, which, in turn, limits the maximum lending volume.

If the variables from equation (1) are cointegrated, one may model the short-run dynamics as an error correction equation:

$$\Delta \log(c_t) = b_0 + b_1 \varepsilon_{t-1} + b_2' \Delta Z_t + b_3 \Delta \log(c_{t-1}) + u_t, \quad (2)$$

with $\Delta \log(c_t)$ the real credit growth rate (month-on-month changes), ε_{t-1} the error term from the long-run equation (1), b_1 the error correction coefficient governing the speed of adjustment

to the long-term equation, and Z_t a set of possible explanatory variables. We also include a lagged dependent variable to account for potential inertia in the credit dynamics.⁵

In the vector Z_t of short-term determinants, we include four groups of variables. First, banks' domestic liabilities (equity and deposits) account for the source of funds available for lending within the country. As soon as more funds are available, more loans can be extended, and thus we expect a positive sign for this variable. Second, the banks' net external position (external assets minus external liabilities) covers additional supply of loans by acquiring funds from abroad (positive correlation with credit growth). Yet, this position also comprises net foreign assets as a substitute for lending to domestic customers (negative relation – thus the concrete sign of this variable is ambiguous *ex ante*). Third, we include the interest spread between lending and deposit rates to account for the effects of banking competition on credit growth. Signaling profitability, a considerable positive spread acts as an incentive for new banks to enter the market. Lending can be expected to accelerate owing to such new entrants. At the same time, competition among banks increases, which results in a narrowing spread. At that point, the question arises whether – at the lower end of the spread – banks still increase lending in pursuit of market share or rather scale back lending (in which case a positive sign can be expected for this variable). Fourth, we include variables taking external exposure and credit risk into account (industrial production in the euro area as well as exchange rate volatility of the local currency vis-à-vis the euro, as the share of euro-denominated loans is relatively high in a number of CESEE countries).

While equation (2) is based on the assumption that the adjustment process to the equilibrium is regime-invariant, we drop this assumption in the MS-ECM framework and let the coefficients switch according to unobservable states. Thus, there is no single error correction equation and, in the case of a first-order Markov process with two states,⁶ equation (2) evolves to:

$$\Delta \log(c_t) = b_{01} + b_{11}\varepsilon_{t-1} + b_{21}'\Delta Z_t + b_{31}\Delta \log(c_{t-1}) + u_t, \text{ if } s_t = 1, \quad (3a)$$

⁵ Note that we do not include lagged differences of the explanatory variables of equation (1) as we presume their impact to be mainly a long-run demand-side one. Moreover, residual graphs do not really hint at missing lagged variables. Since we already have a highly nonlinear model with short sample periods, we prefer not increasing the number of variables to be able to execute the quasi-maximum likelihood estimation in the MS-ECM.

⁶ The MS-ECM could also be extended to a model with more than two regimes. However, the model then becomes highly nonlinear, which causes problems for the estimation (in our case quasi-maximum likelihood). Furthermore, models with more than two regimes do not necessarily perform much better (see Gallo and Rossi, 2006). Note further that the setting of the model includes the existence of one single switch, i.e. an absorbing state, as a special case. Thus, the model is a very flexible one in terms of the possible cases included.

$$\Delta \log(c_t) = b_{02} + b_{12}\varepsilon_{t-1} + b_{22}'\Delta Z_t + b_{32}\Delta \log(c_{t-1}) + u_t, \text{ if } s_t = 2, \quad (3b)$$

where the short-term equation is conditional on the unobservable regime variable s_t . The coefficients b_{k,s_t} , where $k=1,\dots,3$ (i.e. three different groups of explanatory variables) and $s_t=1,2$ (i.e. two different states), may now take different values conditional on s_t . The regime variable follows a two-regime Markov chain process and is characterized by the following transition probabilities p_{ij} for moving from regime i to regime j :

$$\begin{aligned} p_{11} &= P(s_t = 1 | s_{t-1} = 1), \quad p_{12} = 1 - p_{11} = P(s_t = 2 | s_{t-1} = 1), \\ p_{22} &= P(s_t = 2 | s_{t-1} = 2), \quad p_{21} = 1 - p_{22} = P(s_t = 1 | s_{t-1} = 2). \end{aligned} \quad (4)$$

Thus our model extends the standard (linear) error correction model by allowing the parameters in the error correction equation to depend on the stochastic outcome (s_t) of the unobserved Markov process. The main advantages of this approach are the ability to capture different kinds of adjustment processes including temporary nonstationarity, periods of differing short-term variables, and the estimation of the regime switches from the sample data. Consequently, it is not necessary to make a priori assumptions about the exact occurrence of regime changes.

To assess the stability of the adjustment toward equilibrium and respective regime-specific deviations, we need the following characterizations: a stable (or corrective) regime i is given by $b_{1i} < 0$ (a significantly negative error correction coefficient), as in this case any departure of credit from the underlying macroeconomic fundamentals is corrected by a change in credit growth. In turn, an unstable (or noncorrective) regime is defined by $b_{1i} \geq 0$, whereby $b_{1i} > 0$ marks an explosive deviation and $b_{1i} = 0$ indicates a very sluggish or constant and persistent deviation from the credit equilibrium in the case of temporary over- or undershooting of credit levels. As Psaradakis, Sola and Spagnolo (2004) pointed out, it is no contradiction that one finds cointegration in the long run (indicated by $b_1 < 0$ in equation (2)), whereas locally the connection between the variables may get temporarily lost as if cointegration had been “switched off” and there was no disequilibrium adjustment in particular regimes. However, the model is flexible enough to cover situations where the variables in both regimes are cointegrated, where both regimes have different adjustment speeds, or where additional short-

run determinants show a regime-dependent impact (even if the adjustment speed does not change at all).

The MS-ECM is estimated by quasi-maximum likelihood, based on Kim and Nelson (1999). From the estimation procedure we directly receive the ex ante probabilities $P(s_t = i | \Phi_{t-1})$ and the filter probabilities $P(s_t = i | \Phi_t)$. These are the probabilities of being in a particular regime at time t based on all the information available up to time $t-1$ or up to time t , respectively, i.e. $\Phi_t = \{c_1, \dots, c_t; Z_1, \dots, Z_t\}$ for the variables from equation (3). For an ex post analysis, however, it is more appropriate to rely on the smoothed probability $P(s_t = i | \Phi_T)$, where Φ_T is the set of all the information available up to time T , i.e. for the whole sample period with $\Phi_T = \{c_1, \dots, c_T; Z_1, \dots, Z_T\}$. The smoothed probability requires an additional filter algorithm for the estimation procedure. Alternative algorithms have been proposed in the literature; we use the one by Kim (1994), which is easy to implement and commonly used in the literature. For a detailed description of the smoothing algorithm, see Kim and Nelson (1999).

One could also think of using alternative empirical approaches to model credit growth, e.g. by letting the long-term equation change instead of the adjustment process or by introducing a time trend into the long-term equation that captures the deepening of the financial market. The first approach could be justified by financial sector reforms that resulted in new equilibria, which could also be captured by including dummy variables (see our robustness checks in section 5.3). In contrast, a time trend would represent a more gradual evolution of the financial sector. However, the residuals of equation (1) do not give any reason to include a time trend in the model.

4 Descriptive Statistics: Evolvement of Credit Stocks and Credit Growth

This section describes our basic variable of interest – the evolvement and composition of credit stocks and credit growth in the CESEE-11 since 1996 (which we compare with the euro area). Basic data issues and a description of other variables are covered in the annex (see table A1).

[Chart 1 about here]

Chart 1 depicts, for each country, domestic private sector credit stocks (dark blue area) and cross-border credit stocks (orange area) as a percentage of GDP. Whenever disaggregate information was available, be it for the whole observation period or for particular subperiods, we distinguished domestic private credit by households (purple area) and by firms (light blue

area). Moreover, we also show the year-on-year real growth rate of domestic private credit (black line).

After some disruptions due to country-specific crises in the 1990s, most CESEE-11 countries experienced a strong and smooth expansion of private sector loans until late 2007/early 2008. Nevertheless, as a result of the global economic crisis, credit growth rates decelerated sharply; in the Baltic countries, the year-on-year change of domestic private credit turned even negative in real terms in the first quarter of 2009.

In terms of the evolvement of domestic private sector credit over time, we can distinguish three groups of countries. First, the Czech Republic and Slovakia already disposed of considerably high credit stocks in the mid-1990s (around 60% of GDP). However, credit stocks shrank remarkably as a consequence of bank restructuring in the late 1990s and early 2000s. As a case in point, Slovakia recorded real average change of –20% in 2001 and the Czech Republic –28% in 2002. Credit stocks have still not reached the degree of financial intermediation observed earlier (the high values registered in the Czech Republic and Slovakia in the mid- and late 1990s have to be interpreted with caution as they were “inflated” by a comparatively high share of nonperforming loans; see Eller and Haiss, 2003). Second, Poland and Hungary were characterized by real credit growth rates of more than 20% already in the late 1990s but have experienced a comparatively moderate and steady expansion of credit since then. Third, Slovenia, Bulgaria, Romania, and especially the Baltic countries went through a brisk increase of credit stocks as a percentage of GDP starting with 2000–2003. From January 2003 until December 2007, the average (year-on-year) real credit growth rate was 19% in Slovenia, 28% in Estonia, 35% in Bulgaria, 38% in Romania, 40% in Latvia, and 44% in Lithuania.

Croatia is a special case, where the expansion of domestic credit was comparable with Hungary or the Czech Republic (at least since 2003), but at the same time the share of cross-border credits increased strongly and reached more than 40% of GDP in December 2008. In the CESEE-11, this is by far the highest share of cross-border credits, followed by 30% in Bulgaria, and around 22% in Estonia and Latvia.

Given these different patterns of financial development, we expect that also the dates for the regime shifts in the MS-ECM will differ across countries (see chart 2). Generally speaking, a regime shift can be expected when the country under examination experienced pronounced changes in the pattern of credit growth (e.g. in the Czech Republic and Slovakia in 2001–2002 or in the Baltic countries after mid-2007) or in the shape of GDP growth (e.g. in some of the CESEE-11 countries in the wake of the 1998 Russian financial crisis or during the most recent crisis situation).

Besides the overall expansion of domestic private sector credit, the share of household credit increased considerably over time in all the CESEE-11 countries (especially in the Baltic countries and Croatia). The bulk of new lending is attributable to housing loans, which already account for more than 50% of total household loans (see Walko, 2008).

Even though the degree of financial intermediation has been on the rise over the last decade, there is still a considerable catching-up potential vis-à-vis the euro area. The latter's share of domestic private sector credit in GDP lies just above 140% (see the last panel of chart 1). Only Estonia⁷ has reached a respective share of nearly 100%, while on the other end, Romania (40%) and Slovakia (45%) clearly lag behind.

A final aspect that we want to address here is the currency decomposition of domestic private sector credits. In line with deepening integration of the CESEE-11 into European financial markets, the massive entry of foreign banks⁸ and the prospects of joining the euro area in the foreseeable future, the share of foreign currency loans in total domestic private sector loans has risen steadily in most of the countries. Nevertheless, there is still a great deal of cross-country heterogeneity in the region. In August 2008 (i.e. just before these shares were distorted in a few countries due to crisis-related depreciations of the local currencies), we can distinguish three groups of countries (based on data from national central banks and the ECB): Estonia and Latvia with a very high foreign currency loan share of about 85%; Romania, Bulgaria, Hungary, Croatia and Lithuania with a medium share ranging between 55% and 63%; and finally, countries with relatively small shares: Poland (26%), Slovakia (19%; this share fell to nearly 1% after the introduction of the euro in January 2009), the Czech Republic (9%) and Slovenia (7%; before euro adoption in January 2007, the share was 64% and had risen substantially in the period immediately before euro adoption). In most of these countries, the euro accounts for a clear majority of total foreign currency loans to the nonbank private sector. Notable exceptions are Hungary and Poland, where the Swiss franc predominates foreign currency loans to households.

5 Results and Interpretation

5.1 Long-Run Evolution of Credit Aggregates: Cointegration Relation

⁷ However, if we also include cross-border credits, the share of total private sector credit lies clearly above 100% of GDP not only in Estonia, but also in Latvia, Bulgaria and Croatia (in Slovenia at 100%).

⁸ According to the EBRD structural change indicators (see EBRD, 2009), the share of banks with foreign ownership exceeding 50% at year-end in total bank sector assets amounted to a CESEE-11 average of 81% in 2008. The individual CESEE-11 figures range from 31% (Slovenia) to 99% (Slovakia).

To identify the long-run determinants of the credit volume, we estimate equation (1) from section 3; the results are presented in table 1. Since unit root tests on the data indicate the presence of unit roots in levels (see table A2),⁹ we can test for cointegration. The statistics for Johansen's cointegration test show evidence for at least one cointegration relation between credit volume, industrial production, interest rates and inflation rates in all cases but Slovakia, and partly also Hungary and Croatia.^{10,11}

[Table 1 about here]

All countries show a positive and robust correlation of industrial production and credit volume. The comparatively large coefficients, with the impact being much stronger for household credits than for firm credits, highlight an economically meaningful relationship between credit levels and economic activity in the CESEE-11. As in Kiss, Nagy and Vonnák (2006) or Backé, Égert and Zumer (2006), inflation shows mostly the expected negative correlation with lending. This is particularly the case for Estonia, the SEE-3 and most of the CEE-5. In contrast, the lending rate does not show the expected negative sign in most of the countries. The counterintuitively positive and in some cases even significant sign, however, corroborates existing empirical evidence (Backé, Égert and Zumer, 2006, for Southeastern European transition and non-European emerging market economies; Fair, 2004; for some countries also Boissay, Calvo-Gonzalez and Koźluk, 2005). A possible reason for the positive correlation between credit and interest rates could also be reverse causality: While higher interest rates are expected to decrease the demand for credit, there could also be a reversed impact, namely that a stronger demand for credit by the private sector creates more incentives for banks to increase lending rates in order to maximize their profits. If the causality really ran in the opposite direction, we would have the problem – as some of our regressors are endogenous – that ordinary least squares (OLS) estimation would deliver biased and inconsistent estimates.

⁹ A unit root in levels is clearly the case for the credit aggregates and industrial production, while the results point to a certain degree of stationarity of the lending and the inflation rate. This is, however, in line with existing empirical evidence (Crespo Cuaresma et al., 2009) and with the expectation that the price level is integrated of order one. In our cointegration analysis, we include all variables, because – although it is less common to use stationary and nonstationary data in the same analysis – Johansen and Juselius (1992) recommend this approach if the fit can be improved.

¹⁰ This may be due to the well-known lack of power of the Johansen test in small samples, but also to strong deviations from the equilibrium at the beginning (initial undershooting) and at the end (the global economic crisis 2008–2009) in our sample. Furthermore, the inclusion of country-specific dummies for economic crises and extraordinary data outliers improve the cointegration evidence. The results are not presented here, but available on request.

¹¹ If the trace- and the maximum eigenvalue-based assessment of the number of cointegration relations differ from each other, we rely on the trace-based assessment as Monte Carlo simulations by Lütkepohl, Saikkonen and Trenkler (2001) show that the power performance of the trace test is superior in small samples.

We are also aware of another potential source of bias in equation (1): Backé, Égert and Zumer (2006) emphasize that the estimates in the long-run equation could be upward biased because of initial undershooting in the case of transition countries (i.e. these countries started with lower credit-to-GDP ratios than countries with the same level of development given their repressed financial system under communism). Backé, Égert and Zumer (2006) thus use the estimated long-run coefficients for nontransition benchmark economies and realized values for the transition countries to properly fit equilibrium credit-to-GDP levels (out-of-sample approach).

We did not explicitly test for endogeneity of the regressors, but there are some reasons not to go deeper into the mentioned sources of biased coefficients in our analysis: First, the coefficients – particularly for industrial production – are large enough such that even after bias correction there should still be a non-negligible positive correlation with credit. Second, as the cointegrating vector is super-consistently estimated by OLS, conventional residual-based cointegration tests constructed under the assumption of linear adjustment toward equilibrium will still be valid and can be expected to be able to detect the presence of an equilibrium relationship (see Psaradakis, Sola and Spagnolo, 2004) – the basic prerequisite for our subsequent error correction analysis. Third and finally, also the out-of-sample approach used by Backé, Égert and Zumer (2006) has some challenges, such as the necessity that there is long-run parameter homogeneity between benchmark and transition countries and a stable structural relationship in the benchmark countries over time.

5.2 Short-Run Determinants of Credit Developments: Error Correction Model

In this subsection, we focus on the determinants of short-run private sector credit dynamics, arguing that changes in supply-side variables are directly correlated with credit growth. We do this by estimating the error correction equations (2) and (3a), (3b) for the linear and nonlinear case, respectively.

5.2.1 Evidence from the Linear Error Correction Model

The estimation results for the linear error correction model (i.e. for the whole sample period without subperiod-specific differences that are elaborated in section 5.2.2) are given in table 2. The error correction coefficient is in most of the cases significantly negative, which confirms the

finding of cointegration between the variables of equation (1) and indicates that in most countries there is an adjustment toward the credit equilibrium in the long run. However, there are also a few countries with an error correction term that is not statistically different from zero (such as the Czech Republic, Slovakia, Lithuania, and Croatia). In these countries there is thus either a very sluggish disequilibrium adjustment (that can be explained with frictions and transaction costs in the credit market; see Calza, Manrique and Sousa (2006) for respective euro area evidence) or a constant and persistent deviation from the credit equilibrium.

We find that bank deposit and equity growth explain a major part of the variation in credit growth rates. Romania is the only exception, showing a significantly negative relation between the growth rate of aggregate and corporate credit and equity growth. However, in the case of Romania this seems to be offset by a much more pronounced positive relation with the changes in deposits. The latter finding is also corroborated by the other countries, where the coefficient for deposit growth is in the majority of cases large and highly significant (e.g. in Poland a 1% increase of bank deposit growth is associated with an increase of total domestic private sector credit growth by 0.67%).

In contrast, changes in the net external position provide – in line with its theoretical inconclusiveness discussed before – only low explanatory power (i.e. very small coefficients), although there is mostly a negative relation (less pronounced in the CEE-5, but more so in the Baltic countries and the SEE-3). The remaining variables (interest spread, exchange rate volatility, output in the euro area and lagged credit volume) do not show a clear pattern. For the Baltic countries there seems to be weak evidence for a positive correlation with industrial production in the euro area. A positive relation with lagged credit growth can be unambiguously detected only for some credit aggregates in the Czech Republic, Hungary, the Baltic countries and Romania.

[Table 2 about here]

5.2.2 Evidence from the Markov-Switching Error Correction Model

Let us now turn to the Markov-switching error correction model that relaxes the assumption of a time-invariant short-run relation.¹² The series for firm and household credits are shorter for

¹² We do not formally test for Markov-switching, i.e. $k=1$ versus $k=2$. The reason is that testing in a Markov-switching framework is highly nontrivial and requires a grid search over all combinations of the transition probabilities, and the critical values from the literature (see Garcia, 1998) do not apply to our particular model. However, looking at the clear results of the Wald tests (see table A3), which

some countries (the Czech Republic, Hungary and Estonia), which poses challenges to the estimation of the highly nonlinear MS-ECM and leads to less pronounced regime switches in these cases. Therefore, and for the sake of brevity, we do not present MS-ECM results for the disaggregate series (available from the authors on request). The MS-ECM results for total domestic private sector credit are presented in table 3.

The overall picture that equity and deposit growth are the most important explanatory variables of total domestic private sector credit growth is confirmed for all countries. However, their impact differs significantly across the two identified regimes in most of the countries (see the Wald tests in table A3), which suggests that the main short-run determinants of credit growth do not have the same (i.e. linear) impact over the whole sample period.

There are only slight differences between the error correction coefficients of the respective regimes, which points to a broadly regime-independent adjustment process. Table A3 shows that the error correction terms differ significantly across the two regimes in Romania, Lithuania and Slovakia only. In Romania, both adjustment coefficients are negative, but there is a faster disequilibrium adjustment in regime 1. In Lithuania, the regime switches are broadly correlated with ups and downs of the business cycle (see table 4 and a broader discussion below). During downturns, credit corrects toward the equilibrium, which is not the case during booms.¹³ In Slovakia, regime 1 (early 2001, late 2002 and early 2003) coincides with the aforementioned period of bank restructuring and shows a correction of credit toward its equilibrium, while the long-lasting regime 2 can be classified as a noncorrecting one¹⁴ (in line with the overall lack of finding a cointegration relation for this country). This evidence for Slovakia and Lithuania highlights that, for the direct linkage between policy measures and the correction of over- or undershooting credit levels, the type of policy measure (in the case of Slovakia bank restructuring) as well as the business cycle position of a country are important.

The existence of only slight differences in the error correction coefficients together with the fact that in most of the countries there is at least one Z_t variable that has a significantly different

are often used as a heuristic approach (see e.g. Dewachter, 2001), we feel sufficiently confident about the existence of regime switches in our sample.

¹³ One might wonder why we were not able to find a similar behavior in the other two Baltic countries. First, the Wald tests in table A3 do not indicate a significant cross-regime difference of adjustment coefficients in Estonia and Latvia (where regime shifts are apparently driven by the short-run supply factors). Second, compared with Lithuania, credit growth rates in Latvia and Estonia were clearly higher (reaching about 80% year on year in real terms; Lithuania: only about 30%, see chart 1) before the spillover of the Russian financial crisis in the late 1990s. This might change the impact of determinants in the regimes coinciding with economic boom periods.

¹⁴ A closer inspection of the residuals of the long-term equation reveals that there was not really a need for correction in Slovakia, as the actual credit level only rarely departed from the level fitted on the basis of the underlying macroeconomic fundamentals.

impact across the two regimes (in most cases banks' equity or deposits, see again table A3) indicates that the switches are driven primarily by the short-run supply factors rather than by the adjustment process itself.

[Table 3 about here]

From the MS-ECM estimation we directly get the regime-switching probabilities. Chart 2 shows, for each country, the probability of being in regime 1 ($prob=1$) or regime 2 ($prob=0$) at time t . In terms of regime-switching behavior, we can divide the countries into two groups: While the first group shows clear and long-lasting regime switches (Poland, the Czech Republic, the Baltic countries and Bulgaria), the second group mainly stays in one regime with only short switches (Croatia, Romania and Slovenia, to a lesser extent Hungary and Slovakia). This is also reflected in the transition probabilities p_{ii} for staying in regime i if the country is already there (last column in table 3). While mostly exceeding 90%, the probabilities are generally low for the second group of countries in one of the regimes, with Croatia accounting for the minimum value of 64% in regime 2.

For the first group of countries with long swings in the error correction equation, i.e. p_{ii} is above 90% for both regimes, we find at least one regime for which bank equity and/or deposits show a very pronounced positive relation with credit growth. However, the dates of observed regime switches vary from country to country and show no common pattern. This means that the switches are likely to be due to country-specific rather than global determinants. Nevertheless, just before and during the current global crisis, all countries in this group except for the Czech Republic show a regime switch. This shift, which occurs between early 2007 (Poland) and late 2008 (Lithuania), invariably shows a weakened relation between credit growth on the one hand and bank equity or deposit growth on the other hand. The coefficient thus becomes insignificant or the coefficient remains significantly positive, but gets smaller. The only exception is Bulgaria, which shows a positive credit-deposit relation in both regimes and moves toward the larger coefficient. For Estonia, we observe the same behavior found in the other countries of the first group for equity, but not for deposits.

Most countries with only short-lived regime swings (Croatia, Romania, Slovakia and Slovenia) have one characteristic in common: The regime in which they stay most of the time shows a textbook-like positive relation with deposits, whereas the short-lived regime is characterized by significant impacts of the external position with both a negative and a positive sign depending on the country under review. One may thus argue that the short-run dynamics of these countries were from time to time affected by external determinants.

[Chart 2 about here]

Regime-specific descriptive statistics for real GDP growth and real domestic private sector credit growth (table 4) provide more information about the macro factors that underlie the two different regimes in each country. It is evident that in the three Baltic countries and in the Czech Republic, the two regimes clearly coincide with the respective business cycle position of the country: One regime represents a boom period with high GDP and credit growth, while the other regime represents more of a crisis period with relatively poor economic performance, higher economic volatility and relatively low – if not negative – credit growth. In the other countries, the regime differences appear to be less business cycle-dependent.

[Table 4 about here]

5.3 Robustness Checks

Finally, we performed various robustness checks, whose results are not presented here but are available from the authors on request. In particular, we checked various alternative specifications of the long-term equation. First, we replaced in equation (1) the interest rate with alternative ones, namely real interest rates and different maturities. This had almost no effect on the results; the observed positive relation between credit volume and the interest rate, in particular, remained stable.

Second, we included cross-border credits in our analysis, since they account for a substantial share of total credit volume in some of the CESEE-11 countries (especially in Croatia and Bulgaria, but also in Estonia and Latvia; see section 4). Their inclusion did not substantially affect the sign and size of coefficients in the cointegration equation, however. Since our proxy for cross-border credits is only available on a quarterly basis for households and firms combined (and thus, in contrast to other variables, interpolation would be necessary), we decided to work exclusively with the domestic private sector credit stock in the estimations.

Third, we included government credit as an additional variable in the cointegration equation to account for potential crowding-out effects. Again, there was no impact on the estimation results.

Fourth and finally, we constructed a dummy¹⁵ that captures substantial reform progress in the financial sector based on the EBRD transition indicator for banking reform and interest rate

¹⁵ Based on the EBRD transition indicator for banking reform and interest rate liberalization (see EBRD, 2009), the dummy was constructed as follows: 0 if the transition indicator's score was smaller than

liberalization. We included it in the cointegration equation to account for long-run structural conditions that are most likely to have determined the evolvement of credit volumes over time (in contrast to short-run competition effects approximated by the interest spread in the credit growth equation). There is a strong and positive correlation with credit volume in nearly all of the CESEE-11, which indicates that credit expansion in CESEE had also been based on better-functioning financial institutions. The effect on the other coefficients in the long-term equation and on the residuals to be used in the ECM is, however, only marginal.

6 Summary

In this paper, we analyze the determinants of domestic private sector credit developments in eleven CESEE countries, namely the CESEE EU Member States and Croatia, from January 1997 to April 2009. Our multidimensional approach (distinction between supply- and demand-side determinants, separate analysis of lending to firms and to households, identification of subperiods with a different impact of credit growth determinants) contributes to the existing literature since studies researching determinants of credit developments at this level of disaggregation are still rare (see Aisen and Franken, 2010). The finance and growth literature showed that countries with more developed financial systems tend to record stronger growth than countries with less developed systems (see e.g. Rajan and Zingales, 1998). Thus, it is crucial to learn more about the long-run driving forces of credit developments in order to assess the catching-up potential of the examined CESEE countries. Moreover, analyzing the variables that determine credit growth in the short run and especially their varying impact over time is important to assess financial sector risks and macrofinancial stability in the CESEE region.

We find long-term equations that are in line with our expectations. In most countries, there exists at least one cointegration relationship. The most significant long-term determinant of domestic bank lending to the private sector is economic activity (especially pronounced for household credits). Inflation shows the expected negative relation to lending for most countries, whereas the lending rate displays in some cases a counterintuitively positive sign, which is,

3.33 and 1 if it was larger than or equal to 3.33. Note that 3 marks “substantial progress in establishment of bank solvency and of a framework for prudential supervision and regulation; full interest rate liberalisation with little preferential access to cheap refinancing; significant lending to private enterprises and significant presence of private banks” and 4 stands for “significant movement of banking laws and regulations towards BIS standards; well-functioning banking competition and effective prudential supervision; significant term lending to private enterprises; substantial financial deepening.” As the transition indicators are only available at an annual frequency, a change in the dummy starts in July of the respective year.

however, in line with the existing empirical evidence. In the short run, credit supply factors like bank deposits and banks' equity explain a major part of the variation in credit growth rates.

Applying a Markov-switching error correction model, we provide a model that is more plausible than a simple linear error correction model and that relaxes the assumption of a time-invariant credit growth relation. We arrive at the following findings: First, deposits and equity remain the main short-run determinants of credit growth; yet, the strength of their impact differs substantially across the identified subperiods ("regimes" in the diction of the Markov-switching error correction model). This finding is important for financial stability analysis as it should – in the assessment of short-run credit developments – focus also on bank-related credit supply variables and their apparently changing impact over time. Second, as the error correction coefficients differ significantly across the identified regimes only in a few countries, the regime switches are mostly driven by differences in the short-run credit supply factors rather than by the adjustment to the credit equilibrium. Third, for a few countries, the linear model suggests that there is either a very slow or no correction toward the credit equilibrium if the credit level departs from its underlying macroeconomic fundamentals. The Markov-switching error correction model, in contrast, reveals that, in some of these countries, correction does take place in particular subperiods and is correlated with bank restructuring or low growth phases. Fourth, the subperiods separated by the regime shifts differ across the countries under review. We nevertheless identify two groups of countries: those with one dominant regime that is only temporarily interrupted by a second, short-lived one and those with two equally pronounced regimes leading to long-lasting regime switches. While the majority of regime switches seems to be country-specific rather than determined by the global environment, we find for most of the countries in the latter group a marked regime switch just before or during the current global crisis. This switch pushed the way credit growth was determined back to a regime that had already been observed earlier (in most cases, before the economic boom period from 2000 to 2007) and that is characterized by a weaker relation of deposit growth and credit growth.

Based on this evidence, future research could further explore country-specific reasons for the detected regime switches. This could shed light on the effectiveness of policy measures that were implemented to curb rapid credit growth in the period up to 2007–2008¹⁶ and that have been used to sustain lending during the more recent crisis situation.

¹⁶ Such as the tightening of capital adequacy requirements, of minimum reserve requirements, or of foreign exposure regulations; particularly in Croatia, Bulgaria, Romania, and Poland, and, to a more limited extent, in the Baltic countries.

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Tables and Figures

Chart 1: CESEE-11: Stock and Growth Rates of Domestic Private Sector Credit Compared with Cross-Border Credit

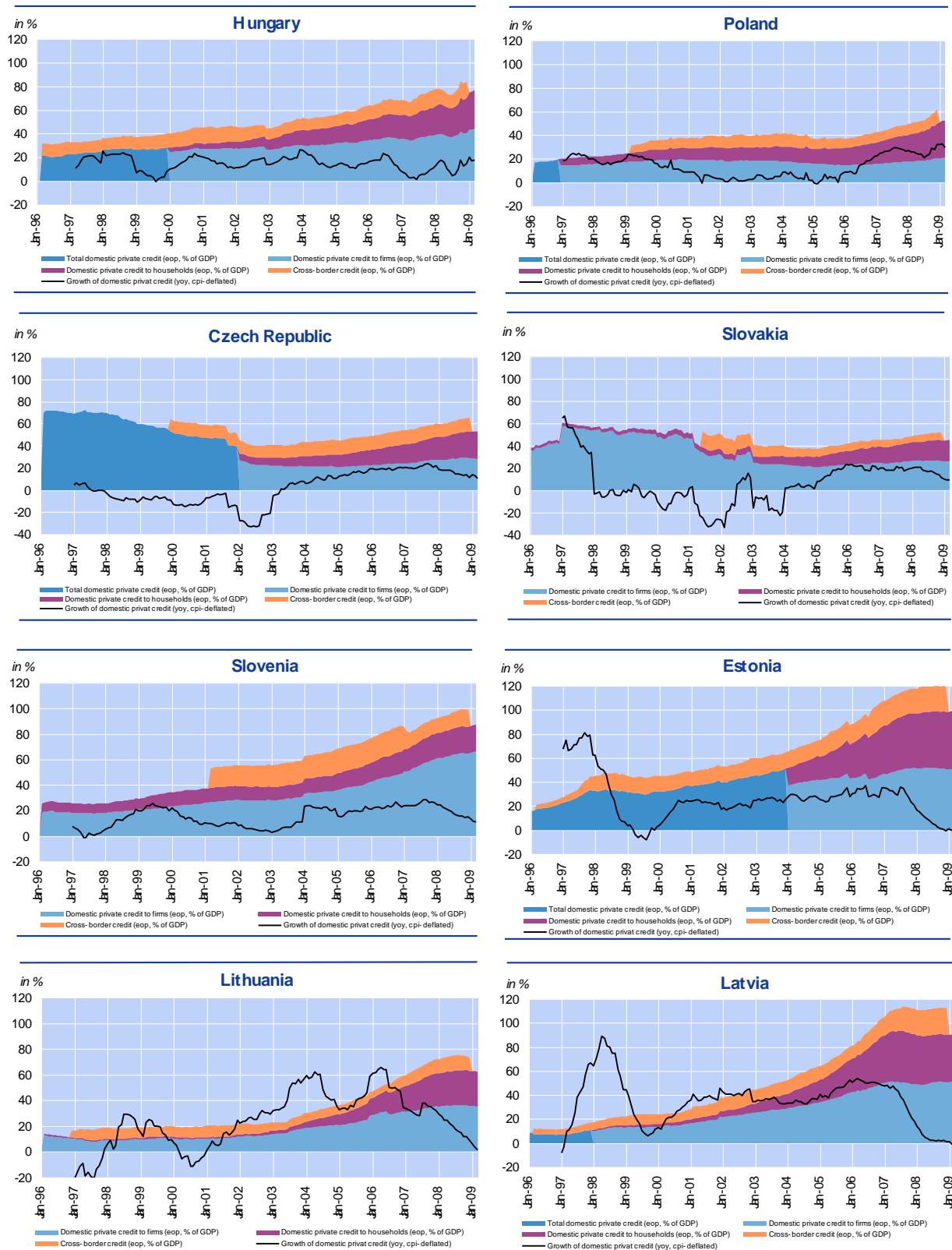
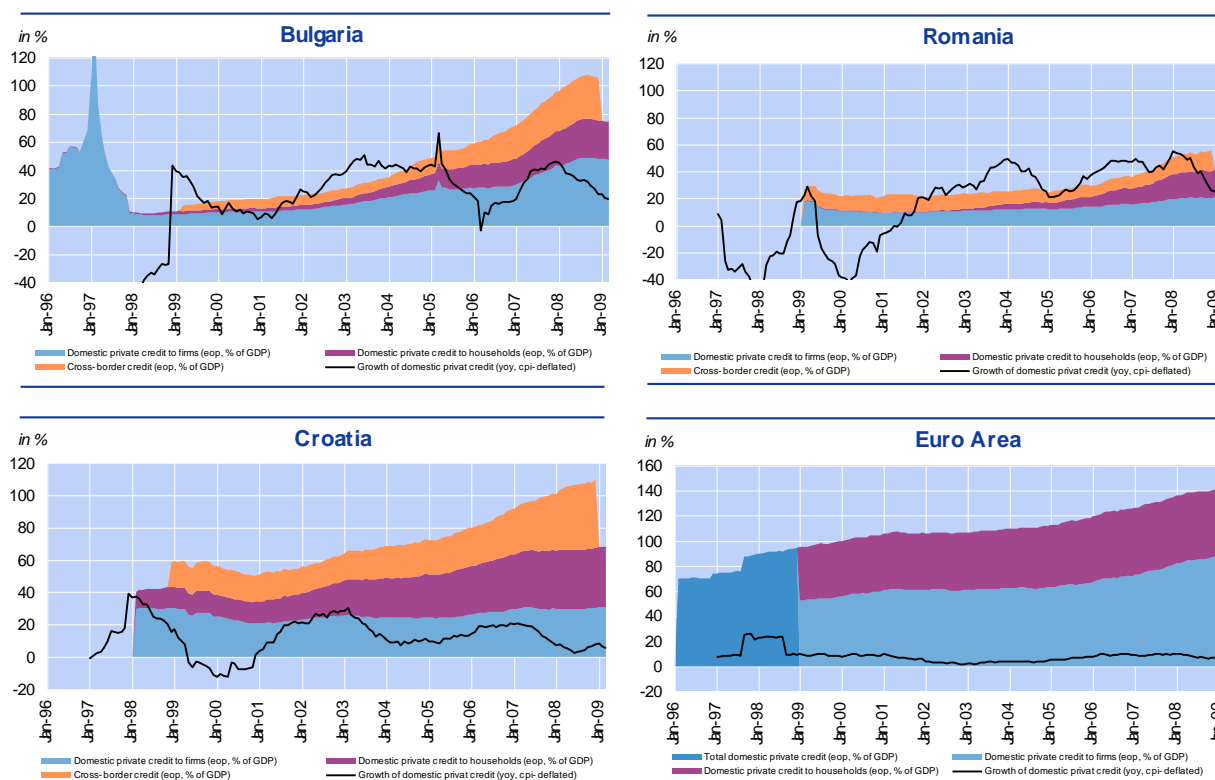


Chart 1 (continued)



Source: Authors' calculations based on IMF (1996), national central banks (1997-2003), and the ECB (2004 onwards).

Note: End-of-month *credit stocks* are presented as shares of nominal GDP (in local currency), whereby a rolling 12-month GDP, which was previously linearly interpolated from quarterly to monthly frequency, is used. The (real) *growth rate* of domestic private credit is calculated as the year-on-year percentage change, deflated by the CPI-based inflation rate. *Cross-border credits* are approximated by external debt of the non-bank private sector, excluding intercompany loans and trade credits (liabilities). They were only available on a quarterly basis (not available at all for the euro area) and thus we interpolated the end-of-quarter stocks linearly to monthly frequency (this type of interpolation should be straightforward as credit stocks evolve quite moderately over time). For further details see table A1.

Chart 2: Regime Switching Probabilities from the MS-ECM for Real Domestic Private Sector Credit Growth

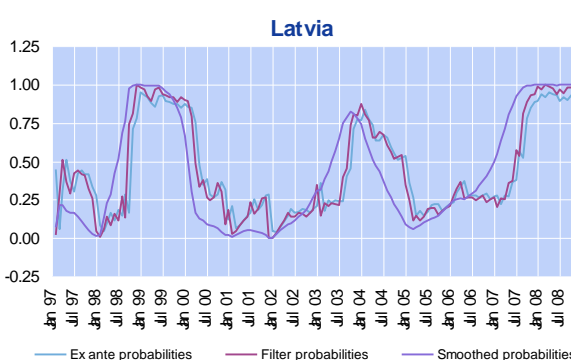
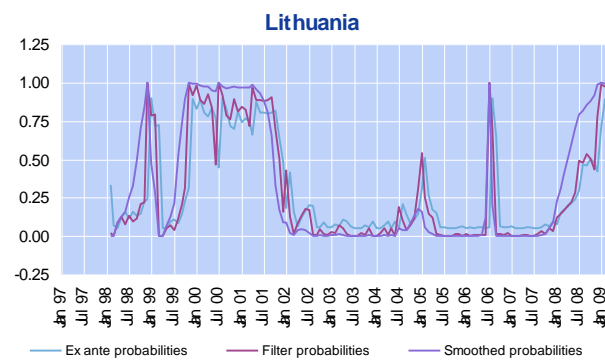
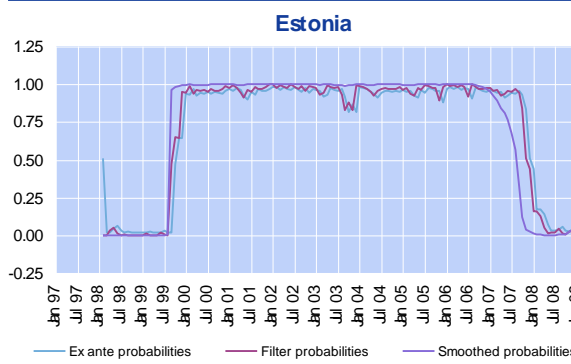
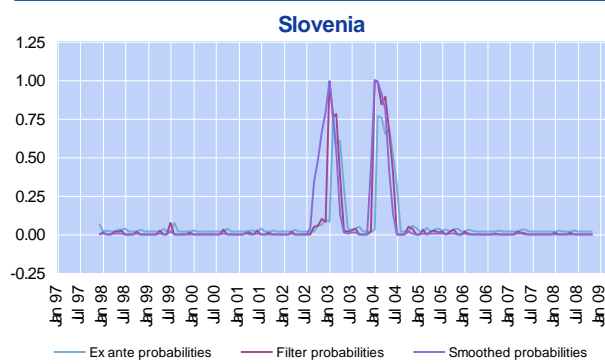
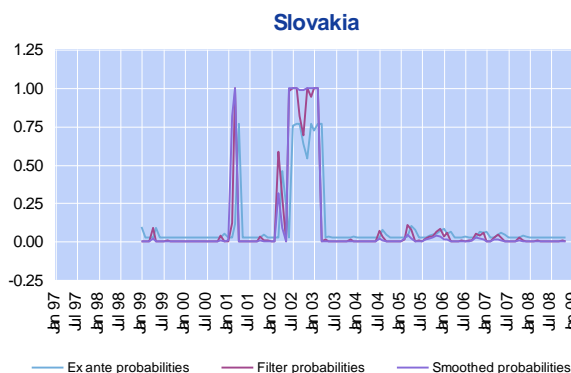
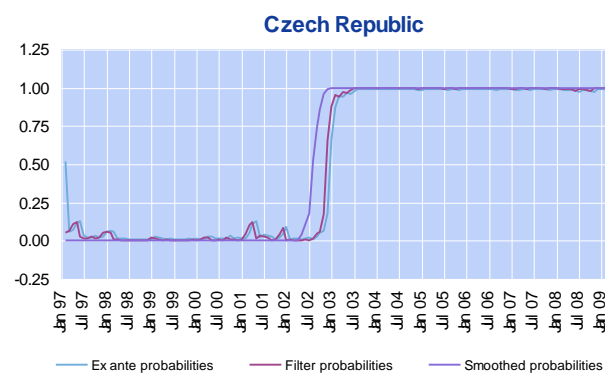
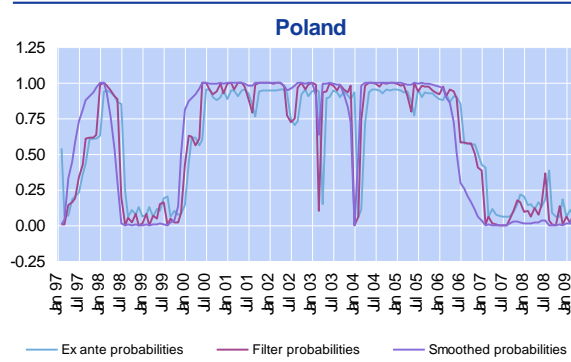
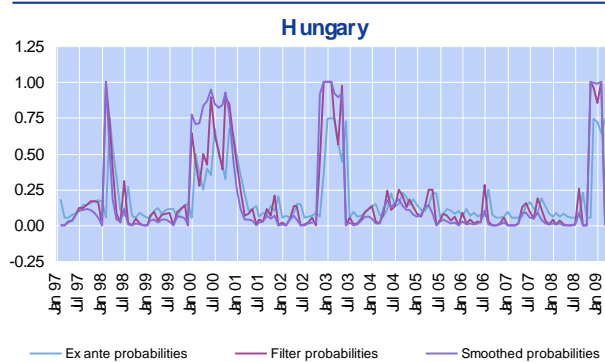
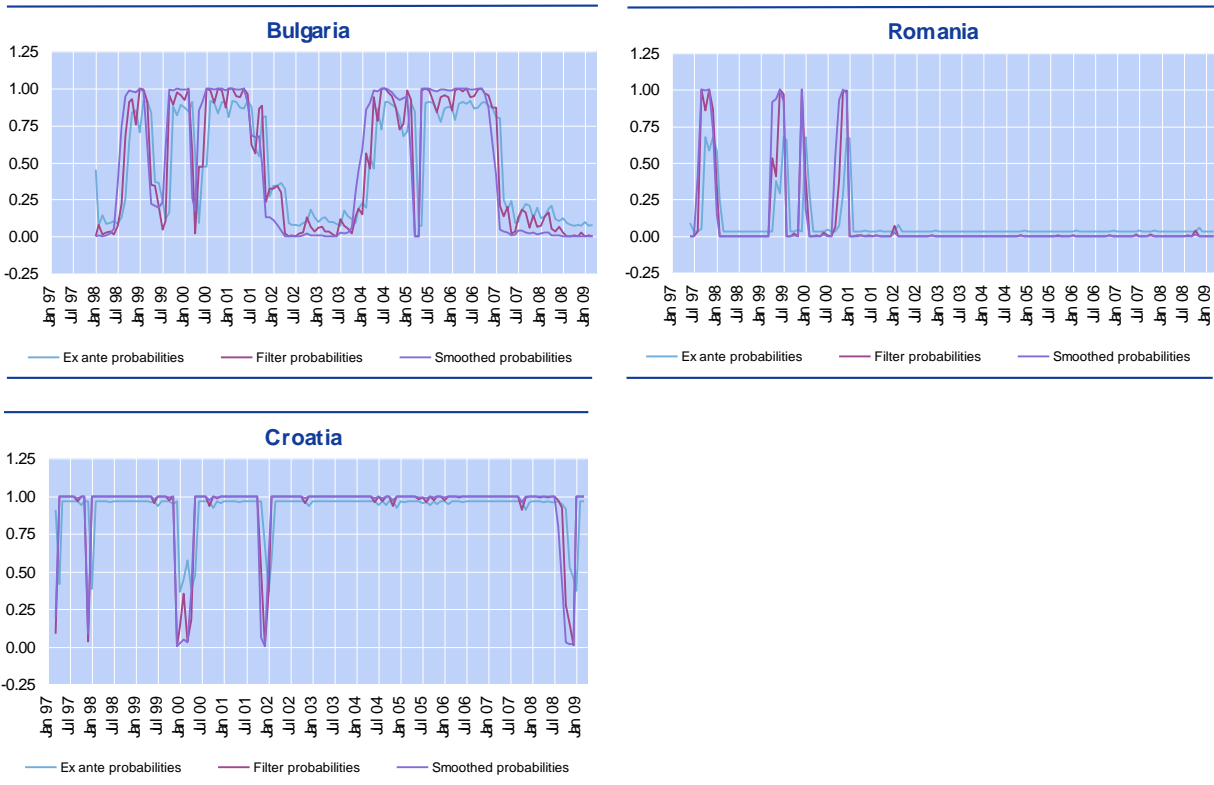


Chart 2 (continued)



Source: Authors' estimations.

Note: We show the time-varying probability of being in regime 1 as reported in table 3 at time t , based on all available information up to time $t-1$ (ex ante probabilities), up to time t (filter probabilities), and up to time T , i.e. as an ex post analysis for the whole sample period (smoothed probabilities).

Table 1: Cointegration Relation

							Selected (5% level) number of cointegrating relations	
		Dependent variable: $\log(c_t)$						
Country	c_t	$\log(IP_t)$	LR_t	π_t^{CPI}	Adj. R ²	Sample	Trace	Max-Eig
CEE-5								
Czech Rep.	Total	0.753*** (0.000)	0.063*** (0.000)	0.022 (0.146)	0.48	1997M01-2009M04	4	1
	Firms	1.227*** (0.000)	0.204*** (0.000)	-0.006 (0.567)	0.68	2002M01-2009M04	1	1
	Households	2.807*** (0.000)	-0.049 (0.702)	0.013 (0.592)	0.75	2002M01-2009M04	3	1
Hungary	Total	2.146*** (0.000)	0.062*** (0.001)	-0.044*** (0.002)	0.94	1997M01-2009M04	0	0
	Firms	1.415*** (0.000)	0.035*** (0.007)	-0.042*** (0.000)	0.92	2000M01-2009M04	0	0
	Households	4.186*** (0.000)	0.111*** (0.000)	-0.147*** (0.000)	0.93	2000M01-2009M04	1	1
Poland	Total	1.643*** (0.000)	0.019*** (0.000)	-0.028*** (0.000)	0.87	1997M01-2009M04	2	2
	Firms	0.774*** (0.000)	0.020*** (0.000)	-0.031*** (0.000)	0.65	1997M01-2009M04	2	1
	Households	2.511*** (0.000)	0.017*** (0.006)	-0.031*** (0.000)	0.93	1997M01-2009M04	2	1
Slovakia	Total	1.198*** (0.000)	0.058*** (0.000)	-0.006 (0.382)	0.52	1997M01-2008M11	0	0
	Firms	0.428 (0.129)	0.058*** (0.000)	-0.006 (0.473)	0.68	1997M01-2008M11	0	0
	Households	3.581*** (0.000)	0.003 (0.753)	0.006 (0.398)	0.95	1997M01-2008M11	0	0
Slovenia	Total	2.195*** (0.000)	-0.058*** (0.000)	0.008 (0.573)	0.88	1997M01-2009M04	1	1
	Firms	2.378*** (0.000)	-0.057*** (0.000)	0.004 (0.794)	0.89	1997M01-2009M04	2	1
	Households	1.755*** (0.000)	-0.058*** (0.000)	0.019 (0.178)	0.87	1997M01-2009M04	1	1
Baltic countries								
Estonia	Total	2.791*** (0.000)	0.051** (0.033)	-0.014 (0.484)	0.92	1998M01-2009M04	2	2
	Firms	1.440*** (0.000)	0.119*** (0.000)	-0.018* (0.097)	0.87	2004M01-2009M04	1	0
	Households	4.008*** (0.000)	0.302*** (0.000)	-0.073** (0.015)	0.84	2004M01-2009M04	4	1
Latvia	Total	6.150*** (0.000)	0.012 (0.741)	-0.008 (0.818)	0.78	1997M01-2009M04	1	0
	Firms	3.849*** (0.000)	0.010 (0.711)	0.037*** (0.006)	0.84	1998M01-2009M04	1	0
	Households	7.049*** (0.000)	0.002 (0.974)	0.065*** (0.009)	0.84	1998M01-2009M04	3	3
Lithuania	Total	3.741*** (0.000)	0.036 (0.189)	0.027 (0.242)	0.92	1998M01-2009M04	2	1
	Firms	3.043*** (0.000)	0.023 (0.295)	0.019 (0.330)	0.92	1998M01-2009M04	2	1
	Households	6.018*** (0.000)	0.062 (0.179)	0.036 (0.333)	0.91	1998M01-2009M04	2	2
SEE-3								
Bulgaria	Total	3.109*** (0.000)	-0.033 (0.251)	-0.003*** (0.000)	0.89	1997M12-2009M04	1	1
	Firms	2.681*** (0.000)	-0.031 (0.233)	-0.002*** (0.000)	0.87	1997M12-2009M04	1	0
	Households	4.193*** (0.000)	-0.046 (0.201)	-0.005*** (0.000)	0.91	1997M12-2009M04	1	1
Romania	Total	4.039*** (0.000)	-0.004 (0.447)	-0.002 (0.174)	0.72	1997M01-2009M04	3	3
	Firms	2.333*** (0.000)	-0.0009 (0.807)	-0.006*** (0.000)	0.71	1997M01-2009M04	4	4
	Households	7.024*** (0.000)	-0.020** (0.026)	-0.012*** (0.000)	0.85	1997M01-2009M04	3	3
Croatia	Total	3.578*** (0.000)	-0.022 (0.143)	-0.286*** (0.000)	0.95	1997M01-2009M03	1	0
	Firms	2.606*** (0.000)	-0.003 (0.817)	-0.276*** (0.000)	0.94	1997M01-2009M03	0	0
	Households	4.725*** (0.000)	-0.069*** (0.004)	-0.305*** (0.000)	0.94	1997M01-2009M03	1	0

Source: Authors' estimations

Note: Coefficients are estimated with OLS. The p -values in parentheses (for the null hypothesis of a coefficient being equal to zero) are based on Newey-West heteroskedasticity and autocorrelation consistent standard errors. The asterisks *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. All regressions contain a constant (not reported). *Trace (Max-Eig)* indicates the cointegration test assessment based on the trace statistic (the maximum eigenvalue statistic). We refer to a specification where we do not allow for a deterministic trend in the data, but include an intercept in the cointegration equation (in line with the specification in equation (1)). Significance stems from critical values based on MacKinnon, Haug, and Michelis (1999).

Table 2: Linear Error Correction Model

 Dependent variable: $\Delta \log(c_t)$

Country	c_t	ε_{t-1}	$\Delta \log(\text{equity})$	$\Delta \log(\text{depos})$	$\Delta \log(\text{extpos})$	$\Delta(\text{spread})$	er_vola	$\Delta \log(\text{IP_EA})$	$\Delta \log(c_{t-1})$	Adj. R ²	Sample
CEE-5											
Czech Rep.	Total	-0.011 (0.243)	0.514*** (0.000)	-0.007 (0.966)	0.0004*** (0.002)	0.024* (0.065)	0.024 (0.347)	-0.087 (0.468)	0.177** (0.030)	0.39	1997M02-2009M03
	Firms	-0.017 (0.203)	0.509*** (0.002)	0.113 (0.577)	0.033 (0.132)	0.005 (0.069)	-0.025 (0.376)	-0.113 (0.163)	0.345*** (0.008)	0.32	2002M03-2009M03
	Household	0.005 (0.231)	0.166*** (0.003)	0.181* (0.070)	-0.005 (0.687)	0.017* (0.060)	-0.083*** (0.000)	0.057 (0.168)	-0.144 (0.225)	0.39	2002M03-2009M03
Hungary	Total	-0.002 (0.865)	-0.022 (0.617)	0.103 (0.495)	-0.029 (0.191)	-0.001 (0.762)	0.055*** (0.007)	0.103 (0.213)	0.149 (0.201)	0.09	1997M02-2009M03
	Firms	-0.036** (0.022)	0.187** (0.042)	0.322** (0.015)	-0.025 (0.286)	0.005 (0.316)	0.04 (0.100)	0.069 (0.481)	0.226*** (0.005)	0.16	2000M03-2009M03
	Household	-0.012 (0.286)	0.127 (0.251)	0.280** (0.015)	-0.025 (0.287)	0.001 (0.702)	0.049** (0.010)	0.027 (0.796)	0.25 (0.294)	0.14	2000M03-2009M04
Poland	Total	-0.012* (0.099)	0.049 (0.440)	0.676*** (0.000)	-0.0003 (0.113)	0.001 (0.635)	0.024** (0.031)	-0.087 (0.399)	0.036 (0.688)	0.41	1997M02-2009M03
	Firms	-0.016** (0.015)	0.202*** (0.000)	0.226*** (0.002)	-0.0003 (0.134)	0.005* (0.087)	0.007 (0.211)	-0.195*** (0.006)	0.273*** (0.000)	0.31	1997M02-2009M03
	Household	-0.013 (0.183)	-0.149 (0.315)	1.178*** (0.000)	-0.0003 (0.594)	-0.002 (0.616)	0.042** (0.010)	0.079 (0.639)	-0.167** (0.041)	0.45	1997M02-2009M03
Slovakia	Total	-0.027 (0.183)	-0.137 (0.584)	0.174 (0.395)	-0.0007 (0.357)	0.002 (0.306)		0.009 (0.966)	0.016 (0.794)	0.00	1997M02-2008M11
	Firms	-0.036 (0.134)	-0.165 (0.572)	0.137 (0.546)	-0.0005 (0.512)	0.002 (0.308)		0.011 (0.961)	0.002 (0.975)	0.00	1997M02-2008M11
	Household	0.005 (0.373)	0.013 (0.516)	0.257** (0.021)	-0.007 (0.479)	0.001 (0.107)		0.02 (0.738)	0.229* (0.069)	0.13	1997M02-2008M11
Slovenia	Total	-0.014** (0.019)	0.049 (0.756)	0.043 (0.711)	0.001 (0.161)	-0.005** (0.024)		-0.030 (0.703)	0.176* (0.064)	0.09	1997M02-2009M03
	Firms	-0.012** (0.026)	0.06 (0.708)	-0.034 (0.765)	0.001* (0.073)	0.005** (0.025)		-0.069 (0.464)	0.017 (0.882)	0.03	1997M02-2009M03
	Household	-0.028** (0.025)	-0.005 (0.973)	0.143 (0.356)	0.001 (0.155)	-0.002 (0.407)		0.016 (0.881)	0.146 (0.155)	0.05	1997M02-2009M03
Baltic countries											
Estonia	Total	-0.016** (0.026)	0.089*** (0.001)	0.132** (0.035)	-0.0003** (0.024)	0.0001 (0.909)		0.238*** (0.001)	0.21 (0.112)	0.20	1998M02-2009M03
	Firms	-0.081* (0.094)	0.227** (0.031)	0.199 (0.151)	-0.001*** (0.000)	0.010* (0.061)		0.553*** (0.000)	-0.089 (0.325)	0.13	2004M03-2009M03
	Household	-0.0007 (0.894)	0.133** (0.010)	0.235*** (0.001)	-0.0007*** (0.000)	0.001 (0.538)		0.141 (0.117)	0.676*** (0.000)	0.79	2004M03-2009M03
Latvia	Total	-0.013*** (0.000)	-0.003 (0.401)	0.459*** (0.000)	-0.001* (0.050)	-0.0004 (0.372)		-0.094 (0.219)	0.167 (0.119)	0.48	1997M02-2009M03
	Firms	-0.017*** (0.000)	-0.004 (0.151)	0.406*** (0.000)	-0.001 (0.123)	-0.0009 (0.170)		-0.129 (0.122)	0.16 (0.217)	0.30	1998M03-2009M03
	Household	-0.006** (0.022)	-0.008 (0.247)	0.439*** (0.000)	-0.0002 (0.837)	-0.0005 (0.583)		0.158* (0.088)	0.392*** (0.002)	0.51	1998M03-2009M03
Lithuania	Total	-0.007 (0.347)	0.219*** (0.007)	0.405*** (0.000)	-0.001* (0.065)	-0.0001 (0.944)		0.168* (0.086)	0.287*** (0.001)	0.33	1998M02-2009M03
	Firms	-0.016 (0.162)	0.235** (0.013)	0.453*** (0.000)	-0.002** (0.010)	-0.0001 (0.965)		0.157 (0.132)	0.148 (0.104)	0.25	1998M02-2009M03
	Household	-0.012 (0.114)	0.141 (0.181)	0.121 (0.463)	0.0005 (0.749)	-0.003 (0.572)		0.391** (0.030)	0.433*** (0.000)	0.23	1998M02-2009M03
SEE-3											
Bulgaria	Total	-0.016** (0.015)	-0.032 (0.389)	0.796*** (0.000)	-0.0009* (0.075)	-0.0006 (0.654)		-0.028 (0.84)	-0.053** (0.015)	0.52	1998M01-2009M03
	Firms	-0.008 (0.306)	-0.061 (0.161)	0.964*** (0.000)	-0.001* (0.072)	-0.001 (0.515)		-0.033 (0.832)	-0.054* (0.050)	0.49	1998M01-2009M03
	Household	-0.015** (0.022)	0.197*** (0.000)	0.229 (0.120)	-0.003 (0.345)	0.001 (0.154)		0.028 (0.806)	0.552*** (0.000)	0.72	1998M01-2009M03
Romania	Total	-0.018** (0.017)	-0.071*** (0.004)	0.752*** (0.000)	-0.001*** (0.001)	-0.004** (0.046)	0.095** (0.017)	-0.035 (0.800)	0.373*** (0.000)	0.52	1997M06-2009M03
	Firms	-0.038 (0.112)	-0.093*** (0.006)	0.151 (0.819)	-0.001 (0.434)	-0.001 (0.740)	0.06 (0.242)	-0.172 (0.371)	-0.093 (0.345)	0.00	1997M06-2009M03
	Household	-0.014*** (0.000)	0.01 (0.542)	0.372*** (0.009)	-0.0005 (0.452)	0.0009 (0.610)	0.023 (0.486)	0.025 (0.889)	0.636*** (0.000)	0.56	1997M06-2009M03
Croatia	Total	-0.0005 (0.952)	0.392*** (0.000)	0.609*** (0.000)	-0.0002 (0.408)	-0.0007 (0.266)	-0.021 (0.934)	-0.062 (0.462)	0.002 (0.640)	0.99	1997M03-2009M03
	Firms	-0.0004 (0.968)	0.460*** (0.000)	0.546*** (0.000)	-0.0003 (0.247)	-0.0007 (0.449)	-0.076 (0.756)	-0.073 (0.476)	0.003 (0.516)	0.99	1997M03-2009M03
	Household	-0.009 (0.417)	0.257** (0.039)	0.737*** (0.000)	-0.0003 (0.398)	-0.001 (0.206)	0.024 (0.919)	0.002 (0.977)	0.004 (0.616)	0.99	1997M03-2009M03

Source: Authors' estimations

Note: Coefficients are estimated with OLS. The p -values in parentheses (for the null hypothesis of a coefficient being equal to zero) are based on Newey-West heteroskedasticity and autocorrelation consistent standard errors. The asterisks *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. All regressions contain a constant (not reported).

Table 3: Markov Switching Error Correction ModelDependent variable: $\Delta \log(c_t)$, with c_t representing total domestic private sector credit

Country	Regime	ε_{t-1}	$\Delta \log(\text{equity})$	$\Delta \log(\text{depos})$	$\Delta \log(\text{extpos})$	$\Delta(\text{spread})$	er_vola	$\Delta \log(\text{IP_EA})$	$\Delta \log(c_{t-1})$	Transformed probability	Sample
CEE-5											
Czech Republic	Regime 1	0.013 (0.279)	0.381** (0.015)	0.279 (0.175)	0.010 (0.368)	0.009 (0.373)	-0.075 (0.141)	-0.018 (0.392)	0.120 (0.332)	0.993	1997M02-2009M03
	Regime 2	0.018 (0.119)	0.468*** (0.000)	-0.083 (0.305)	0.000 (0.278)	0.020** (0.016)	0.259 (0.132)	-0.213 (0.211)	-0.077 (0.215)	0.993	
Hungary	Regime 1	0.012 (0.324)	0.648*** (0.004)	-0.827** (0.048)	0.028** (0.034)	0.012 (0.148)	0.123*** (0.000)	0.474** (0.011)	-0.284** (0.017)	0.743	1997M02-2009M03
	Regime 2	0.012 (0.178)	-0.074** (0.010)	0.129* (0.069)	-0.068*** (0.000)	-0.002 (0.327)	0.034** (0.031)	-0.007 (0.398)	0.440*** (0.000)	0.945	
Poland	Regime 1	-0.010 (0.283)	0.094 (0.250)	0.822*** (0.000)	-0.008 (0.146)	0.000 (0.397)	0.021 (0.342)	0.203* (0.060)	-0.026 (0.371)	0.950	1997M02-2009M03
	Regime 2	-0.018 (0.107)	-0.017 (0.395)	0.168 (0.159)	0.000 (0.267)	-0.001 (0.395)	0.019 (0.117)	-0.301*** (0.002)	-0.260 (0.220)	0.942	
Slovakia	Regime 1	-0.272*** (0.000)	-1.325*** (0.000)	-0.667 (0.179)	0.043*** (0.005)	0.082*** (0.000)		-0.533 (0.256)	-0.318** (0.013)	0.769	1999M01-2008M11
	Regime 2	-0.014 (0.206)	0.166*** (0.000)	0.355*** (0.002)	-0.001 (0.331)	0.003* (0.061)		0.172 (0.201)	0.280*** (0.000)	0.976	
Slovenia	Regime 1	-0.135* (0.075)	-0.571*** (0.000)	0.248 (0.306)	-0.046 (0.246)	-0.072*** (0.002)		0.540 (0.146)	-0.008 (0.398)	0.766	1997M12-2008M11
	Regime 2	-0.014** (0.028)	0.227*** (0.000)	0.154** (0.012)	0.002 (0.125)	-0.004* (0.057)		0.069 (0.188)	0.184** (0.022)	0.982	
Baltic countries											
Estonia	Regime 1	-0.020 (0.164)	0.154** (0.020)	0.024 (0.373)	0.000 (0.169)	0.000 (0.363)		0.206* (0.076)	-0.129 (0.144)	0.983	1998M02-2009M03
	Regime 2	0.002 (0.387)	0.117** (0.015)	0.209** (0.039)	0.000 (0.397)	0.001 (0.193)		0.107 (0.316)	0.419 (0.120)	0.983	
Latvia	Regime 1	-0.010 (0.111)	-0.003 (0.376)	0.320** (0.011)	0.001 (0.366)	0.000 (0.398)		0.094 (0.309)	0.379*** (0.006)	0.949	1997M02-2009M03
	Regime 2	-0.014*** (0.001)	-0.005 (0.380)	0.416*** (0.002)	-0.002 (0.121)	0.000 (0.388)		-0.308* (0.063)	-0.064 (0.342)	0.958	
Lithuania	Regime 1	-0.040*** (0.001)	-0.077 (0.367)	0.113 (0.307)	0.000 (0.391)	0.000 (0.398)		0.082 (0.363)	-0.033 (0.395)	0.902	1998M02-2009M03
	Regime 2	0.004 (0.351)	0.308*** (0.000)	0.377*** (0.001)	-0.001 (0.334)	-0.005 (0.164)		-0.085 (0.364)	0.190** (0.043)	0.950	
SEE-3											
Bulgaria	Regime 1	-0.038** (0.016)	-0.089* (0.051)	0.403*** (0.000)	0.000 (0.270)	-0.001 (0.353)		0.373** (0.050)	0.117 (0.120)	0.912	1998M01-2009M03
	Regime 2	-0.022*** (0.001)	-0.027 (0.288)	1.125*** (0.000)	0.000 (0.396)	0.001 (0.239)		-0.088 (0.299)	-0.081*** (0.000)	0.927	
Romania	Regime 1	-0.086*** (0.000)	-0.109*** (0.000)	-0.895*** (0.005)	0.050 (0.167)	-0.010*** (0.000)	1.356*** (0.000)	0.942 (0.216)	-0.066 (0.296)	0.674	1997M06-2009M03
	Regime 2	-0.006* (0.099)	-0.018 (0.259)	0.515*** (0.000)	-0.001** (0.050)	-0.001 (0.330)	0.047** (0.025)	0.104 (0.234)	0.355*** (0.000)	0.969	
Croatia	Regime 1	-0.001 (0.392)	0.289*** (0.000)	0.715*** (0.000)	0.000 (0.217)	0.000 (0.395)	0.105 (0.366)	0.026 (0.382)	0.003 (0.315)	0.963	1997M03-2009M03
	Regime 2	0.029 (0.226)	0.549*** (0.000)	0.043 (0.371)	0.047*** (0.000)	-0.007*** (0.005)	3.915*** (0.000)	-1.297*** (0.000)	0.026 (0.322)	0.636	

Source: Authors' estimations

Note: Coefficients are estimated with quasi-maximum likelihood. p -values for the null hypothesis of a coefficient being equal to zero are in parentheses. The asterisks *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. The transformed probability represents the transition probability p_{ii} for staying in regime i , if the country is already there. All regressions contain a constant (not reported).

Table 4: Regime-specific Descriptive Statistics for GDP Growth and Credit Growth

		Real GDP growth in %		Real credit growth in %	
		Average	SD	Average	SD
Countries with two equally-pronounced regimes					
Czech Rep.	Regime 1	4.4	2.6	11.4	11.3
	Regime 2	1.3	1.9	-9.7	9.2
Poland	Regime 1	4.0	2.4	7.8	6.4
	Regime 2	5.2	2.0	22.8	5.2
Estonia	Regime 1	8.3	2.1	24.5	7.3
	Regime 2	0.6	7.1	11.8	16.9
Latvia	Regime 1	3.0	7.3	24.8	19.8
	Regime 2	8.7	3.5	41.8	15.7
Lithuania	Regime 1	1.5	5.5	7.6	10.0
	Regime 2	7.9	2.3	36.6	14.6
Bulgaria	Regime 1	4.9	2.3	19.8	18.1
	Regime 2	4.8	2.5	25.2	26.6
Countries with mainly one regime and only short switches					
Hungary	Regime 1	2.6	4.3	16.8	3.8
	Regime 2	3.8	1.4	14.3	6.2
Slovakia	Regime 1	4.3	2.5	1.5	11.2
	Regime 2	4.9	4.2	3.0	16.0
Slovenia	Regime 1	3.6	0.8	11.5	9.6
	Regime 2	4.1	2.6	15.3	7.6
Romania	Regime 1	na	na	-18.3	21.9
	Regime 2	na	na	20.3	27.3
Croatia	Regime 1	4.6	4.7	13.8	10.2
	Regime 2	5.8	8.5	5.3	16.7

Source: Eurostat, IMF, NCBs, ECB, authors' calculations.

Note: Averages and standard deviations (SD) are calculated for the yoy percentage change of quarterly GDP at market prices and for the yoy percentage change of CPI-deflated monthly domestic private sector credit stocks. These statistics are calculated separately for regime 1 and regime 2 as indicated by the smoothed probability depicted in chart 2 (as soon as it is larger than 0.5 we classify the related subperiod as regime 1).

Appendix

Data Issues and Description of Variables

For our analysis we use data with monthly frequency (from January 1997 to April 2009) that are real-valued, seasonally adjusted and denominated in local currency. Those variables that are only available in nominal terms are deflated by using the all-items HICP index (2005=100). All series are seasonally detrended by applying the Census X12 method (also used by Eurostat to de-seasonalize EU series). Table A1 provides detailed definitions and sources of the variables used in the analysis.

Table A.1: Description of Variables

Variables	Description	Source
1) Credit variables		
Total domestic private sector credits	Credit to resident non-monetary financial institutions (MFIs) excluding the general government in local currency (LC) mn, end-of-period (eop)	IMF (1993-1996), NCB (1997-2003), ECB (2004 onwards)
Domestic firm credits	Domestic credit to resident enterprises (non-financial corporations and other financial intermediaries) in LC mn, eop	"
Domestic household credits	Domestic credit to resident households and non-profit institutions serving households in LC mn, eop	"
Cross-border credits to the private sector	Calculated as external debt of the non-bank private sector, excluding intercompany loans and trade credits (liabilities); in EUR mn, eop (conversion to LC mn using the eop exchange rate). Available only on a quarterly basis, and thus we interpolated them linearly to monthly frequency	NCB and IMF (International Investment Position)
2) Long-run (demand-side) determinants		
Industrial production (IP)	Real industrial production (excl. construction), gross volume index (wiiw). For the Baltic countries and the euro area (IP_EA) we use working day adjusted data from Eurostat	wiiw, Eurostat
Lending rate (LR)	Weighted average rate charged by non-MFIs on short-term loans to the private non-financial sector. The counterparties, maturities and weightings vary slightly from country to country	IMF International Financial Statistics (Datastream)
Inflation rate (π^{CPI})	Year-on-year percentage change of the all-items HICP (index, 2005=100)	Eurostat
3) Short-run (supply-side) determinants		
Bank equity (equity)	Banks' capital and reserves in LC mn, eop	IMF (1993-1996), NCB (1997-2003), ECB (2004 onwards)
Domestic bank deposits of households and firms (depos)	Deposits of residents excluding the general government in LC mn, eop. For Czech Republic, Hungary, Latvia, and Slovakia we used deposits of resident non-MFIs excluding the central government (longer time series available)	"
Banks' net external position (extpos)	External assets minus external liabilities, LC mn, eop	"
Lending-deposit rate (spread)	Spread between lending rate (see before) and deposit rate (weighted average rate offered by non-MFIs on deposits of the private non-financial sector), in percentage points	IMF International Financial Statistics (Datastream)
Exchange rate volatility (er_vola)	Percentage monthly variation of daily nominal exchange rates from their monthly mean, as measured by the coefficient of variation	WM / Reuters (Datastream)

Table A.2: Unit Root Properties of Variables Used in the Cointegration Relation

Country	Test	$\log(c_t^{\text{TOTAL}})$	$\log(c_t^{\text{FIRMS}})$	$\log(c_t^{\text{HOUSEHOLDS}})$	$\log(IP_t)$	LR_t	π_t^{CPI}
Czech Rep.	ADF	I(1)	TS	I(1)	I(1)	I(1)	I(0)
	PP	I(1)	TS	I(1)	I(1)	I(1)	I(1)
Hungary	ADF	I(1)	TS	I(1)	I(1)	I(0)	I(1)
	PP	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
Poland	ADF	I(1)	I(1)	I(1)	I(1)	I(1)	I(0)
	PP	I(1)	I(1)	I(1)	TS	I(1)	I(0)
Slovakia	ADF	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	PP	I(1)	I(1)	I(1)	TS	I(1)	I(1)
Slovenia	ADF	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
	PP	I(1)	I(1)	I(1)	TS	I(1)	I(1)
Estonia	ADF	TS	I(1)	I(2)	I(1)	I(1)	I(0)
	PP	I(1)	I(1)	I(2)	I(1)	I(1)	I(1)
Latvia	ADF	I(1)	I(1)	I(2)	I(1)	I(1)	I(0)
	PP	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
Lithuania	ADF	I(1)	I(1)	I(1)	TS	I(0)	I(0)
	PP	I(1)	I(1)	I(1)	TS	I(0)	I(0)
Bulgaria	ADF	TS	TS	TS	I(1)	I(0)	I(0)
	PP	TS	TS	I(1)	I(1)	I(0)	I(0)
Romania	ADF	I(1)	I(1)	I(1)	I(1)	TS	I(0)
	PP	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Croatia	ADF	I(1)	I(1)	I(1)	I(1)	I(0)	I(1)
	PP	I(1)	I(1)	I(1)	TS	I(0)	I(1)

Source: Authors' estimations.

Note: Based on the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests, we show whether a series used in equation (1) has no, one, or two unit root(s), i.e. is integrated of order zero - I(0), of order one - I(1), or of order two - I(2). "TS" indicates that the series is trend-stationary, i.e. the hypothesis of a non-stable series is rejected as soon as a deterministic trend is included in the test equation in levels. The detailed test output is available from the authors on request.

Table A.3: Wald Tests for Differences in Coefficients Across Regimes

Country	ε_{t-1}	$\Delta\log(\text{equity})$	$\Delta\log(\text{depos})$	$\Delta\log(\text{extpos})$	$\Delta(\text{spread})$	er_vola	$\Delta\log(\text{IP_EA})$	$\Delta\log(c_{t-1})$
Czech Republic	0.09	0.31	2.17	0.15	0.00	3.37	1.02	8.40**
Hungary	0.00	11.46***	5.46*	32.64***	0.00	10.13**	12.51***	68.97***
Poland	0.22	0.46	20.58***	1.89	0.00	0.00	28.99***	0.97
Slovakia	12.88***	146.16***	3.61	8.98**	0.02		1.45	17.88***
Slovenia	2.67	31.74***	0.07	1.03	0.04		1.52	2.11
Estonia	1.58	0.24	2.48	0.72	0.00		0.27	3.46
Latvia	0.14	0.02	0.25	1.20	0.00		3.89*	6.45*
Lithuania	10.31**	5.79*	2.07	0.02	0.00		0.38	0.75
Bulgaria	1.01	1.32	43.77***	0.39	0.00		4.43*	6.47*
Romania	30.20***	14.04***	20.79***	1.82	0.00	29.29***	63.47***	47.20***
Croatia	1.17	3.84*	32.09***	15.78***	0.04	12.89***	21.11***	0.33

Source: Authors' estimations.

Note: This table shows whether there are significant differences in the coefficients in equation (3a) and equation (3b), i.e. the Wald test statistics for rejecting the null hypothesis of $b_{k1}=b_{k2}$, where k represents the different explanatory variables. The asterisks *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively. The results for the constant are not reported.

CHAPTER 3 High and Low Tide of Credit Growth in Central and Eastern European Countries

High and Low Tide of Credit Growth in Central and Eastern European Countries*

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Abstract

In this paper we examine whether factors determining bank lending in Central and Eastern European Countries (CEEC) have changed during the Financial Crisis. We use a sample of more than 250 banks from eleven CEECs over the period of eleven years, including both macroeconomic and balance sheet variables. Results show that bank lending in general depends on the considered macro- and microeconomic factors, although during the global crisis the impact of these determinants changed. Macroeconomic conditions matter for both domestic and foreign bank lending during the whole period, although we notice a decoupling from these factors during the crisis period. Among microeconomic conditions, deposit base growth seems to affect both foreign and domestic bank lending in a similar way, but there are differences in how other factors shape lending –both across ownership and across different periods.

Keywords: Bank lending, transition economies, credit dynamics, macroeconomic factors, bank-level factors

JEL: C3, E4, E5

"A tide is a distortion in the shape of one body induced by the gravitational pull of another nearby object." The Planetary System (Morrison and Owen, 1966)

1 Introduction

This paper analyzes micro- and macroeconomic determinants of credit growth in eleven Central and Eastern European Countries (CEEC). Most of these countries experienced during the transition process in the 1990s a massive foreign bank entry leading to a market share of foreign banks which often exceeds 90%. They are now characterized by a vast presence of foreign banks and developed management techniques and products, comparable to the banks in Western Europe. Bank lending in the last decades experienced surge due to financial deepening, privatization, foreign investments inflow, but also due to a higher demand as a consequence of low initial indebtedness of households, investment opportunities and other favorable factors.

Credit growth in CEEC has gained a lot of attention. While most research focused on the questions how the entry of foreign banks affects the financial system in terms of efficiency and stability (see e.g. Claessens et al. 2001, Weill 2003, De Haas and van Lelyveld 2006) and later on whether credit growth was excessive (see e.g. Kiss et al. 2006, Zumer et al. 2009), the financial crisis raises the question how banks in CEEC master the current situation.

We contribute to, and go beyond, the existing literature by explicitly looking at how the determinants of credit growth changed during the global crisis. In particular, using a large panel data set we seek to answer three questions.:

First, we investigate whether it is micro- or macroeconomic factors that drive credit growth, and whether there is a difference between normal times and times of crisis. We have been witnessing a turnaround in the credit growth developments in the region since the beginning of the most recent crisis, and while there has been a plenty of research on drivers behind these developments in the years preceding the crisis, until now we have not seen evidence on the most recent developments nor drivers behind it. Hence, we aim to answer if there has been a change in determinants of the bank lending during the most recent crisis.

Second, we attempt to answer if bank lending drivers changed to the same extent for foreign and domestic banks. Namely, some papers that are motivated by the financial stability concerns analyze the credit behavior of foreign versus domestic banks in the most recent crisis. However, currently there is no evidence on differences between drivers of the credit growth of foreign banks in normal times and in the times of crisis. It is interesting to check if foreign bank lending is determined differently by micro- and macroeconomic factors than for domestic banks, and moreover what is the behavior across economic cycles. By the same means, we test if credit drivers of foreign and domestic banks react at the same time to the crisis.

Third, in the last step we also distinguish between different types of ownership/ mode of entry, in order to detect possible differences between domestic state-owned, domestic private-owned, foreign greenfield and foreign brownfield banks.

We cannot discern if the current increase in non-performing loans came as a result of a high credit growth prior to the crisis or because of the crisis itself, or both. But we should seek to understand the credit demand and supply interplay that takes place in the CEEC in order to regulate the banking sector more efficiently. The trend of dynamic provisioning and countercyclical buffers falls into this category. If there is a major difference between banks' behavior in normal times and in the times of crisis, then regulation should ensure that both scenarios are covered and there are no remaining caveats. Also, as foreign banks represent a substantial part of the banking sector in the region, if they tend to behave much differently than domestic ones it should be foreseen when constructing targeted regulatory measures. These notions help in designing a healthy banking system which follows and supports the real economy, instead of contributing to the buildup of macroeconomic imbalances.

We find that the credit growth can be explained rather by macro- than microeconomic factors, and in the times of crisis it seems to be under major influence of bank liquidity. These findings are in line with previous results which confirm that deposit growth fuels bank lending, but we are also first one to show that in crisis deposits' growth decouples from credit growth, and that the same holds for macroeconomic factors. We find differences between domestic and foreign banks, where the latter seem to be less affected by the liquidity and driven more by return on equity. Of all the banks, lending of foreign greenfield banks seems to be the most susceptible to the macroeconomic conditions.

The paper is organized as follows. In Section 2 we review the existing literature. In the subsequent section 3 we describe our data set. In Section 4 we introduce our empirical approach, whereas Section 5 discusses the results. Section 6 concludes.

2 Literature Overview

Real GDP as well as long and/or short term interest rates are most commonly used in estimating credit equations (Calza et al. 2003, Brzoza-Brzezina 2005, Boissay et al. 2005). Other authors suggest adding further macroeconomic variables. Backé et al (2007) use the following independent variables: nominal short and long term interest rate, PPP-based GDP per capita, industrial production, CPI inflation, government credit, financial liberalization index, housing prices and existence of public and private registries. A slightly smaller set of independent

variables is used in Kiss et al (2006), namely real short term interest rate, PPP-based GDP per capita and CPI inflation.

While the above mentioned authors exclusively rely on macroeconomic variables, Frömmel and Karagyozyova (2008) for the case of Bulgaria and Eller et al (2010) for a broad set of CEEC countries go a step further and use besides standard macroeconomic determinants such as real GDP, real interest rates and inflation aggregate deposits and equity. Furthermore they introduce regime switches to the analysis, thus emphasize switches of determinants depending on the economic conditions. While Frömmel and Karagyozyova (2008) and Eller et al. (2010) estimate regime switches endogenously, interaction terms with dummies for exogenous states are being employed in some of the papers relevant to our research, mainly to check whether independent variable's property changes during the crisis. Detragiache and Gupta (2006) test whether the Asian crisis affected differently banks of different ownership in Malaysia. For this purpose they use interaction terms (product of a dummy for the crisis period and relevant variables) as independent variables and test whether the coefficient for the interaction term is significantly different from zero. A similar approach is used in de Haas and Lelyveld (2011) where they use the interaction term between the crisis dummy and domestic ownership to check if the domestic banks were better able to continue lending during the Great Recession as compared to the multinational subsidiaries. In the same paper, using an interaction term between the crisis dummy and deposits' growth, they show that deposits as determinant of credit growth gain on importance during the crisis. However, they do not test for possible changes in importance of other micro and macro determinants during the crisis.

In the same vein, one strand of literature examines if domestic bank credit growth reacts differently than foreign banks credit growth during the crisis. De Haas and Lelyveld (2006, 2010, and 2011) and de Haas et al (2012) examine if lending by domestic banks in crisis is more stable or less stable than lending by foreign banks. There is some indication that domestic and foreign bank lending stability differs, so it is desirable to inspect whether their behavior is motivated by micro- or macroeconomic variables, and does this alter during the crisis.

3 Data Description

We use an unbalanced panel dataset consisting of balance sheet data and macroeconomic variables for CEEC. It covers the years 2001 through 2011 and more than 250 banks from the following eleven CEEC: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. These are all transition economies which joined the

European Union including Croatia which will join EU in summer 2013. To avoid any survivorship bias, we also include banks that were founded, ceased to exist or merged during the sample period or changed their owner, which makes the number of banks per year slightly differ. The total number of banks decreased from 251 in 2001 to 213 in 2011 (Table 1), which is to some extent a result of the consolidation and reconsolidation processes paired with the privatization. We notice a stable trend in the state bank ownership during the observation period, whereas the number of foreign banks exceeds the number of domestic banks over the years.

[Table 1 about here]

[Figure 1 about here]

Macroeconomic data was culled from different sources, including national central banks, IMF statistics and Eurostat. For the bank specific variables we rely on data from Bureau van Dijk's BankScope database. This database contains balance sheet data for a large number of banks on a yearly basis. The variables we achieved from this source are deposit stock and ratios such as solvency, liquidity, profitability, efficiency and loan quality. Data on bank ownership is the same as in de Haas et al. (2011)¹⁷. We distinguish not only domestic and foreign banks, but also domestic state-owned and domestic private banks, as well as foreign brownfield (takeovers) and foreign Greenfield (de novo) banks. A thorough description of data and data sources can be found in the Appendix.

We have removed all implausible values, together with observations where the loan growth exceeded 100% in order to control for mergers and acquisitions. We have also removed observations with implausible values for the deposit growth.

The following table gives an overview of the average growth in loans, deposits and equity in our sample. We notice that in the crisis period, i.e. the years 2008-2011, most of the presented variables deteriorated substantially across ownership types.

[Table 2 about here]

4 Methodology

We start with the following benchmark credit equation without consideration of the financial crisis:

¹⁷ We would like to thank Ralf de Haas for sharing this data.

$$\Delta c_{it} = a_0 + \sum_{j=1}^m a_j Macro_{j,it} + \sum_{k=1}^n b_k Bank_{k,it} + \varepsilon_{it} \quad (1)$$

where Δc_{it} is the credit growth of bank i in period t . The right hand side variables include both macroeconomic variables reflecting the condition of the economy and bank-specific variables. Macroeconomic variables are economic activity, proxied by industrial production, interest rates represented by nominal t-bill rates¹⁸ and the CPI based inflation rate. These variables are the most commonly used macroeconomic variables in the literature and mainly reflect the pure demand for credit (Pazarbasioglu 1997; Ghosh and Ghosh 1999; Barajas and Steiner 2002; Calza, Gartner and Sousa 2003; for a survey see Kiss et al. 2006). According to the existing literature we expect a positive relation between economic activity and credit growth, while for the the inflation rate we expect a negative coefficient. The interest rate is ambiguous, since on the one hand one might expect credit growth to be negatively related to interest rates, whereas the empirical literature suggests particularly for CEEC a positive coefficient (see Eller et al. 2010 and the references therein).

The bank-specific variables are growth of deposits, solvency (measured as the ratio equity/total assets), loan quality (ratio loan loss reserve/gross loans), liquidity (liquid assets/customer and short-term funding) and return on equity as a measure of profitability. We expect a positive relation between deposit growth and credit growth since deposits are the main funding source for banks in the CEEC, which rely less on issuing securities than banks in Western Europe. The relation should therefore be particularly pronounced for domestic banks, but also visible for subsidiaries of foreign banks, which seem to be comparatively independent from their holding institution (De Haas and van Lelyveld 2006). In contrast, the relation between credit growth and solvency, liquidity, loan quality and profitability is ambiguous.

We work in differences instead of applying a cointegration approach, because our time dimension is comparatively short compared to the number of banks. A cointegration approach over such a short period (with different regimes being likely) is hardly meaningful, second panel approaches such as dynamic OLS would substantially reduce our degrees of freedom. We therefore follow e.g. Peek and Rosengreen (2001), Kiss et al. (2006), De Haas and van Lelyveld (2006, 2012) and estimate the equation in differences.

Furthermore, we construct crisis and ownership dummy variables for each year in the dataset and each type of ownership, distinguishing between foreign and domestic but also between private, state, brownfield and greenfield banks. Moreover, we add one more dummy for the crisis years, i.e. 2008-2011. In order to distinguish between effects of the different factors in

¹⁸ Alternative specifications using the (also nominal) lending rate or government bond yields do not substantially affect the results.

normal times and the times of crisis, we introduce interaction terms: product of crisis dummy and relevant variable. This leads to our main equation of interest.

$$\Delta c_{it} = a_0 + \sum_{j=1}^m a_j Macro_{jit} + (d_C \cdot \sum_{j=1}^m \gamma_j Macro_{jit}) + \sum_{k=1}^n b_k Bank_{kit} + (d_C \cdot \sum_{k=1}^n Bank_{kit}) + \varepsilon_{it} \quad (2)$$

where d_C is the crisis dummy, which takes the value one for the years 2008-2011, and zero otherwise. Equation (2) can be estimated for each of the four ownership types (domestic private, domestic state owned, foreign brownfield, foreign greenfield) or any combination of these subsets separately. Recall that the ownership variable is both, bank- and time-specific, since banks may have changed their ownership status during the sample period.

In the final step we analyze differences between foreign and domestic banks, by repeating the estimation (3) separately for domestic and foreign banks. In particular we will investigate the hypothesis that domestic and foreign bank lending is determined by different factors at different times. We furthermore distinguish between domestic state, domestic private, foreign brownfield and foreign greenfield banks by repeating the estimation (3) separately for each of the four ownership types.

Based on the results of the Hausman test which points to the possible correlation between our independent variables and bank specific effects, we estimate our main equation (2) using fixed effects estimator with heteroscedasticity robust standard errors.

In summary, based on equation (2) we can test the following hypotheses:

Hypothesis 1a: Regime-dependence of determinants.

The importance of determinants in the pre-crisis and the crisis period differ, i.e. the coefficients for the interaction terms are significant.

Hypothesis 1b: Shift from macroeconomic to bank-specific factors.

In some papers macroeconomic factors are interpreted as demand-side determinants, and microeconomic factors as supply-side determinants. During the crisis banks will be exposed to internal restraints and therefore rely on bank-specific factors when determining lending behavior. As a result, the interaction terms should have a negative sign for the macroeconomic, and a positive sign for the bank-specific variables.

Hypothesis 2: Domestic versus foreign banks.

Foreign banks are less exposed to macroeconomic influences of the host country and will therefore be less affected by the regime shift from hypothesis 1b.

5 Results

In the first step we estimate the proposed model for the whole sample period, but without interaction terms, as a benchmark model. The results can be found in Table 3, second column. The estimated coefficients for all main variables suggested by the empirical literature show the expected sign, i.e. credit growth is positively related to the interest rate, the growth rates of economic activity, deposits and profitability, whereas the coefficient for inflation has a negative sign. Most of the coefficients are significant. We can thus conclude that the baseline regression describes the dynamics of bank lending sufficiently well.

In the second step we add interaction terms to the variables of interest, which allows us to test hypotheses 1a and 1b, and the results are shown in the last column of Table 3. Some of the coefficients for the interaction terms turn out to be significant, indicating that the credit function is state-dependent and the financial crisis created a regime switch. We can thus confirm hypothesis 1a.

Moreover, we can to a certain extent confirm the hypothesis 1b as well because the significant coefficients on the interaction terms show a negative sign for the macroeconomic variable of economic growth, and a positive sign for the bank-specific variable liquidity. Therefore we can recognize the expected shift from macroeconomic to bank-specific determinants.

The exact nature of this regime switch, however, shows some specific features. First of all and as expected, we observe that the macro variables: interest rate, inflation and economic activity indeed change impact during the crisis. During the crisis credit growth becomes seemingly unrelated to the economic activity. Two results are particularly interesting: First, the interest rate coefficient is insignificant, reflecting the inability of monetary policy to push credit growth by lower interest rate. The common wisdom that monetary policy is like a string – you can use it for pulling, but not for pushing – might hold.

[Table 3 about here]

However, we do not observe a full shift to bank-specific factors, as we would expect. In contrast, only liquidity seems to take effect during the crisis. It seems that while liquidity constraints play a role, other bank-specific variables do restrict banks' ability (or willingness) to lend. The results therefore only partially support hypothesis 1b.

We proceed by distinguishing among the four groups of banks: domestic private and state banks, and foreign greenfield and brownfield banks (Table 4). On the disaggregated level we

notice differences in the aforementioned behavior between domestic and foreign banks, and between different types of the ownership.

[Table 4 about here]

First, when distinguishing between domestic and foreign banks we find that macroeconomic factors, especially the economic activity, generally play an equally important role in domestic and foreign banks lending. While for domestic (private) banks we find that the interest rate seems to be an important determinant of credit growth, for foreign banks it is inflation, albeit with a minor economic significance.

Among the bank-specific variables, lending in general shows a strong dependence on deposits, what is apparently offset for domestic banks during the crisis. As predicted, we see that bank-specific factors do not contribute to the credit growth unless there is a period of crisis. Namely, liquidity seems to come into play to a big extent for domestic bank lending during the crisis. The results for foreign banks are somewhat different. They do not show the same pattern for liquidity determinants, as we suppose they can rely on liquidity lines from their mother banks in the case of emergency. Wald tests for all of the specifications can be found in the Table 5.

[Table 5 about here]

6 Conclusions

This paper aims to reveal how credit growth determinants in CEEE changed during the last crisis as compared to the normal times. Findings are further refined to differentiate between credit drivers for domestic and foreign banks, and even further between different types of ownership.

The main contribution of our study lies in going beyond the analysis of developments of credit growth and differences between domestic and foreign banks, to dissect the interplay of demand and supply factors, which are shown to behave differently in the crisis period.

Our results differ from de Haas and van Lelyveld (2011) by the effect of deposits' growth on credit growth during the global crisis. That is, they find positive effect, which is challenged by our finding of significantly negative effect of deposit growth on domestic bank lending during the crisis. We go further in exploring macro- and microeconomic determinants of credit growth and find that both factors matter, but in a different way.

In general, macroeconomic and bank-specific factors play a substantial role in determining credit growth. But some of these effects seem to have switched importance during the last crisis. To a certain extent we find a shift from macro- to microeconomic determinants in crisis, and confirm stated hypotheses. Namely, whereas economic activity contributes to lending in normal times, bank-specific liquidity takes over as main determinant during the times of crisis.

Based on this evidence we conclude that the measures for credit growth recovery during the crisis which are directed toward macroeconomic effects, such as stimulation of GDP growth, might not have as positive effects as desirable, whereas the measures directed to liquidity enhancements might prove efficient. It would be interesting to verify findings from the CEEE for other European banks and make general policy recommendations on accelerating the credit growth during the crisis.

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Tables and Figures

TABLES

TABLE 1. Number of banks in the dataset

Country	Domestic				Foreign				Total	
	Private		State		Greenfield		Brownfield			
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Bulgaria	10	6	2	2	9	4	4	10	25	22
Czech Republic	7	3	3	2	8	5	9	10	27	20
Estonia	2	3	-	-	-	1	3	2	5	6
Croatia	26	16	2	2	7	6	2	8	37	32
Hungary	4	4	5	2	13	10	6	5	28	21
Lithuania	4	3	-	-	5	5	-	-	9	8
Latvia	15	8	1	2	5	4	-	-	21	14
Poland	11	5	3	3	15	11	13	4	42	23
Romania	7	4	2	2	10	10	2	16	21	32
Slovenia	8	8	4	4	5	6	-	8	17	26
Slovakia	2	-	3	1	9	7	5	1	19	9
Total	96	60	25	20	86	69	44	64	251	213

TABLE 2. Mean of the main bank-specific variables

Variable	All banks		Domestic banks		Foreign banks	
	Whole sample	Crisis years	Whole sample	Crisis years	Whole sample	Crisis years
Loan growth (%)	16.2	5.5	17.1	7.58	15.8	4.5
Deposit growth (%)	18.2	8.57	20.2	13.4	17	5.8
Solvency (%)	12.6	11.8	14.1	12.9	11.6	11.2
Loan Quality (%)	5.3	6.1	6.4	6.9	4.5	5.5
Liquidity (%)	37.4	34.6	48.8	51.5	29.8	25.1
Profitability (%)	6.7	0.3	4.7	-2.3	7.9	1.5

TABLE 3. Lending determinants in CEEE (2001-2011): all banks

0

Dependent variable: Credit growth		
Variable	All banks	All banks
GDP growth	1.359*** 0.0000	2.051*** 0.0000
GDP growth_crisis	-	-1.111*** 0.0010
Tbill	0.432 0.1460	0.079 0.8070
Tbill_crisis	-	0.171 0.5900
CPI	-0.008*** 0.0000	-0.014** 0.0150
CPI_crisis	-	0.002 0.1570
Deposits growth	0.124*** 0.0000	0.118*** 0.0000
Deposits growth_crisis	-	-0.021 0.4560
Solvency	-0.602*** 0.0050	-0.635*** 0.0060
Solvency_crisis	-	-0.167 0.4490
Loanquality	-1.886*** 0.0000	-1.637*** 0.0000
Loanquality_crisis	-	-0.349 0.2320
Liquidity	-0.023 0.2180	-0.052** 0.0160
Liquidity_crisis	-	0.072*** 0.0070
ROE	0.058** 0.0470	0.043 0.1570
Method	FE	FE
Hausman test statistic	105.54***	97.60***
R ²	0.33	0.35
Number of Obs.	1624	1624

*p<0.1, **p<0.05, ***p<0.01; We use heteroscedasticity robust standard errors; we also use unreported constant.

TABLE 4. Lending determinants in CEEE (2001-2011): different ownership

Dependent variable: Credit growth	All	Domestic	Domestic	All	Foreign	Foreign
Variable	domestic	Private	State	foreign	Brownfield	Greenfield
GDP growth	1.886*** 0.0030	2.100*** 0.0090	1.935 0.2290	2.018*** 0.0000	1.918*** 0.0000	2.398*** 0.0000
GDP growth_crisis	-1.291** 0.0400	-1.393* 0.0900	-1.614 0.3750	-0.796* 0.0640	-0.296 0.6100	-1.521*** 0.0070
Tbill	0.839 0.1700	1.377* 0.0920	-0.173 0.7720	-0.316 0.4590	-0.640 0.2740	-0.193 0.7460
Tbill_crisis	-0.806 0.1910	-1.136 0.2040	-1.139 0.2060	0.712 0.1000	0.668 0.2000	0.540 0.4330
CPI	-0.012 0.2210	-0.012 0.3190	-0.017 0.3150	-0.015** 0.0420	-0.012 0.1900	-0.018 0.1020
CPI_crisis	0.002 0.4590	0.001 0.6410	0.004 0.2140	0.003 0.1580	0.002 0.3920	0.005 0.2070
Deposits growth	0.100** 0.0330	0.068 0.2040	0.239 0.1070	0.136*** 0.0030	0.147** 0.0300	0.104* 0.0830
Deposits growth_crisis	-0.042** 0.0240	-0.030** 0.0320	-0.276* 0.0890	-0.011 0.8440	-0.056 0.1640	0.083 0.2510
Solvency	-0.417 0.2260	-0.735* 0.0680	-0.091 0.8600	-0.984*** 0.0060	-0.812 0.1450	-1.064*** 0.0090
Solvency_crisis	-0.159 0.5650	0.017 0.9730	-0.116 0.8140	0.106 0.7760	-0.311 0.5790	0.475 0.3830
Loanquality	-1.968*** 0.0000	-1.545** 0.0180	-2.722*** 0.0000	-1.602*** 0.0000	-1.449*** 0.0010	-1.528*** 0.0000
Loanquality_crisis	0.134 0.7650	0.019 0.9810	0.271 0.7150	-0.564 0.1620	-0.861* 0.0820	-0.601 0.4220
Liquidity	-0.064** 0.0100	-0.022 0.7530	-0.071 0.2060	0.032 0.6680	-0.049 0.6740	0.076 0.4570
Liquidity_crisis	0.070*** 0.0090	0.146 0.2780	0.062 0.2340	-0.139 0.2050	0.077 0.6770	-0.227 0.0960
ROE	0.003 0.9450	0.080 0.3400	-0.020 0.8190	0.113*** 0.0050	0.152** 0.0170	0.091* 0.0710
Method	FE	FE	FE	FE	FE	FE
Hausman test statistic	59.72***	37.06***	26.44**	59.69***	34.03***	36.29***
R ²	0.32	0.31	0.36	0.31	0.47	0.37
Number of Obs.	668	510	158	953	472	481

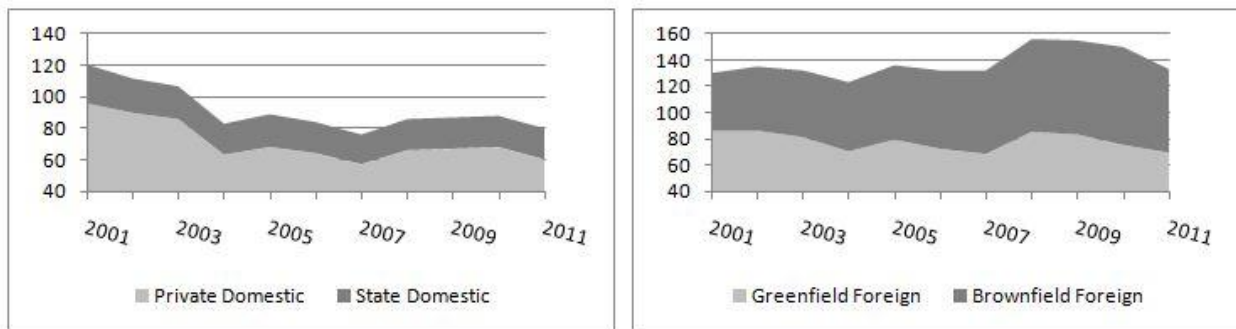
*p<0.1, **p<0.05, ***p<0.01; We use heteroscedasticity robust standard errors; we also use unreported constant

TABLE 5. Wald test for the coefficients and the interaction terms

Null: coefficients on a particular variable -without and with the crisis- are jointly equal to zero							
Variable/ F statistic	All banks	Domestic	Foreign	Domestic Private	Domestic State	Foreign Brownfield	Foreign Greenfield
GDP growth	33.44***	6.73***	34.55***	6.93***	1.15	25.31***	12.61***
GDP growth_crisis	0.0000	0.0017	0.0000	0.0016	0.3328	0.0000	0.0000
Tbill	0.26	1.19	1.39	1.58	0.87	1.20	0.31
Tbill_crisis	0.7728	0.3084	0.2513	0.2120	0.4303	0.3075	0.7327
CPI	6.96***	2.28	3.03*	2.40	0.91	1.26	1.46
CPI_crisis	0.0011	0.1070	0.0514	0.0961	0.4168	0.2909	0.2370
Deposits growth	6.83***	4.26**	6.01***	3.05*	1.59	2.72*	6.50***
Deposits growth_crisis	0.0013	0.0164	0.0031	0.0519	0.2247	0.0722	0.0024
Solvency	6.55***	2.11	4.99***	2.10	0.73	3.60**	3.57**
Solvency_crisis	0.0017	0.1256	0.0079	0.1286	0.4918	0.0321	0.0326
LoanQuality	51.05***	33.40***	35.41***	13.92***	20.57***	28.23***	14.73***
LoanQuality_crisis	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Liquidity	4.48**	4.53**	0.81	0.60	0.92	0.13	1.48
Liquidity_crisis	0.0122	0.0128	0.4473	0.5504	0.4143	0.8767	0.2343

FIGURES

FIGURE 1. Developments in ownership per year



Appendix

DATA DESCRIPTION

Variable	Description	Source
Total Assets	Total assets - EUR	Bankscope
Deposits	Deposits & Short term funding -EUR	Bankscope
Equity	Equity - EUR	Bankscope
Loan quality	Loan Loss Reserve/Gross Loans-%	Bankscope
Solvency	Equity / Total Assets - %	Bankscope
NIM	Net Interest Margin - %	Bankscope
Profitability	Return on Average Equity - %	Bankscope
CI	Cost to Income Ratio - %	Bankscope
Liquidity	Liquid Assets/Cust&ST Funding - %	Bankscope
Loans	Loans - EUR	Bankscope
Gross Loans	Gross Loans- EUR	Bankscope
Loan Loss Reserves	Loan Loss Reserves - EUR	Bankscope
GDP growth	Real GDP growth (% YoY)	Datastream (WIIW)
CPI Inflation	CPI inflation	Datastream (IFS)
Tbill	Treasury bills rate	Datastream (mostly IFS)
Deposits Growth	Percentage growth in deposits	calculated
Loans Growth	Percentage growth in loans	calculated

CHAPTER 4 Financing Patterns and Banking Relationships: Evidence from Croatia

Financing Patterns and Banking Relationships: Evidence from Croatia

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Abstract

This paper contributes to the literature on capital structure and banking relationships employing a large micro-data set covering the whole universe of Croatian companies. We show that bank loans, followed by short term trade credit are the major source of finance. Smaller companies concentrate their borrowing and rely heavily on external finance. We find evidence that industry, assets structure, collateral strength and profitability matter for the debt maturity and debt structure. Banking relationships are related to the industry in which the firm operates and to the company size, credit quality and ownership as well.

JEL classification: G32

Keywords: financing patterns, financing mix, banking relationships, trade credit

1 Introduction

Capital structure topics appear as interesting as ever in spite of the fact that it has been well over five decades since these issues were addressed by Modigliani and Miller (1958). The theoretical and empirical literature on capital structure decisions seems to be ever greening, from testing different theories, to using new methodologies or fresh data sets. In this spirit, we analyze financing pattern of Croatian firms, estimate its determinants, examine banking relationship and draw policy implications.

We address three questions in our study, using company characteristics as the explanatory tool. Firstly, can we relate certain company characteristics to the observed debt maturity? Second, can they help explain the differences in the liabilities' mix? And lastly, are they linked to the bank relationship that firms establish?

Similar studies for groups or individual countries have been done, and there is a considerable literature on cross-country differences in the financing patterns of companies, mostly relying on explanations regarding differences in macroeconomic variables, financial and legal institutions' development, and firm characteristics. Our contribution to the existing literature is using a detailed data set which allows for testing of a wide set of hypotheses, usually not tested or tested separately in the previous literature due to limited data. We are also the first to thoroughly examine the financing structure of Croatian firms and its determinants.

Since the early nineties, as in every transition country, there have been a lot of changes in the finance industry, ownership structure of companies and banks, and institutional environment in general. The financial industry is nowadays largely dominated by banking activities, and the latter are dominated by foreign banks. Croatia has experienced a substantial penetration of foreign banks, so that they nowadays account for over 90% of total banks' assets. State owned banks do not play a major role on the market, considering the fact that they represent less than 5% of total banks' assets. The concentration in the banking sector is higher than in the Western European countries, and also higher than the South-eastern European countries' average: the five largest banks held three quarters of total banks' assets at the end of 2012. The stock market is still quite shallow and narrow, with the market capitalization of around 55 per cent of the GDP (2012), with a deepening trend.

It is worth noticing that EBRD transition indicators confirm that Croatia has reached the standards of an industrialized market economy when it comes to the banking reform and interest rate liberalization. However, the same indicators show that the competition policy and reform of non-bank financial institutions in Croatia could still be improved. Leasing activities

started to develop more intensively only after 1997, and the Leasing Act came into force as late as 2006. As of March 2012, insurance market assets amounted to EUR4.6 billion, whereas the total bank assets amounted to EUR55.6 billion. In comparison, total assets of leasing companies amounted to EUR3.3 billion.

We believe that the Croatian case is of broader interest, because it is characterized by a high degree of banking concentration, extensive foreign banks participation, and a high share of cross-border credits. While our research focuses on Croatia, its conclusions are comparable to findings for other Central and Eastern European countries. Understanding financing choices is valuable in deciding in which direction the institutions and markets should be developed. Timely and targeted actions in these processes, as well as in the creation of government aided programs, can save a lot of resources.

Results show that the determinants of funding can be found among the firm-level characteristics, such as industry in which the enterprise operates, assets structure and profitability of a company. Relationship lending is most strongly linked to the size of the company, but also to the credit quality and the ownership. Industry in which the enterprise operates matters for the bank relationship as well.

The structure of this paper is as follows. Section 2 gives an overview of the related literature. Section 3 describes the data set and Section 4 presents the econometric specification we use. The results can be found in the Section 5, whereas the Section 6 summarizes and concludes.

2 Literature overview

Two lines of research on static capital structure models are relevant for this study. The first one explores the financing patterns and capital structure decisions, trying to relate them to firm characteristics, or to institutional differences and macroeconomic variables. The second strand explores credit availability and bank relationships.

One of the most relevant cross-country studies on determinants of capital structure using data from G-7 countries was done by **Rajan and Zingales** (1995). They do not set out on testing any capital structure theory in particular, but rather look for empirical correlations and conclude that theoretical underpinnings of their findings are problematic. The capital structures were studied also by **Booth et al.** (2001) and **Fan, Titman and Twite** (2004) who use an extensive sample of developed and developing countries. The latter find that the taxes, inflation and legal institutions have substantial impact on financing of corporations, and in general we observe

that cross-country studies devote their attention to the institutional differences in explaining financing decisions. Another interesting study on developed and developing countries was done by **Demirgüç-Kunt and Maksimovic (1998)**.

Beck et al. (2008) use disaggregated debt instead of debt-equity ratios to examine how financial and institutional development affects financing of small firms, using a broad data set covering almost fifty countries. Dependent variables are proportions of investments financed externally: by bank debt, equity, leasing, supplier credit, development banks and money lenders, together with the aggregate measure of proportion of investments financed externally.

Terra (2009) investigates simultaneously the choice between debt and equity and between short- and long term debt, on a sample of almost thousand firms from Latin America. Another study of companies in emerging markets, especially financing of small- and medium-size firms, was conducted by **Klapper et al. (2002)** on a sample of firms from Eastern European countries including Croatia. Because of their data set coverage, it qualifies rather as a general analysis of the debt maturity choice than a thorough capital structure examination.

There is also evidence from individual countries which typically exclude institutional determinants from the models. **Kumar and Francisco (2005)** on the Brazilian data set explore the extent to which the firm size affects financing patterns, together with credit constraint of small firms. Their analysis of financing patterns is limited to a simple comparison across firms of different sizes.

Relationship lending was interesting to **Berger and Udell (1995, 2002)** but in the context of small firms. In the same line, small business lending was of importance to **Petersen and Rajan (2002)**, **Cole et al. (2004)** and **Berger et al. (2007)**. Another typical focus in this strand of literature is the impact of foreign bank penetration on small business lending as in **Kraft (2002)**, **Clarke et al. (2001, 2005)**, or on lending in general, as in **De Haas and Naaborg (2006)**, **Detragiache et al. (2006)**, **Haber and Musacchio (2005)**, **Giannetti and Ongena (2009)** and **Berger et al. (2008)**.

Geršl and Jakubik (2010) use the Czech sample to analyze whether firm- and industry-level variables determine the choice of bank financing model, using the share of the main relationship lender in the firm's total bank debt as dependent variable. They find that older companies with more turnover have less concentrated loans, whereas firms in technology and knowledge intensive industries concentrate their borrowing. **Memmel et al. (2008)** examine the impact of borrowers' characteristics on relationship banking, measured as the number of lending relationships. German evidence shows that larger and older companies have more lenders whereas R&D intensive firms have significant less lending relationships.

3 Data and descriptive analysis

In this paper we combine companies' balance sheet data (FINA-Croatian Financial agency database) with anonymised firm-level data on loans from the credit register of the Croatian National Bank. Our period of interest covers three years, 2008-2010, and altogether we have 201,553 firm-year observations. The panel is unbalanced and allows us broad overview of firm characteristics and banking relationship characteristics.

We start by justification of our main variables, followed by summary statistics. Thorough explanation on the construction of variables can be found in the Table 8 in the Appendix. One of the core factors is industry median, as a measure of industry conditions. By choosing this factor, we take into account different forces and processes which would otherwise influence our results. The next factor is growth, measured as change in log assets. Under the pecking order theory it should be positively related to debt. Better measure for growth would be the asset market-to-book value ratio, but our data set entails non-listed firms as well. Alternatively, we can use the ratio of research and development investments to total assets as a proxy for growth opportunities.

Ratio of short term assets to total assets and collateral strength both assess the nature of assets. In the case of maturity matching, we would expect the firms with more short term assets to have more short term liabilities as well. Tangible assets on the other hand are easily used as collateral and the lower expected costs of distress together with less agency problems should yield a positive relation between tangibility and debt.

We measure profitability as the return on assets. Different theories have opposing views on this variable, but according to the pecking order theory, profitable firms become less levered over time. We also plug in the ownership and region dummies in our model because these factors might influence the financing choices and should be controlled for.

Substantial part of the companies in the data set is situated in three regions: Zagreb with surroundings and the two coastal regions- Dalmatia, Istria and Primorje. Over 60% of the total assets in the sample are concentrated in the companies in Zagreb and surroundings, together with almost 60% of the total income. Another interesting feature of the sample is that the number of small firms²¹ makes around 97% of all companies, but less than one third of the total

²¹ We define a company size according to the Croatian Accounting Act, where small, medium and large firms are classified according to the three criteria: amount of the total assets, amount of the total income and the average number of employees. Accounting Act in Article 3 offers the following definition. Small firms satisfy at least two of the following criteria: total assets below HRK 32,5 million (\approx EUR 4,5 million), total income below HRK 65 million

assets and total income, respectively. In contrast, large firms count for over half of the total assets and total income, respectively.

The prevalent industry in all of the regions and in the Croatian national income is trade, which counts for one third of all of the firms in Croatia. It is followed by professional, scientific and technical activities, construction and manufacturing. The latter is only second to trade in the total income. Construction is expectedly the 'heaviest' industry when it comes to asset size, due to the nature of the business.

[Table 1 about here]

Over 96% of the companies in Croatia are privately owned, and they make one half of the total assets and 2/3 of the total income. State-owned companies represent only 1% of the total number of firms in the sample, yet they own almost one third of all firms' assets. Similarly, the firms that became private after privatization or they have mixed ownership with major private stake account for only 1.7% of the total number of firms but own over 20% of the total assets. State owned firms create only 12.5% of the total income even though they hold big assets' share.

[Table 2 about here]

Table 2 gives an idea about the first part of the research question, the maturity structure of the liabilities. The major part form short term liabilities and together with long term liabilities they represent on average 60% of total liabilities. The firms in Croatia have a high share of debt financing compared to the equity.

In support to the findings of **Titman and Wessels** (1988), in Table 2 we observe that the small firms employ more short term financing than large firms, which could be a reflection of their constraints in obtaining long term debt or equity. These firms might be simply matching the maturities of their assets and liabilities, so that if the short term assets prevail, they would prefer obtaining short term debt. This remains to be inspected in the following Section, together with the hypothesis that the firms with more borrowing capacities have more long term debt, possibly also because they have lower transaction costs when issuing long term debt or equity. **Demirgüç-Kunt and Maksimovic** (1999) find that the small firms are destined to use more short term liabilities, claiming it is because this limits time during which they can exploit creditors

(≈EUR 8,9 million) and maximum 50 employees. Medium firms are the firms which do not satisfy at least two of the mentioned criteria, but do satisfy at least two of the following criteria: total assets below HRK 130 million (≈EUR 17,8), total income below HRK 260 million (≈EUR 35,6 million) and maximum 250 employees. Big firms are then those firms which do not satisfy at least two of the previously mentioned criteria.

without ending up in default. In that sense, it is rational that lenders protect themselves by monitoring the firm more frequently and changing the terms of financing before any large losses occur.

[Table 3 about here]

As for the second part of the main research question, the dominance of bank loans and (short term) trade credit is obvious. This finding contradicts similar studies on transition countries, where the trade credit is found to be low. In the study conducted on transition countries worldwide, bank loans were found to be the most common source of external finance, whereas on a study conducted on a set of Baltic, CESEE²² and CIS²³ countries it was found to be low. Finding that the bank finance is leading might be pertinent to CEE countries, and definitely to Croatia. As we have pointed out, another important source of financial intermediation in Croatia are firms providing trade credit among themselves²⁴.

Finally, we observe that securities issuance is the least used funding source and this indicates underdeveloped financial markets and classifies Croatia as a bank-based economy.

The next interesting observation is that small firms have on average fewer loans obtained from the group of connected parties. A plausible explanation is that they less commonly belong to a group of connected parties or holdings, and operate more on stand-alone basis.

A decreasing share of short-term trade credit over the sample period, and an increase in loans from the Group deserve a closer look. Trade credit seems to have decreased the most for the small, private companies in the construction, manufacturing and services industry- but more for the regions other than Zagreb. As we know that small private companies mostly do not belong to holdings, it is an indicator of their endangered position during the most recent crisis. Interesting increase and then sudden decrease in the short-term bank loans, together with less short-term advanced payments could be pointing to a liquidity squeeze.

Interestingly enough, Table 2 showed that small firms have on average less equity than large firms, but here we notice that on average they also use less short-term bank credit. This could be in line with the hypothesis proposed by **Berger et al.** (2001) that the large and foreign-owned banks have difficulties in extending relationship loans to informationally opaque small businesses, but it requires further analysis. We observe the average amount borrowed from big

²² Central, Eastern and South Eastern European countries

²³ Commonwealth of Independent States

²⁴ This potentially interesting issue requires further analysis, and we find that the bigger companies with more collateral strength and more bank loans act as the trade creditors on the Croatian market. Smaller companies with less collateral strength and less bank loans act as trade debtors.

and foreign banks for all firm sizes in Figure 2. While the share borrowed from big banks increased for firms of all sizes over the observation period, it is obvious that the share of foreign banks' loans improved only for large companies, whereas the small and medium ones experienced decreasing portion of foreign banks' loans in total bank loans. These trends brought to ever larger gap between the loans that large companies can obtain from big/foreign banks as compared to the small companies.

[Figure 1 about here]

Analysis of the concentration of borrowing reveals the number of lenders per company. Relationship lending is defined as a close tie between the firm and the bank, signaled by a very concentrated borrowing. Data set allows us to calculate the share of single biggest lender in the total banking debt of a company²⁵. Table 4 shows that the fraction of loans obtained from the single biggest lender for the smallest firms is close to 100% on average and decreases gradually to 90% on average for the biggest firms. Small firms borrow at least 39% of bank loans from the primary bank, whereas large firms diversify their loans so that they borrow at least 18% of all bank loans from the primary bank. Furthermore, in the first part of the table we present the average number of bank relationships for firms of different sizes. We observe that the smallest firms have on average less banking relationships than bigger firms. While small companies obtain loans from a maximum of four banks, for large companies the number of bank relationships can go up to 16. This could as well be a reflection of legal provision which prohibits banks to invest more than 10% of their total exposure in one group of connected parties. Due to that provision, a large firm which needs substantial financing could get only a limited amount from one bank. Consequently, such a firm would have to approach other banks when the current bank has reached the legal lending limit. Also, there is endogeneity arising from the mere fact that firms of particular size require more funds for their investments which can be sometimes obtained from multiple banks only.

[Table 4 about here]

These figures agree with the previous work of **Petersen and Rajan** (1994) who use various measures of borrowing concentration and find that the small firm borrowing is the most concentrated, and that larger firms diversify their borrowing.

²⁵ In our data set the correlation coefficient between these two indicators (the number of lending relationships and the share of the single biggest lender in total bank loans) is 0.76, which makes it possible to use these two indicators equivalently in analyzing relationship lending.

4 Empirical methodology

4.1 Capital structure choices

The capital structure studies look primarily at variations in debt ratios, whereas we try to explain the variations in the structure of debt as well. We analyze separately every decision of financing mix- the disaggregated sources of finance- rather than the aggregate measures of debt. Admittedly, we do not check for institutional differences because we do not deal with cross-country data set.

Based on the literature review and data availability, we opt for the following firm level variables as financing determinants: industry median, growth, ratio of short term assets to total assets, collateral strength, profitability as well as control variables: ownership and region dummies. The correlation tables²⁶ for dependent and independent variables show that our dependent variables are correlated to the firms' characteristics that we have included.

After examining unconditional correlations²⁷, we proceed to the regression analysis. In order to answer our research questions, we will examine different kinds of dependent variables. In the first set of regressions (Table 5) our dependent variables will be equity, long- and short term liabilities in proportion to total assets. We aim to discover what affects the sort and maturity of liabilities. In the second set of regressions (Table 6), our dependent variables will become the ratios of different classes of liabilities to total assets, and we will examine which of the firm-level factors are relevant for financing mix decisions.

The most straightforward approach would be to employ, as many other studies on this topic, the pooled model but for different reasons it might result in the inefficient or biased estimates. Therefore we use it only as one of the alternative models for the robustness check purposes. The dependent variable takes values between 0 and 1, but barely ever touches boundaries. Hence, we use the fixed effects²⁸ model in estimating a specification of the following general form (1):

²⁶ Available from authors on request.

²⁷ In spite of the detailed data set, we decided to leave some of the variables out of the analysis because of the possible multicollinearity concerns.

²⁸ Hausman specification test declines random effects model. In addition to the fixed effects, we also run cross section regressions for each of the years using OLS. Additionally, we run pooled OLS and Tobit model as a robustness check.

$$FinancingSource_{i,t} = \alpha_0 + \sum_{k=1}^N \beta_k \times FirmCharacteristics_{k,i,t} + \varepsilon_{i,t}$$

Where $FinancingSource_{i,t}$ is firm i 's ratio of particular financing source to total assets at time t , and $FirmCharacteristics_{k,i,t}$ is a vector of k firm i 's characteristics. Determinants that we employ in this study surely have different effects on demand and supply side, but the aim of this paper is not a structural test of any of the capital structure theories. We try to discover which factors work empirically. As many authors conclude, unfortunately none of the existing capital structure models satisfactorily explains all of the observed structures, i.e. they do not yet cope with all of the factors that are empirically observed as important.

It is important to mention that the firms in our sample which are joined in a group of connected parties do not report their balance sheets in a consolidated manner, which means that they might appear to have lower leverage than actual, because they might report affiliates' net assets as long term investments. Also, when window-dressing the balance sheet firms sometimes place the debt they take on in subsidiaries and then borrow it back via inter-firm trade credit or similar instrument.

Besides the concern of concealing debt in subsidiaries, there are some other country-specific characteristics of Croatia. Namely, until a few years ago, a principle of notional interest rate on equity was applied, which enabled entrepreneurs to report higher costs and consequently report lower profit and taxes. However, since this rule was abandoned, there is a suspicion that entrepreneurs tend to report minimum equity in their balance sheets and the rest of the equity as a loan because the interest rate is accepted as a profit deducing cost. Firms that have zero shareholder equity remained in the sample (0.7%), due to the fact that the lenient enforcement of minimum equity provision enables enterprises to operate without the shareholder equity²⁹.

4.2 Relationship banking

We use similar firm specific variables in our examination of the relationship banking. Here we add a dummy for big companies as the size variable, as it is considered to be a valid measure of informational transparency. Growth variable is often used in empirical analysis as well, and to the ownership variables we add a dummy variable indicating if the company has foreign

²⁹ Our data set excludes companies with equity < 0EUR and total assets < 150EUR, but in order to additionally control for possible "ghost" firms we ran all regressions excluding companies with no reported employees. Results remain robust.

ownership. Our equity ratio turns into independent variable indicating creditworthiness of a company.

There are a couple of indicators proposed for the relationship banking, including the number of lenders, duration of the lending relationship and the share of the biggest lender in the firm's total bank loans. It could be that, in spite of many lenders, firms have actually close ties with only one lender. This is why we opt for the ratio of loans obtained from the biggest lender in total bank loans as dependent variable. It takes values between 0 and 1 and mostly lies on or close to the boundaries. We estimate a specification of the following general form (1):

$$ShareSingleBiggestLender_{i,t} = \alpha_0 + \sum_{k=1}^N \beta_k \times FirmCharacteristics_{k,i,t} + \varepsilon_{i,t}$$

Where $ShareSingleBiggestLender_{i,t}$ is firm i 's ratio of funds obtained from the single biggest lender in total bank loans at time t , and $FirmCharacteristics_{k,i,t}$ is a vector of k firm i 's characteristics. Tobit model appears as the most suitable considering the truncated nature of the dependent variable.

5 Empirical Results

The three main questions we try to answer are: which firm level factors are relevant for the maturity structure of liabilities, which of them are relevant for the choice of various classes of liabilities and lastly to which extent do they influence banking relationship? To that end, in our regression analysis we have examined three different kinds of dependent variables. We interpret a significant positive (negative) coefficient in the regressions as evidence of positive (negative) relation between the examined dependent and a particular independent variable. We restrict to commenting only the significant results.

[Table 5 about here]

Table 5 shows that the use of equity finance is mostly determined by the industry in which the firm operates. Change in log assets increases the financing deficit, and the growth variable is consequently related to less equity and more debt, but economically hardly of any significance. We also find evidence for maturity matching, as the companies that have more short term assets also have more short term liabilities. As expected, collateral strength is positively related to long term liabilities because companies can pledge tangible assets as collateral. Profitability as measured by ROA has strong positive effect on the equity, and we can argue that firms over

time possibly inactively accumulate profits. In the same line, profitability has strong negative impact on short term liabilities. Ownership and region dummies serve as a control variables and indeed do not contain economic meaning even when statistically significant. We proceed by summarizing the results from the Table 6.

[Table 6 about here]

Loans depend strongly on industry, and this is even more pronounced for other loans than for the bank loans. Industry variable captures specific features that are positively related to credits. As a confirmation of the findings in the Table 5, we find that the companies with more short term assets also have a higher level of long and short term debt. Other debt on short term comprises salaries, contributions and taxes, which are probably offset by the short term assets.

As expected, collateral strength is positively related to the loans, which we believe reflects the policy of Croatian banks to rely mostly on the tangible assets as credit collateral. In that sense, companies that have more tangible assets prefer loans as a funding source to other financing sources. Profitable firms are clearly less levered, which can be best explained by the pecking order theory, according to which the firms prefer internal over external funds where fixed dividends and investments lead to less leverage of profitable firms. Besides the vague economic significance of ownership and region characteristics, we again find very low economic significance of the growth variable.

We continue by examining the determinants of relationship lending, using a broader set of variables that are shown to matter in the empirical literature.

[Table 7 about here]

The most important association is found for the size variable, whereas size acts also as a transparency proxy. Larger companies concentrate their borrowing less with one single lender, as expected. Credit quality of the borrower, proxied by the equity ratio, is positively related to the concentration, meaning that more creditworthy companies concentrate credits with one lender.

Foreign owned companies also concentrate their borrowings with one lender. State owned companies disperse their borrowings, hence we note a negative relationship between state ownership and the share of the single biggest lender. Industry seems to matter as well, which is in line with existing research. Quite opposite, region dummies have doubtful economic impact even when statistically significant.

5.1 Robustness checks

A possible limitation of our results might be the loss of some time-invariant variables, but we employ alternative models including the pooled OLS and Tobit model, and confirm our findings. Next to limiting our data set to companies which have positive value of equity and total assets higher than 150EUR, we also control for possible “ghost” companies by excluding all companies with no reported employees. Our findings remain robust. We also include different variables which might be perceived as interchangeable³⁰ to cross check our results, and they do not show major differences. We split our sample into net trade credit creditors and net trade credit debtors to see whether their financing mix is determined by different factors. We notice no major differences in results. At last, we run the model by size group and conduct quartile regressions in order to see whether the determinants of capital structure and financing mix operate differently for companies of different sizes. All of the signs and significance of the coefficients remain the same with some minor changes in the magnitude.

6 Conclusions

In this study we use Croatian data set to examine the impact of firm-level determinants on the financing patterns and banking relationships. We explore a wide range of firm-level characteristics and financing sources. An important strength of this research is the unique micro data set which contains the whole universe of Croatian companies.

Trade credit and bank loans are the most prevalent financing source. It is confirmed that the access to finance is of the paramount importance for the endurance of smaller companies. Moreover, our results confirm the fragility of small, mostly private, companies that rely heavily on the external funding from the mere start-up. Policies that can improve access to finance for small firms include strong creditor protection laws and regulations, development of credit-rating system, and small-business co-financing programs.

We find that the large firms diversify their borrowings across many banks, whereas the small companies tend to have fewer lenders and borrow more from the single biggest lender. Notably, some previous studies pointed to the low levels of trade credit in the region, whereas

³⁰ Instead of $\ln(\text{Total assets})$ growth, Total assets growth; instead of $\ln(\text{Total assets})$ growth, research and development investments to total assets as alternative measure of growth opportunities etc.

we show that one of the most popular debt class for the firms in our sample is a short term trade credit. This is broadly in line with findings for developing countries. Thus, firms act as financial intermediaries in providing the trade credit. Consequently, a strong legal enforcement of payment agreements is crucial for a sound liquidity of Croatian economy.

Of particular interest are the results identifying firm characteristics that affect liabilities' maturity and structure. Industry characteristics are a very important determinant of equity and loans of a company. Assets structure is another important determinant of financing patterns. More short term assets are related to less equity and more tangible assets are related to more long term liabilities, in particular bank credit. One feasible explanation is maturity matching, which states that firms with more long term assets opt for longer term liabilities, whereas firms with short term assets are not using long term liabilities intensively. Profitability is positively related with equity and negatively to all other financing sources, which confirms theory according to which firms passively accumulate profits over time. Interestingly, net trade credit is negatively related to short term assets. Ownership and region dummies serve as a control variables and are not economically relevant even when statistically significant.

Examination of the bank relationships points to the size as the most important determinant, where bigger firms tend to disperse their borrowing from the single lender. There are numerous explanations for this dispersion, while we propose two possible reasons: one bank can hardly meet all of the investment needs of a big company and bigger firms might be less informationally opaque and therefore borrow more easily from different lenders. We find that the foreign owned companies concentrate credits with one lender, just like the more creditworthy enterprises. Industry seems to matter for bank relationships as well, which is in line with similar research. Quite opposite, region dummies have doubtful economic impact even when statistically significant.

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Tables and Figures

TABLES

TABLE 1.: Ownership break-down

Ownership	Number of firms			% sample	Asset size % sample	Total Income % sample
	<i>Small</i>	<i>Medium</i>	<i>Large</i>			
Private since established	88179	881	197	96.41%	49.34%	64.81%
Private after privatization and mixed-with major private stake	1078	351	144	1.70%	20.30%	22.39%
State and mixed-with major state stake	774	167	81	1.10%	30.05%	12.48%
Common	719	8	0	0.79%	0.32%	0.31%
TOTAL	90750	1407	421	100.00%	100.00%	100.00%
Asset size (% sample)	28.74 %	16.09%	55.16%	100.00%		
Total Income (% sample)	24.72 %	21.01%	54.27%	100.00%		

TABLE 2.: The structure of the liabilities

Firm size	Equity	Long term liabilities	Short term liabilities	Other
Small	31.07%	14.01%	53.53%	1.39%
Medium	37.45%	17.95%	39.83%	4.77%
Large	40.63%	16.02%	38.69%	4.66%

TABLE 3.: Debt breakdown

Debt class	Term³¹/ Firm size	Small	2008 Medium	Big	Average 2008	Average 2009	Average 2010
Trade credit	Long term	0.8%	0.3%	0.2%	0.4%	0.7%	0.7%
	Short term	24.4%	24.5%	19.5%	22.8%	20.7%	18.3%
Loans from banks and other FI	Long term	24.7%	26.9%	25.3%	25.6%	25.2%	25.4%
	Short term	8.2%	31.7%	23.9%	21.3%	24.4%	18.5%
Other loans, deposits and similar	Long term	9.1%	4.8%	7.4%	7.1%	8.3%	7.3%
	Short term	9.8%	3.6%	2.5%	5.3%	5.7%	6.3%
Loans from Group ³²	Long term	5.0%	5.2%	10.0%	6.7%	7.3%	10.3%
	Short term	4.3%	9.1%	11.1%	8.2%	8.5%	9.3%
Advance payment	Long term	0.2%	0.0%	0.1%	0.1%	0.1%	0.1%
	Short term	2.4%	2.5%	2.2%	2.4%	2.0%	1.7%
Issued securities	Long term	0.2%	1.1%	1.9%	1.1%	1.0%	0.7%
	Short term	0.4%	0.7%	2.1%	1.1%	0.9%	1.0%
Other debt ³³	Long term	1.4%	1.3%	0.8%	1.2%	1.1%	1.5%
	Short term	9.1%	7.4%	6.0%	7.5%	7.7%	7.2%
TOTAL DEBT		100%	100%	100%	100%	100%	100%

³¹ Short term is due within one year and long term is due after one year

³² Group refers to a group of connected parties, via ownership or otherwise

³³ The biggest portion of Other debt on long term refers to balance sheet category “other long term liabilities” and only smaller part refers to “long term deferred tax liabilities”. Half of the Other debt on short term refers to taxes and contributions, one third are the salaries and the rest is mostly balance sheet category “other short term liabilities”.

TABLE 4.: Concentration of borrowing from banks³⁴ in 2008

Total assets (000EUR)	Assets Percentile	Number of banking relationships			Loans from single biggest lender		
		Average	Minimum	Maximum	Average	Minimum	Maximum
Less than 100.7	0-25	1.07	1.00	4.00	0.99	0.39	1.00
100.7-311.8	25-50	1.16	1.00	4.00	0.97	0.30	1.00
311.8-1,126.5	50-75	1.25	1.00	8.00	0.96	0.26	1.00
Over 1,126.5	75-100	1.62	1.00	16.00	0.90	0.18	1.00
<i>F test value</i>		752.83			523.24		
<i>p value</i>		0.0000			0.0000		

The F-test is used for equality of means hypothesis

TABLE 5. Determinants of maturity structure

Dependent variable	Equity	Long-term Liabilities	Short-term Liabilities
Industry median	0.112*** <i>0.0050</i>	0.273 0.302	0.044 <i>0.3780</i>
Growth	-0.007*** <i>0.0000</i>	0.001*** <i>0.0000</i>	0.005*** <i>0.0000</i>
Short term assets	-0.044*** <i>0.0000</i>	-0.014*** <i>0.0000</i>	0.065*** <i>0.0000</i>
Collateral strength	-0.037*** <i>0.0000</i>	0.156*** <i>0.0000</i>	-0.107*** <i>0.0000</i>
Profitability	0.356*** <i>0.0000</i>	-0.047*** <i>0.0000</i>	-0.299*** <i>0.0000</i>
Method	FE	FE	FE
Hausman test statistic	1342.6***	700.9***	1105.7***
R ²	0.18	0.04	0.10
Number of observations	93587	93587	93587

*, **, *** indicate significance levels at 10, 5 and 1 % respectively

Regressions use unreported constant, ownership and region dummies. We employ heteroscedasticity robust standard errors

³⁴ It should be noted that the Figure 2 and Table 4 were produced based on a reduced sample, which excluded firms that do not have any relationships with banks and consequently no bank loans.

TABLE 6. Determinants of financing patterns

	Loans from banks and other FI	Other loans, deposits and similar	Net trade credit	Other LT&ST debt	Other liabilities
Industry median	0.301***	2.843***	0.002	0.138	-0.002
	<i>0.0000</i>	<i>0.0000</i>	<i>0.9800</i>	<i>0.3070</i>	<i>0.9780</i>
Growth opportunities	0.000	0.001***	0.001***	0.000	0.000
	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.8830</i>	<i>0.0000</i>
Short term assets	-0.017***	-0.013***	-0.610***	0.025***	-0.006***
	<i>0.0000</i>	<i>0.0090</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0070</i>
Collateral strength	0.103***	0.070***	0.000	-0.063***	-0.009***
	<i>0.0000</i>	<i>0.0000</i>	<i>0.9930</i>	<i>0.0000</i>	<i>0.0010</i>
Profitability	-0.047***	-0.093***	-0.136***	-0.043***	-0.009***
	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>	<i>0.0000</i>
Method	FE	FE	FE	FE	FE
Hausman test statistic	437.0***	779.4***	445.3***	275.7***	705.7***
R ²	0.03	0.02	0.31	0.01	0.01
Number of observations	93,587	93,587	93,587	93,587	93,587

*, **, *** indicate significance levels at 10, 5 and 1 % respectively

Regressions use unreported constant, ownership and region dummies. We employ heteroscedasticity robust standard errors

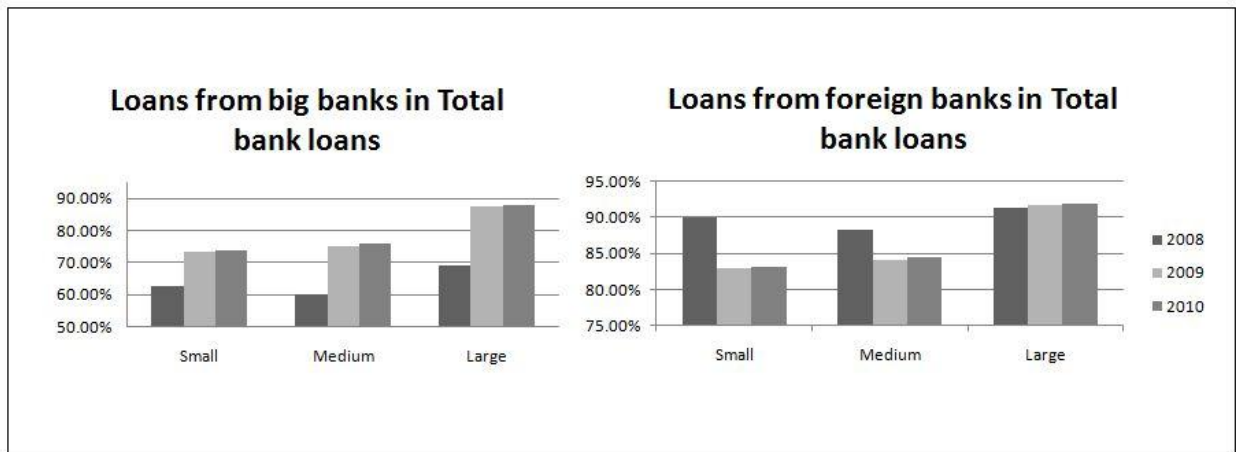
TABLE 7. Determinants of relationship lending

	Share of single biggest lender
Big	-0.215***
	0.0000
Growth	0.000
	0.8870
Equity ratio	0.068***
	0.0000
Foreign	0.018***
	0.0020
Private ownership	0.011
	0.2190
State ownership	-0.051***
	0.0000
Manufacturing	-0.003
	0.6740
Electricity, gas	0.013
	0.6470
Construction	0.011
	0.1020
Wholesale and retail trade	0.002
	0.7710
Transport	-0.015**
	0.0120
Information and communication	-0.014**
	0.0320
Professional and technical activities	0.025***
	0.0000
Zagreb	0.003
	0.2140
Dalmatia	-0.005
	0.1460
Istria	-0.003
	0.2770
Northern Croatia	-0.003
	0.3590
Slawonia	-0.009**
	0.0310
Central Croatia	0.002
	0.6920
Method	Tobit
Number of observations	27,038

*, **, *** indicate significance levels at 10, 5 and 1 % respectively. Regressions use unreported constant.

FIGURES

FIGURE 1.: Percentage of bank loans borrowed from big and foreign banks



Appendix

TABLE 8. VARIABLES DESCRIPTION

Capital structure- variables	Calculation	Basis for calculation
Equity	Equity/Total assets	Balance sheet categories
Long-term liabilities	Long term liabilities/Total assets	Balance sheet categories
Short-term liabilities	Short term liabilities/Total assets	Balance sheet categories
Advanced payments	Advanced payments/ Total assets	Balance sheet categories
Loans from banks and other FI	Loans from banks and other FI/ Total assets	Balance sheet categories
Other loans, deposits and similar	Other loans, deposits and similar/ Total assets	Balance sheet categories
Net trade credit	(Accounts payable- Accounts receivable)/ Total assets	Balance sheet categories
Other LT&ST debt	Other LT&ST debt/ Total assets	Balance sheet categories
Other liabilities	Other liabilities/ Total assets	Balance sheet categories
Firm characteristics- variables		
Growth	Percentage growth of ln(Assets)	Balance sheet
Size	ln (Total assets)	Balance sheet
Big	Dummy (1=large company, 0 otherwise)	
Short term assets	Short term assets/ Total assets	Balance sheet
Collateral strength	Tangible assets/ Total assets	Balance sheet
Growth opportunities	Research and development investments/ Total assets	Balance sheet
Profitability	ROA=(Profit before taxation/ Total assets)	Balance sheet, P/L account
Private ownership	Private and majorly private ownership	FINA database
State ownership	State and majorly state ownership	FINA database
Industry median	Median value of particular dependent variable for industry/ year	Balance sheet
Agriculture	Agriculture-industry	National classification
Manufacturing	Manufacturing-industry	National classification
Electricity, gas	Electricity, gas supply-industry	National classification
Construction	Construction-industry	National classification
Wholesale and retail trade	Wholesale and retail trade-industry	National classification
Transport	Transport-industry	National classification
Information and communication	Information and communication-industry	National classification
Professional/technical services	Professional and technical services-industry	National classification
Zagreb	Zagreb and Zagreb county	See Appendix Table 9
Dalmatia	Dalmatia region	See Appendix Table 9
Istria	Istria region	See Appendix Table 9
Northern Croatia	Northern Croatia region	See Appendix Table 9
Slawonia	Slawonia region	See Appendix Table 9
Central Croatia	Central Croatia region	See Appendix Table 9

TABLE 9. Construction of the region variable

REGION	COUNTIES
Zagreb	Zagrebacka City of Zagreb
Dalmatia	Zadarska Sibensko-Kninska Splitsko-Dalmatinska Dubrovacko-Neretvanska
Istria and Primorje	Primorsko-Goranska Istarska
Northern Croatia	Krapinsko-Zagorska Varazdinska Koprivnicko-Krizevacka Medjimurska
Slawonia	Viroviticko-Podravska Pozesko-Slavonska Brodsko-Posavska Osjecko-Baranjska Vukovarsko-Srijemska
Central Croatia	Sisacko-Moslavacka Karlovacka Bjelovarsko-Bilogorska Licko-Senjska

CHAPTER 5 Economy of Ragusa, 1300-1800: The Tiger of Mediaeval Mediterranean

ECONOMY OF RAGUSA, 1300-1800

The Tiger of Mediaeval Mediterranean

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Abstract

Using data for proxying economic activity, we confirm historical consensus that the mediaeval Republic of Ragusa (now Dubrovnik) was a prosperous small open economy, rivaling bigger competitors like Venice. More tentatively we test a number of hypotheses on determinants of success, finding partial evidence that Ragusa had strong fundamentals with prudent finances, effective rule of law, good governance, social fairness, business-friendly institutions, and trade openness. Ragusa may be an early example of a “Tiger” economy with growth-promoting institutions. Future research should test the “resilience hypothesis”, that such economies are best able to deal with external shocks.³⁶

Keywords: small open economy, strong fundamentals, institutions, rule of law

JEL: D002, N10, N123, N83, N94

³⁶ We wish to thank for their encouragement and suggestions: Frank Lewis, Susan Mosher-Stuard and Nenad Vekaric, as well as two anonymous referees and participants of the 18th DEC. The Croatian National Bank has been kind in allowing us to participate in the annual Dubrovnik Economic Conference, and we admit the views from the Conference venue of Ragusa’s majestic city walls were an important part of our inspiration. Nora Srzentic acknowledges support from the Fund for Scientific Research (Flanders).

There where your argosies with portly sail...

Do overpeer the petty traffickers ...

As they fly by them with their woven wings³⁷."

(Shakespeare, The Merchant of Venice)

1 Introduction and motivation

While the Republic of Ragusa was one of the smallest Mediaeval city-states in the Mediterranean, it is widely considered by historians as one of the most successful, with volumes of shipping and trade, level of wealth, architectural and cultural achievements, disproportionate to its size. Innumerable authors over the centuries have attributed its success to effective governance based on a political regime of republicanism that may not have been democratic but relatively fair and benevolent providing pioneering social provisions like education, health care, quarantine systems, and provision of grain reserves for times of shortage. To this was coupled a generally liberal, open economy, with prudent state finances, limited market intervention, and encouragement of private enterprise. The Croatian economic historian Vladimir Stipetic captures this nicely in a recent article (Stipetic, 2000, p.24): *"Dubrovnik traded like Hong Kong, Singapore, Taiwan ...but did so some five hundred years before ..[and like these countries] became prosperous ..because of their adopted economic policy"*.

One is tempted to think of Ragusa as the "Adriatic Tiger" of yesteryear, an early example of a small open economy with strong fundamentals and outward orientation. The paper has three aims. First it will demonstrate Ragusa was a very successful economy, using a quantitative³⁸ approach with a dataset of economic variables or proxies we have compiled. Second and more tentatively we test **the strong fundamentals hypothesis** that success was due to sensible policies, and thereby show that Ragusa was an early example of today's "favourable institutions" development model. Third, the paper demonstrates that the vast historical literature on Ragusa can be revisited using quantitative methods.

³⁷Webster's Dictionary, NY, 2003 gives: "Argosy: a large merchant ship especially one with a rich cargo [1570-80]; earlier Ragusy, Italian = Ragusea, a ship of Ragusa"

³⁸For some, any use of data in historical analysis is a form of "Cliometric" (from Clio, muse of history, and metrics=measuring). We do not have enough time series to run actual regressions, but do show the possibilities of working in the mode of the new economic history, exemplified by work of North, Fogel and Temin – Ravancic (2010) gives a succinct review.

Two points tempt one to test further **the resilience hypothesis**: a small economy's ability to mitigate external shocks. First are current discussions on how to minimize the impact of external crises³⁹, and second the fact that rich detail on commercial activities going back to 13th century exists in Dubrovnik Archives -potentially allowing more detailed quantitative analysis. That Medieval Europe experienced many economic crises, including financial ones not unlike the current global one, is very clear in the literature and is most recently reviewed in the popular work of Reinhart and Rogoff (2009)⁴⁰. How Ragusa reacted to such shocks would add an important early example of present day relevance, but apart from a tentative interpretation of reactions to loss of Eastern markets in the 16th century, this will be left to future archival research.

The present paper relies on prior archival studies culling a large amount of economic data from secondary sources. While a lot of data are available in the literature, they are for infrequent intervals, of varying periodicity and unsystematic in coverage or definition. Interpolation⁴¹ was done to create the time-series shown below. Despite these qualifications, the data is consistent with the common view that Ragusa was a prosperous economy. To what extent this was due to its prudent and open policies is more conjecturally tested as data are very partial, but complementary qualitative information abounds, and also supports the 'strong fundamentals hypothesis'. The rest of the paper is structured as follows. Section II. reviews the historical literature on Ragusa and derives some key "hypotheses" amenable to quantitative testing. Section III proposes a phasing of the main economic periods different from historic-political ones, and for each undertakes quantitative tests of hypotheses on what happened.. Section IV analyses the main determinants of this success, that is: why it happened. Section V summarizes the main findings and points to future research directions.

Three clarifications are in order. First, we generally use the Latin name Ragusa, as Dubrovnik was then known. Second, we do not claim Ragusa was the only example of a prosperous city state with sensible policies, indeed we accept the view of some scholars that a lot of Ragusa's wise policy was an emulation of -with perhaps improvement upon- those of its main rival and overlord Venice. Third, while the analysis here is based on numerous sources, references are limited to the key sources.

39Numerous recent work exists on this –an illustrative paper is Ghosh et.al.(2009)

40 Postan (1952, p.340) wrote of the 14th century:"It was not one world yet, but there was a sensitive world market and it reacted quickly to crises in distant countries." Cipolla (1987) describes for Florence the 14th century "excess "credit boom followed by a policy-induced credit squeeze-very like modern boom-bust cycles.

41 We have collected all of the available data points from the references and then used linear interpolation to obtain new data points, with about one observation each 25 years. At times we had to interpolate only between the neighboring fifty years, and at times we had to interpolate for broader data range. Details are in the Appendix tables, Havrylyshyn and Srzentic (2012).

2 The historical literature on Ragusa's economy

The voluminous literature on Ragusa is almost entirely the work of historians, and generally contains little statistics, most interpretations are based on written evidence in archival works or contemporaneous writers. When data are shown they are fragmentary, illustrative, lack long-term continuity, rarely in tables or charts. We have culled statistics from the literature, systematized them as much as possible, and used them to analyze this important historical case. Several recent works by Croatian scholars do use a quantitative approach, with careful data collection, sorting out unreliable estimates, and presenting the most solid ones to complement qualitative analysis. The earliest is the time-series population estimate in Vekaric (1998), then a partial but careful and very useful estimate of GDP in Croatia 1500-1900 by Stipetic (2004), and Zlatar's (2007) analysis of private credits in 16th-17th century⁴². Our new data set allows us to add to this research with some longer-term analysis of Ragusa's evolution.

2.1 Timeline of Ragusa's Political-Historical Evolution

The first "records [of] Dubrovnik's arsenals (*shipyards*) date from the year 782,"⁴³ a factoid broadly consistent with the consensus that Ragusa was founded as a significant settlement by the 7th century, allegedly by Greek-Italian denizens fleeing from the 639 Avar invasions of Epidaurus (Cavtat). As for all early history, there is a mixture of myth and fact, as argued *inter alia* by Carter (1972), and Stuard (1992). That from the 11th century Ragusa emerged as a maritime and mercantile city, is a view widely shared by contemporary and modern writers. In 1153 Andalusian geographer Idrisi wrote: "*Ragusa was a large maritime town whose population were hard-working craftsmen and possessed a large fleet which traveled to different parts.*" (Carter, 1972, p.74). In 1553 Giustinani noted that its nobles had fortunes far in excess of other Dalmatian cities, and comparable to the Venetian elite, with "*many individuals having [wealth]*

42 A fourth is the much narrower but extremely novel socio-economic exercise by Ravancic (2010) using archival data on court cases related to tavern disputes and finding they are highest on weekends and off season! Lonza (2002) contains many data on criminal court procedures, of potential value in future research about the quality of legal institutions, analogous to indicators in the World bank's Doing Business reports.

43 Nicetic (2002, p.11)

of 100.000 ducats and more⁴⁴. Stuard (1981, p.808) notes that while Shakespeare's term Argosy only alludes to Ragusa, other English writers of the time explicitly recognised its greatness, as did Pepys in *Diary: 1660-69*: "a small country, but it is said older than Venice"⁴⁵. The renowned 20th century economic historian of capitalist development, Fernand Braudel, labeled Ragusa "the Jewel of the Adriatic".

Many observers emphasize its "uniqueness" as an *independent Republic* with relatively lot of democratic procedures.⁴⁶ This is arguable, though *de facto* it was certainly quite autonomous in its internal governance and external commerce, justifying its motto *LIBERTAS*⁴⁷. But *de jure* it was usually in a suzerainty, tributary, or protectorate status under one or another of the larger powers. Historians vary in designating historical phases, but a broad consensus allows us to propose the following periodicity:

- The Byzantine period to 1204 saw Ragusa mostly under Constantinople's suzerainty, with many short periods of forced or voluntary submission to Venice, Hungarian kings, Normans in Naples, and even some years of independence. But distance allowed considerable autonomy with the help of strong fortifications, and diplomatic efforts to play off one power against another, and enough neutrality to achieve trading rights with all sides.
- The Venetian period, 1204 to 1358 required Ragusa to accept formal submission to Venice, a Republic at least 10 times larger, and a far more powerful naval fleet. It had to accept Venetian Counts as formal heads of state, pay tribute, contribute one vessel per thirty Venetian ones in wartime. Nevertheless, a great deal of autonomy was practiced particularly in trading, including the valuable privilege of intermediation between the Balkans and Venice. But even during this period -and certainly afterwards- Ragusa was a significant rival of Venice in Mediterranean trade.
- Hungarian suzerainty, 1358-1526 allowed Ragusa even greater autonomy. In the middle of the 14th century, the Kingdom of Hungary and Croatia under Ludovik began to strengthen regional power, and undertook to drive the Venetians from Dalmatia, succeeding in its conquest with the 1358 Treaty of Zadar, Hungary conjured most of the coast including Ragusa under *de jure* dependency. But the Hungarian kings were content with inland superiority over Venice and not interested in Mediterranean trade. Thus all trade was freely allowed for Ragusa with little interference.

44 Krekic (1997, p.193) Well-paid sailors could earn a few hundred ducats yearly, captains 3-4 times.

45 Reference given by Basic (2006, p. 152)

46 Havrylyshyn and Srzentic (2012) discuss these claims

47 .Kuncevic (2010) elaborates on the reality and myth of LIBERTAS.

- The Ottoman period: 1526-1684 brought a new protectorate status under The Porte after the Hungarian defeat at Mohacs. Importantly, under the loose control of Hungary, formal relations with the Ottomans began much earlier. The first treaty was in 1392, with expansion of its terms in 1397 to fully free-trade in Ottoman regions, with yet another treaty in 1459 after Turkish occupation of Serbia. The well-remembered defeat of Serb forces at Kosovo Polje in 1389, and Ottoman's crowning achievement with the fall of Constantinople in 1453, clearly signaled the need of Ragusa to deal directly with the Porte.
- The Austrian period, 1684-1806 was a faint echo of the earlier tributary periods, with continued governing autonomy, particularly for Balkan trade with Ottomans. However diplomacy was decreasingly effective as Ragusa's economic strength had been sapped by the overall economic decline of the eastern Mediterranean. Some interpretations suggest Austrians did not seek firmer authority over Ragusa (now mostly called Dubrovnik) partly because its relative commercial importance was much reduced.⁴⁸,
- French occupation in 1806 ends independence of Dubrovnik, not just *de facto*, but *de jure*. During the Austrian-French wars, facing overwhelming French forces, and unable to use its earlier diplomatic efforts to retain neutrality, it surrendered and became a mere city in the Illyrian province. With Napoleon's defeat the 1815 Congress of Vienna returned Austrian control over Dalmatia, but not Dubrovnik's city-state privileges⁴⁹. By 1900 railroads had further undermined Dubrovnik's advantages. It became part the South-Slav Kingdom in 1918 as a much reduced maritime power, though increasingly an important tourist destination, designated as a UNESCO World Heritage site in 1979.

2.2 Common Hypotheses on Ragusean Economic Prosperity

The historical literature is virtually unanimous on the fact that Ragusa was extremely prosperous despite its very small size and poor resource base. Authors vary somewhat on the question of the when, how, and why of this success, but enough consensus exists to allow us to derive some economic hypotheses (HH), subject to quantitative testing. The first five are related

48 "Relative" is the operative word here: In Sec II we show data suggesting absolute level of economic activity might have been still very large .

49This lends truth to the assertion by Luetic (1969, p107) : "the French occupation...overthrew the 1,000 year historical thread of Dubrovnik's sea-based livelihood, and destroyed the significance of Dubrovnik as a world-class maritime power."

to economic evolution -or WHAT happened- and the other four to explaining prosperity -or WHY it happened.

- *HH1: The Golden Years of prosperity were about 1350-1550.*
- *HH2: The preceding Silver Period was economically also very dynamic⁵⁰,*
- *HH3: sustainable population level was very limited, well under 100,000,*
- *HH4: The commercial fleet of Ragusa at its peak equaled that of Venice, and exceeded that of England.*
- *HH5: Ragusa's decline began with the discovery of The Cape of Good Hope route in the early 16th century,*
- *HH6: State laws , regulations, institutions were favorable to commercial activity,*
- *HH7: The State conducted very prudent and conservative financial policies, avoided budget deficits, debts, inflationary debasement,*
- *HH8: Enlightened social policies provided for basic needs of the entire populace,*
- *HH9: Ragusa had very low military-naval expenditures, relying on diplomacy for its achievements.*

3 Testing hypotheses on the evolution of the economy

Virtually all histories of Ragusa are structured on historical political models, with period classifications dependent on key events: wars, victories, treaties, regime changes. Given this paper's focus on economic evolution we propose a classification based on the nature of the economic development shown in Table 1 with approximate dates.⁵¹ For all but the last of these periods we test the above hypotheses using quantitative indicators as available, and complementing the analysis with other fragmentary statistics or qualitative assessments from the literature.

50 In fact most historians do not give special importance to this period, with possible exception of Stuard (1975,1992); we take the liberty to make it a more explicit hypothesis than she does in her many works on this period.

51 The rationale is explained in Havrylyshyn and Srzentic (2012)

[Table 1 about here]

But first consider as a broad overview an indicator which may differentiate the relative economic dynamism of each period. A chart in Carter (1972) listing the major monumental buildings in the city from the 9th century to 1877 is used to create Figure 1, showing for each period the absolute numbers, the share of the total, and a crude index of building intensity (=number of buildings per 100 years)⁵².

[Figure 1 about here]

Taking this at face value –the data are consistent with HH1 that the Golden Years 1350-1575 were indeed the most prosperous, with the largest number of buildings, the highest share by period and the highest per century intensity. The foundational period shows a start but still very modest. However, perhaps most interesting in this chart is how large a share of the major structures were put in place in the Silver period, with an intensity of building far greater than the late periods and second only to the Golden Years.

Most histories of “The Adriatic Jewel” justifiably focus on the late 14th to late 16th century as the period of greatest prosperity. We propose this new thesis be added HH2- the preceding Silver Period was economically also very dynamic. Some data we present is consistent with this, suggesting that the prosperity of the Golden Years came on top of a very strong buildup in the Silver period⁵³. The data in Figure 1 reflect the subsequent decline in the 17th and 18th century, with a far lower number of buildings, smaller share and intensity. There were none in the brief revival, and only a few more in the post-independence period. We turn now to some elaboration of the individual periods.

3.1 Foundational period -until 1100

There is a broad consensus that in its early years the economy was very simple, largely self-sufficient, based on fishing, some agriculture, building of small craft. This was nevertheless an important period in building the foundations of future prosperity and dominance in Dalmatia. One sees a gradual movement into nearby coastal entrepot trade, as well as intermediation

52 This may underestimate the number in later periods since it shows only buildings within the city walls, and territorial expansion over time likely meant more major building projects outside as well.

53 Several works of Stuard imply such a thesis—we suggest it be made explicit in the literature. Those who have studied the Industrial Revolution will recall the later partial revision of economic history showing that it was preceded and made possible by an earlier agricultural revolution and attendant growth.

between the Balkan hinterland and thriving Italian cities like Venice, Florence, Bari, Ancona. With the first shipyard already in 782 -within a century of its founding- Ragusa was already moving beyond local fishing into maritime activities. Early documentary mention of its shipping prowess notes that in 783 Charlemagne hired Ragusean ships to transport Croatian and Serbian mercenaries across the Adriatic in his campaign to drive Saracens out of Apulia⁵⁴.

Another indicator of an early economic development was its ability to withstand for 15 months the 866 Saracen siege until Byzantine ships lifted it -indirect but strong evidence that: 1) Ragusa was *worth* seizing, and 2) defenses were already quite strong.

Numerous accounts describe the caravan trade between Balkans and Italy through Ragusa well before 1100. Resources like cattle, leather, wood/lumber, honey, wax came from the Balkans, to be traded for textiles, household goods, metal products, and various luxuries from Italy. The share of this Balkan-European trade in Ragusean economy varied in importance over time as the products changed, and other entrepot trade with Levant and elsewhere became at times far more important. However, throughout Ragusean history, the Balkan trade remained a significant component of its income.

3.2 The “Silver” period (1100-1350)

The 13th century saw a boom in minerals trade as mines opened and expanded in the hinterlands (Srebrenica, Novo Brdo, Rudnik). The main item was silver, but other minerals (gold, lead, iron, etc.) also played a role⁵⁵, as did salt exports. Stuard (1975-76, 1981, 1992) describes how Ragusa quickly became a principal intermediary for the silver export to Europe; Stipetic (2000, p.26) states that Balkan silver production about 1400 provided almost one-third of the Europe total, and of this almost one half (*i.e* about 16% of European total) was exported through Ragusa. He also contends that required sales to the Ragusa mint provided the basis for a considerable amount of seigniorage profits for the state treasury. The silver was brought by caravans and then shipped to Italian city states, Florence, Venice, Genoa etc. The return voyages would bring textiles, luxury clothing for Balkan nobles, jewelry, glass, and other manufactures. This is most comprehensively analyzed by Stuard (1975-76). It is significant that the earlier Balkan trade in raw materials continued, though silver and other minerals proved much more

⁵⁴Carter (1972, p.53), based on writing of the Byzantine Porphyrogenitos -though Carter warns in many places such early writings are uncertain.

⁵⁵ Often the location names define the mineral: e.g. Srebrenica for silver, Olovo for lead, but Rudnik simply mine.

profitable, providing a big boost to the Ragusa economy, including the local development of silver and goldsmithing.

The hypothesis we propose based on Stuard, (HH2) that the Silver Period was economically very dynamic is confirmed by Figure 1 and to some extent by the large increase in area, shipping and probably population as well (Figures 2, 4).

This period also saw awareness by the Ragusean elites and authorities that greater benefit would come from Balkan-Italian trade with ships than with land caravans. Thus one sees almost a doubling of the commercial fleet (Figure 4), from about 22 long-distance ships in 1300 to 40 by 1325. These figures are less certain than for later periods (hence a dashed-line in Figure 4), and no reliable estimates are available for earlier years, but the trend and dynamism seems clear.

3.3 The “Golden Years” of maritime prosperity (1350-1575)

This period is almost universally recognized by scholars as the apogee of Ragusean economic prosperity. The Republic’s population reaches its maximum in 1500 of about 90,000 (Figure 2), as does per capita GDP (Figure 3)-though we raise some doubts about this later. The fleet size grew sharply (Figure 4, from the 40 noted in 1325 to 200 by 1575, and tonnage even more substantially (Figure 5), with a sharp increase in the average ship size⁵⁶. All these support HH1: the golden years of maritime prosperity came about 1350-1550/75. We use 1575 as the end – date based on the peak value of shipping tonnage.

On population, Vekaric (1998) argues much of the expansion prior to 1500 was due to Balkan-Slavic refugees fleeing the advance of Ottomans. However, economic attraction also played a role: there is little doubt that the level of per capita income in Ragusa was well above that of the immediate Croatian hinterland (Figure 3). A more intriguing hypothesis stated in Vekaric (1998) concerns the strong decline in population after 1500 notwithstanding the strong growth of shipping activity. He attributes some of this to renewed episodes of the plague, but also to the “correction” of the earlier refugee boom, arguing that the peak population was unsustainable because the Republic was very small and land rather infertile. Hence, we tentatively confirm HH3 that the carrying capacity for population was very limited, well under 100,000.

⁵⁶ Luetic (1969), S. Vekaric (1954), and Nicetic (2002) all emphasize the constant expansion of capacity over this period.

[Figure 2 about here]

[Figure 3 about here]

[Figure 4 about here]

[Figure 5 about here]

The new, additional basis for prosperity in this period now becomes maritime trade, not only throughout the Adriatic but increasingly with the Levant territories under Ottoman rule, providing goods from the Far East such as spices, silk, oriental perfumes, grains, and other raw materials. But with the Balkans the commodity structure of trade continued to be quite similar to that in earlier periods and there is little doubt that the strong preceding experience and the extensive slavization of Ragusa/Dubrovnik, provided a critical comparative advantage. It is a tribute to the governing elites of Ragusa- both the nobility and the merchants- that they used this comparative advantage to provide capital, skills and experience leading to even more maritime trade in the 15th and 16th century. Thus the economy in this period was based largely on entrepot trade services including shipping profits and value of the direct and indirect labor services. One also begins to see Ragusean sailors and officers hiring out to foreign powers - though this becomes much more important in the decline period. Thus Lane (1973, p.425) notes that as Venetian dominance declines in 18th century “shipmasters were no longer Venetian ... [but] mostly Dalmatians with Slavic names”.

That domestic production probably accounted for a quite small portion of value-added cannot be verified quantitatively –even for England and western Europe GDP estimates only go back to late 18th century- but the qualitative analysis makes clear that this was so. Agriculture produced very small amounts of grains (at best one-third of needs according to Carter and others), some wine, olive oil and market garden products, salt exports. Manufacturing was limited to shipbuilding, gold and silversmithing⁵⁷, with jewelry exports to Balkans increasingly coming from domestic production not only imports from Italy. Shipbuilding had always been largely local (recall that the first arsenal dates to 792) but in this period it becomes very significant and includes sales outside Ragusa, based on the reputation of high-quality⁵⁸

This was the period in which Ragusa became, as a prominent American historian of Venice, Lane (1973, p.379, p.381) notes “Venice’s most damaging competitor..bidding cargoes away from the Venetians on all seas, even in the Adriatic...[as] their ships were increasing in number and

⁵⁷ Efforts to subsidise textiles eventually failed as elaborated in Havrylyshyn and Srzentic. (2012)

⁵⁸ Havrylyshyn and Srzentic (2012) cite numerous such references.

size”⁵⁹. Other accolades include claims of Ragusean equality with Venice, based on fleet size and tonnage about 1575 (Figures 4 and 5). As Figure 6 shows, at this time the English fleet was still only about the same size⁶⁰.

The patriotic implication of HH4, that Ragusa was on the par with Venice, is perhaps exaggerated, for over these centuries equivalence only occurred when Venice had lost numerous ships during wars. It is clear in the figures the Venetian fleet had far larger numbers in the 14th century, falling sharply with the many wars with Genoa. Both in defeat and victory, many ships were destroyed, then the fleet was rebuilt to even higher levels about 1425 (over 300 ships), then once again declined as many wars -now with the Ottomans- again decimated the fleet. Ragusa’s neutrality and Ottoman privileges spared its fleet, so that at its peak in 1575 with about 200 ships and peak historical capacity of 33,000 tons it was technically “equal” to Venice -as was also true about 1400.

Of course, to affirm that over the long-term Ragusa did not quite “equal” Venice should not be a surprise or a negative commentary: Given its much smaller size and poor agricultural fertility. The fact that Ragusa “La Città Felice” could be put in same league as “La Serenissima” is already a strongly positive characterization.⁶¹

3.4 Vasco da Gama rounds Cape of Good Hope, Ragusa (gradually) declines (1575-1750)

Most historians attribute the eventual decline of Ragusa’s importance to the shift of economic dynamism to Western Europe, and the related opening of the Cape of Good Hope eastern route. The decline is reflected in the values for population (Figure 2), GDP per capita (Figure 3), number and tonnage of ships (Figures 4 and 5), and GDP (Figure 7). The Italian city-states also declined; for Venice, Lane (1973, p.384-6) refers to the “The Collapse”. However, our data suggests that Ragusa’s decline was not immediate. After Vasco da Gama established a colony in India in 1503 and the first spices are brought to Europe by Portuguese ships in 1506, Ragusean shipping capacity continues to expand until 1575.

59 This is also reflected in the work of Fernand Braudel who writes of Ragusa’s ability to “snatch away goods from under the eyes of Venetian merchants” as cited in Stuard (1992)

60 Some historians claim before mid 16th century Ragusa’s fleet exceeded that of England; we were unable to find hard evidence before 1575.

61 Arguably, the lack of a large and fertile hinterland should not matter, as resources can be imported. But in a mediaeval period, with many episodes of famine, states often forbade food exports, with long travel times, size mattered. Larger size also provided a labor force : sailors, soldiers, chandlers. Venice was in this sense far better endowed than Dubrovnik.

[Figure 6 about here]

The enormous growth of Western European naval powers (Portugal, Spain, then Netherlands, England) is particularly clear in Figure 6. While in 1575 England's fleet tonnage was about the same as in Venice and Ragusa, and that of the Netherlands is "merely" 3-4 times larger, after 1600 both of these move into exponential growth, with both Adriatic cities falling far behind. This creates an eventually unbeatable competitive force for Ragusa unlike the earlier rivalry with Venice which it was able to outcompete because of advantages in Slavic lands and skillful diplomacy with the Porte and the Pope.

The new competition was unbeatable for two reasons. Western European markets for which Balkan resources are insignificant, soon surpass those of Italy. Ragusean authorities and merchants undertook efforts to move into these markets, with some success for a few decades, but not enough to prevent an eventual decline. Second, even with the privileges granted by the Ottomans for eastern trade via the Levant, this becomes far too costly compared to the new sea route around the Cape. Again, Raguseans made efforts to compensate, by providing shipping services to western powers, (ships were re-based, at first mostly to Spain) and perhaps most importantly individuals hired themselves out to the new western fleets –maybe the first significant episode of Dalmatian's famous quest of "trbuhom za kruhom" (loosely translated as following your stomach in a quest for bread). In addition some attempts were made to engage in trans-Atlantic trade, but again with limited success⁶². All this helped mitigate the decline, but in the end was not enough to keep the glory-days alive. Thus available data confirms **HH5 that the rounding of Cape of Good Hope did not immediately lead to Ragusa's decline, though with a long lag it was the key factor**. One could argue further the diversification efforts succeeded in delaying the decline, and giving continued growth almost a century after Vasco de Gama, which in a limited way is consistent with the resilience hypothesis.

Note the above is largely based on shipping tonnage data (Figure 5) which is perhaps the best available proxy for economic activity as Figure 7 and the correlations in Table 2 suggest. One sees indeed a slight decline from 1475 (29 tons) to 1550 (24 tons), but a strong rebound to its peak value in 1575 (53 tons), after which it declines quickly. Note the same trend is seen for Venice, which also suffered from these two new competitive factors. Carter (1972, p.352-3) summarizes earlier arguments of Libyer and Lane for Venice and Marinkovic for Ragusa: "trade of Dubrovnik and Venice was not halted at the Levantine ports...but was carried by merchants of these Republics as far as Goa and possibly even Malaca and Batavia at a period when Portugal

⁶² Several articles in Filipovic and Partridge (1977) discuss this, including: Luetic, Filipovic and Zivojinovic

was supposed to have a ‘monopoly’ of the spice trade.” Thus, the efforts by Raguseans (and Venetians)—e.g. establishing a trading colony in Goa, diplomatic efforts with the Ottomans to maintain the sole rights of spice trade in Alexandria—succeeded for some time.

3.5 The short revival period (1750-1806)

After the decline from 1575-1750, a short revival occurred, not in population, but in the size of the fleet (Figure 4), though the average capacity probably fell⁶³. This revival does not seem to be given much attention by historians, either because it is not clearly understood, or perhaps because by this time the uniqueness of Ragusa /Dubrovnik has long passed and academic interest in the later periods is not as great.

[Figure 7 about here]

The strong correlation between aggregate GDP, tonnage and population points to two puzzles for future research. First, as tonnage continues to rise until 1575, indicating economic expansion, why did population fall? Second, if population declined from 1500 already with continued expansion, why did GDP per capita fall⁶⁴?

[Table 2 about here]

4 Explaining Ragusa’s prosperity and decline

This section will systematize and assess the many explanations in the literature for Ragusa’s success. Our central thesis is that while its locational advantage played some role, Ragusa leveraged this role with wise policies -strong fundamentals- to achieve greater prosperity than other cities also located on the Dalmatian coast. Based on the literature we propose that four

⁶³ Luetic (1969) and other fleet estimates generally agree on this.

⁶⁴ Stipetic (2004) shows a modest increase 1550-1575, then a decline. But later values in Figure 4a are based on the vaguer estimates: he gives only values for all of Dalmatia, we assume earlier proportions—which may be incorrect.

main policy areas be analyzed: good governance including rule-of-law, prudent financial policies and commerce-friendly institutions; an enlightened social policy addressing basic needs of entire populace, and finally minimal reliance on defense expenditures with maximal diplomacy.

But location must not be ignored. Some historians argue that being on the margin between Christian and Muslim worlds was the key factor allowing trade intermediation. Most accept that location was a factor, but gave more emphasis to the above explanations. This seems reasonable given many Dalmatian cities like Kotor, Ulcinj to the south, Split, Zadar to the north had similar location, probably larger and more fertile hinterland resources, some had larger harbours, and did indeed act as trade intermediators, but apparently did not approach the prosperity and reputation of Ragusa . It is more useful to ask how Ragusa leveraged its location to greater success.

We now go on to assess the four policy explanations, with a qualification. Information on policy and institutions is very sparse, with the exception of budget data for about 1800. Therefore the conclusions in Section IV are far more conjectural than those of Section III. Nevertheless we view this preliminary effort as a useful first step that points to future research.

4.1 Good governance

If the World Bank's Governance, and Doing Business surveys were being done in the middle-ages Ragusa might score quite high in the rankings. From today's perspective it provides an early example of good institutions promoting development. Krekic (1980, p.38) captures this: *"[Dubrovnik was] vulnerable [to] Ottoman occupation...This is why the government felt the urge to resolve the daily problems and to improve the functioning of institutions. They knew that internal stability and economic prosperity were the only way to strengthen the international position of the city"*. In the current jargon, it had all three components of good governance: voice, rule-of-law, and ease of doing business).

Voice: Ragusa was by no means a democracy, government being almost entirely in the hands of a nobility mythically based on the "original" settler families, though in fact many rich merchants and Balkan princes were often quietly "ennobled" in turn for the benefits they could bring⁶⁵. Commoners had no voting rights, but rich merchants and skilled professionals did comprise a large part of officialdom. Grubisa (2011) exemplifies a consensus that the political regime is

65 Vekaric (2011) , Vol.1 shows in Table 7 the roots of the noble families whence it is clear that a large proportion were not from Epidaurus.

best characterized as a benevolent rather than rapacious oligarchy, providing many basic needs of the population to an extent not seen in this period. Upward mobility is often considered evidence of good-governance. Vekaric (2011), Krekic (1980), Carter (1972), and others document the shifts of noble lineage, the impoverishment of many noble families, and the rapid growth of wealth of non-noble merchants who were gradually and *volens-nolens* “absorbed” into the upper classes, the ruling elites, government officialdom. One indicator is the increase over time in the share of credit issued by commoners. Thus, Krekic (1980) estimates that as early as 1280-1440 this was already one third; (Zlatar 2007, p.139) shows this increased to about 42% in the next century⁶⁶.

Rule of Law: More important, justice was apparently meted out not with feudal arbitrariness, but on the basis of laws, legislation, judicial process, as symbolized by very early legal codification in the “Statut” of 1272. It was not perfect, but numerous instances of well-applied justice in the law in practice dominate the literature⁶⁷. Sisak (2011) argues this rule-based governance gave long-term stability with virtually no significant peasant uprisings as seen frequently elsewhere, and far fewer internecine revolts within the nobility⁶⁸.

Ease of doing business: Many historians note how favorable institutions promoted economic prosperity. Stipetic (2000) reviews a number of early Ragusean writers with very “modern” views of economic theory. A 1440 work of Filip de Diversis states: *“among the permanent institutions...first is the one responsible to preserve justice and order among the wholesale and retail merchants, customers, irrespective of whether they are foreigners or citizens”*. He goes on (p.32) to documents- the pioneering development of accounting and double-entry bookkeeping by the Ragusean Kotruljevic⁶⁹, whose 1440 handbook detailed the value of instruments like bills of exchange, letters of credit. In his 1458 treatise “Il Libro dell’Arte di Mercantura” he expounded economic philosophy views very radical for the times: interest as the price of capital, credit being critical to fuel commerce and “only” usurious if excessive (5-6% was his proposed limit). Even the **strong fundamentals hypothesis** is found in his work, arguing the state must ensure an open mercantile and trading environment conducive to making money and creating

66 Another striking statistic suggesting upward mobility is in Luetic (1969, p.101): by the mid-18th century, of 380 registered ship-owners only 80 were nobles.

67: Lonza (1998) uses a quantitative review of 2,440 court cases to demonstrate effective implementation. noting incidentally many cases were settled out of court, a practice authorities encouraged. Lonza (2002) gives further quantification of judicial effectiveness.

68 Vekaric (2006) describes a major exception the short-lived and futile rebellion by Lastovo nobles .

69 Stipetic (2000) refers to non-Croatian scholars Postma and van der Helm –presumably less-biased- who have found clear evidence that Kotruljevic was the first to develop double-entry book-keeping, well before the 1496 work of Venetian Lucca Paccioli. A personal communication from van der Helm clarifies that Kotruljevic /Cotrugli did write briefly about double-entry, in his unpublished work, but a first printed manual was indeed that of Paccioli.

wealth, with minimal interference in commerce, and ensuring prudent state finances. Kotruljevic seems to have presaged by six centuries today's received wisdom about ROL and a good business climate.

Stipetic (p.18 ff.) also lists the formalization of institutions, noting notary and registration procedures, records for business contracts existed as early as 1200, then enshrined in the 1272 Statut, and further elaborated in the Customs Book of 1297. Implementation did lead to corruption, but Stipetic (2000) points to many mitigating institutions: annual reviews, oversight by auditors and inspectors who were regularly replaced, hiring only foreigners for some positions. Krekic (1997, p.32-5) describes many cases of bribery, but concludes efforts to curtail it by punishing offenders were generally as effective as can be expected.

In general most historians agree ROL and EDB went beyond formal laws, with effective implementation. Institutional quality is not easily quantifiable even today, but consider some illustrations. In a historical period of state-rivalry there exist numerous instances of Ragusean authorities enforcing claims by foreigners on citizens of Ragusa. Bankruptcy of the Paboras in 1315 led to claims by many creditors from Venice, and the well-known Peruzzi bankers of Florence. Courts ruled in the latter's favor and conveyed Pabora assets to them (Krekic, 1997, p.13). The Ragusean noble and merchant Bunic, a tax-farmer for the Ottomans in 1471 became a fugitive from the Sultan after alleged embezzlement of 55,000 ducats. The Ragusean courts seized his local assets to cover the claim. Years of litigation followed, with Bunic and the Porte, coming to an eventual settlement with encouragement of Ragusa court⁷⁰.

Many other early institutional elements that today would be labeled "a favorable business and rule-of-law climate", can be pointed out. Luetic (1969, p.107), and Carter (1972, p.157) note the beginnings of the first maritime insurance policies in the 14th century, and Doria (1987) notes how elaborate they became by the 16th century. A revealing description of bankruptcy procedures in 14th-15th century by Palic (2008) further attests to the favorable business climate. He emphasizes that -unlike the "debtor's prison" practices found elsewhere- "the ultimate aim of bankruptcy...was not just settling [with the] lender but also...helping the debtor overcome inability of paying...[thus creating] an atmosphere for further co-operation and doing business together." This further confirms the frequent reference to Ragusean Courts encouraging settlement –surely a wise and effective policy for promoting business. All the above provides consistent support for **HH6 which we might re-label "The Kotruljevic Hypothesis": Ragusa conducted a policy of good governance, effectively implemented ROL, and provided market-enhancing institutions.**

⁷⁰ Bojovic (1998, p.114) cites numerous similar cases.

4.2 Prudent fiscal and monetary policies

The literature is replete with references to conservative finances, prudence on expenses, low debt, but virtually no data is shown, with one exception: budget numbers for 1800 reproduced in Bjelovucic (1970)⁷¹. There we find first, evidence of a large budget surplus of about 10% of Revenues, consistent with **HH7, the prudence hypothesis**. Figure 8 indicates shares of different revenue and expenditure categories that provide further evidence of fiscal prudence

[Figure 8 about here]

Reinhartt and Rogoff (2009) remind us that the current recession is NOT that different from historical, cases pointing to the common instance of high debts and defaults in Europe over centuries. In contrast, Ragusa appears to have avoided serious debt problems as strongly implied by interest payments on loans which represented only 1.7% of budget expenditures, far below comparable values. Venice about this time paid out a third to service debt, and more in earlier years, Lane (1973). Koerner's (1995) analysis of 25 states from 1500 to 1800 concludes that "service on the debt varied between 17 and 36% of total expenditures."

Qualitative evidence supports HH7 strongly: one finds no references to defaults, though instances of payment difficulties arose. Krekic (1980) and Sisak (2011) note among the "social obligations" of nobility "sharing proportionately in lending to the state and accepting less than full payment when exigencies arise". Ragusa's net asset position was strongly positive in 1800. Dividends on deposits in Italian and Viennese banks provided 25% of revenues -excluding holdings by individuals! The share of maritime trade in revenues is substantial with customs revenues of 9.3% and various taxes on shipping, shipbuilding, ship sales, navigation, adding 30.2%. Financial conservatism is further reflected in the double-use of consular staff being hired-out to others and yielding revenues of 6.3%.

Another indicator of prudence may be in the low inflation and limited debasement which many writers note.. Most agree with Krekic (1980) that inflation was not high; Stuard (1992, p.810) writes of "mild inflation" in the 17th century but much higher in the next. We have not found enough quantitative evidence to confirm the low-inflation consensus as all such discussions are at best fragmentary and sometimes inconsistent. We were unable to compile inflation or even

71 The "Bara Bettera Memoirs" on which there is some dispute among specialists today; table in Bjelovucic must have a transcription error as total exceeds sum of expense components by 30%. Havrylyshyn and Srzentic (2012). Note how this could be adjusted to calculate probable proportions.

consistent goods price data; while inflation estimates in Northern Italy might be a good proxy, these are less available than numbers for Western Europe⁷².

Banking activity in Ragusa in the 14th and 15th centuries, unlike the large Italian city-states, was at first limited to the Zecca⁷³ (Mint) stamping silver coins, and exchanging currencies. We found no mention of private banks in the historical writings, but it seems over time the Zecca expanded to limited lending activities with explicit references to its credits to the state, state institutions and large influential brotherhoods, and with goods-collateralization and 8% interest for commercial entities. This resembles the function of public banks in other, much bigger, countries of that period. Namely, they relieved the government in bridging intertemporal budget constraints⁷⁴ by providing access to central bank credit, although we cannot talk about a central bank in the proper sense of the term.

The Zecca probably also served as a bank for rich Balkan princes and merchants wary of unfamiliar Italian banks⁷⁵. The activity of Zecca is recorded as early as of 1327, and it certainly had a monopoly on creating silver coins, whereas the monopoly over exchanging gold and silver coins dates back to 1683. There were no deposit banks, but the state pawn shop did provide some degree of lending to those with lower income (Bjelovucic, 1970, p.67). We noted earlier credits issued among private individuals for trading and shipbuilding participation, but these data are too fragmentary to give a clear picture of the nature or magnitude of credit creation, thus it is not possible to seriously discuss the monetary policy of that time

While the 1800 budget and qualitative evidence consistently support **HH7 -the prudence hypothesis**, it is reasonable to ask how representative is this late data point. On the one hand, qualitative evidence suggests similar prudence in all earlier periods; also the fact that well into the period of decline, Dubrovnik still had strong finances with unusually low debt servicing and a positive balance of interest earnings, certainly implies prudence in the preceding decades, if not centuries. On the other hand, this positive balance could reflect the lack of domestic investment opportunities in a declining economy; and certainly one data point is indeed too little to be conclusive.

72 See Allen-Unger Global Commodity Prices database at Oxford and UBC (www.history.ubc.ca/faculty/unger/ECPdb/about.html)

73 <http://numismatica-italiana.lamoneta.it/> explains the derivation of the word “zecca”, which apparently comes from the Arabian word with pronunciation “sikka”=“coinage”

74 M. Fratianni and F. Spinelli (2006, in *European Review of Economic History*, 10, p.260)

75 Carter (1972, p.172) and Kurtovic (10) ; a good example of the advantage of Slavic charatr of Ragusa.

4.3 An enlightened social policy

While self-interest may have been the motive, the Ragusean nobility apparently paid unusually significant attention to the well-being of those who must necessarily be the labor force on ships, shipyards, and trade related activities. Such “fairness” led to a high degree of social stability according to Sisak (2011, p.182) “the loyalty of the Dubrovnik population to the social order and hierarchical structure of government was atypical compared to other cities in the Adriatic”. Most historians broadly agree with this, while recognizing large disparities of status. Carter (1972, p.116) gives a more balanced view: “the ‘cittadini’ and peasants were ruled with wisdom and without oppression”, “[but governors of the territories] governed despotically...Dubrovnik’s ideas of liberty were not only restricted to a limited class, but did not extend a yard beyond the walls”. Leaving aside some uncertainty on “just how fair was fair” in Ragusa, we turn to illustrate the main social welfare measures.

Infrastructure for the populace included street paving as early as the 14th century; sanitation, regulations for wooden buildings to minimize fires, wells, aqueducts for water, public fountains, orphanages and indigent homes. Provision of health care is considered by many a pioneering high point of Ragusean social fairness. A recent systematic review by Lang and Borovecki (2001) concludes: “it is obvious that Dubrovnik had a high level of health and social care”. Frati (2000) details the first regional introduction of quarantine in 1377, as well as other measures: free pharmacies, hiring top physicians from Italy, sending talented youth to study medicine there and so on. Frati realistically notes that the motivation for quarantine “[was] mainly to protect the safety and quality of the commercial network rather than for medical aethopathogenic purposes”, but leaves no place for question: the public spillover benefit was considerable and unique for the time.

Provision of education for all classes in the city -but not rural areas- provides additional evidence of “patrician’s enlightened attitude toward talent”, Bjelovucic (1970, p.62.). At least as early as the 16th century, Jesuits were given funds “to teach all youth who wish to attend public schools” and “send bright boys overseas to study at government expense”. Figure 8 shows that education expenses were 6.8 % of the total, but this is disputed with some sources giving a value as small as 3.3%. Is this high or low? Unfortunately the Bonney (1995) volume on state finances does not provide comparative values.⁷⁶

Another important social measure was the maintenance of emergency grain reserves provided to population at low-cost during the periods of famine. In the mediaeval period this was an

⁷⁶ The implication may be that other states undertook minimal education expenditures; but this requires future research.

arguably justifiable intervention. Overall, even without formal tests, the available information is supportive of **HH8: social policies went far to provide basic needs of the population, especially in comparison to other states.**

4.4 Minimal military expenditures, maximum diplomacy⁷⁷

Our subtitle refers to the common view that Ragusa, unlike other city states of the region, did not achieve commercial power by use of force, but substituted this with skillful and constant diplomacy. On the face of it, Figure 8 supports this with defense accounting for only 12.2% and diplomatic costs 43%.expenditure. In comparison, Bonney (1995) calculates for the 13th-17th century European states' military expenditure were at least 20% to as much as 80% in times of conflict. For Venice in 1763 Lane (1973, p.426) shows one-third after a sharp decline from preceding periods. But since the 1800 situation of Ragusa may not be representative of earlier periods, we again rely on other fragmentary data and qualitative judgement.

Minimal use of naval and military force forms the central thesis of Berkovic (2010, p.220). His assertion that it was “a small country with no military force” surely overstates the case, but that “foreign policy and diplomatic skills played a key role in the survival and development of the Dubrovnik Republic” represents a virtually universal consensus among historians. That naval forces were small is shown by many fragmentary estimates of numbers of warships. Treaty obligations to provide 1 war galley per 30 Venetian ones, implies only 3-4 at-the ready⁷⁸. Less specific demands were made under the Hungarian overlordship. Luetic (1969, p.77) emphasizes “The Most Modest War Fleet” with vague references to types of warships for 17th century from which one can infer a larger number of about 10 –hardly a case of “no military force” but still small.

Thus, the available evidence points to a modest force which at best provided a minimal deterrent, mitigated the threats of pirates, and allowed Ragusa to meet its treaty obligations - and when not used in war, served as diplomatic couriers or escorts of commercial convoys. But some evidence suggests this underestimates defense costs. First several writers emphasize that even the commercial fleet was outfitted to allow swift modification for cannon and decks for armed sailors/soldiers. Second .the cost of massive fortifications (today's great tourist attraction) must count as defense expenditures; the literature gives virtually no information on this. Third one might hypothesize that before Ragusa's commercial and intermediation

⁷⁷ This section is based to a large extent on the comprehensive analyses of Carter (1972) and Berkovic (2010).

⁷⁸ Lane (1973) enumerates Venice's war fleets at about 100

importance was built up enough to make diplomacy a credible option, military actions and costs may have needed to be much larger. Suggestive of this, Carter (1972) mentions several early attacks and sieges besides the Saracen siege of 866-7: In the 14th century at different times Kings of Serbia and of Bosnia are known to have considered capturing Ragusa, but were discouraged by the likely very high cost of breaching the defenses.

Nevertheless, there is reason to conjecture that even these factors would not alter materially the consensus on **HH9: available evidence suggests Ragusean military expenditures were small relative to what typified the period.**

That diplomacy was a substitute for defense is also broadly accepted in the literature. Figure 8 data certainly supports the view with diplomatic costs about 42% of expenditures: 11% for consular expenses (though note fees recouped for services to others yielded 6% of revenues), and nearly one-third -31.9%- for various tributes, “good relations”, diplomatic travel costs etc. The focus on diplomacy was both a choice and a necessity.. Ragusa was not only very small, but its hinterland was infertile, hilly, narrow and difficult to defend, hence diplomacy inevitably became necessary. The relationship between diplomacy and defense is best thought of in a circular causation: early efforts to provide defensive walls and forces were surely needed to discourage attacks and give time for negotiations, but the small size and indefensible territory led to emphasis on diplomacy and neutrality; over time, the increasing success of diplomacy lessened the need for military efforts.

Berkovic (2010, p.220) again typifies the consensus: “aware of their geopolitical position...Dubrovnik entered into numerous international political and trade relations [using this] wisely and skillfully in the defense of independence, sovereignty and economic growth, resorting almost exclusively to diplomatic means and diplomatic skill.” A few examples follow.

The 866-67 siege may not have come to a good end were it not for the appeal to the Suzerain, Emperor Basil, who sent a Byzantine fleet to relieve the city. As Venice began to dominate the region Ragusa often yielded to some informal form of “submission”, accepting Venetian Counts and Archbishops, while still fleeing the Byzantine Imperial standard, and turning frequently to Constantinople diplomatically to offset Venetian pressure. About 1095, still under formal Byzantine protection, Ragusa turned to their enemy Venice to help ward off the incursions of King Koloman of Hungary. In 1186, the Normans of Naples and Sicily occupied Ragusa, but negotiated favorable terms: a Norman titular count, but all decisions of government made by the Great Council, no significant tribute required, and all commercial treaties remaining in force. During the Venetian protectorate from 1204 the formal treaty of submission was signed only in 1232, reflecting Venice’s limited authority and was not very onerous while the obligation of Venice to defend Ragusa and the trading privileges accorded were of great value. Significantly,

Ragusa was exempted from the prohibition for other states to import goods into Venice or export to the Levant.

The height of complex many sided diplomacy and intrigue is exemplified by Ragusa's sobriquet in the late 16th century of "Le Sette Bandieri" (The Seven Flags): "Thus by her successful diplomacy Dubrovnik was under the aegis of seven different powers -Spain, the Papacy, The Empire of Naples, Venice, Hungary, the Turks, and the Barbary Deys." ... although they often were in difficulties with some of their protectors, they could always play one off against the other." (Carter, 1972, p.333).

5 Conclusions and future research

Ragusa in the medieval period is widely considered to be a unique case of a very small economy which, despite having virtually no agricultural or other resources, already by the 14th century was a prosperous entrepot port for Balkan-Italian trade, then built on this to become by the 16th century a major commercial maritime power in the Eastern Mediterranean, competing successfully with much larger Venice, especially in Ottoman lands. Historians give many reasons for its success. Location was important initially but of greater weight was how its ruling elite leveraged this with wise policies to promote prosperity. We have compiled the available economic data from secondary sources for the period 1300-1800, and complementing it with qualitative judgments by historians and some fragmentary statistics, tested nine common hypotheses in the literature. Table 3 summarizes our findings and given the data uncertainty indicates the degree of confidence in the results.

[Table 3 about here]

On Ragusa's economic evolution, we find the data consistent with all but one of the five hypotheses, but with some new interpretations that point to future research. Hypothesis HH1 that peak prosperity came in the "Golden Years" of the 15th-16th century is corroborated by data on population, major buildings, fleet size and tonnage, as well as a rough GDP estimate. However, shipping tonnage which is perhaps the best proxy for economic activity, suggests the peak came about 1575-1600, as opposed to the earlier date many historians use, namely 1550. Most historians give greatest attention to this period but we argue that Stuard's extensive work suggests that the preceding Silver period was also very dynamic. Further, we offer as HH2 that this period -while still not as prosperous- was perhaps equally dynamic in the sense of economic growth, and built up the basis for the Golden Years. Data on major buildings is consistent with

such a view, but other indicators are too sparse to consider this a strong result, hence a good theme for future research

Population reached its peak in 1500, much earlier than other proxies of development a fact consistent with HH3, that carrying capacity of this small infertile territory was extremely limited, to well below 100,000. But like the HH2, the test is very limited.

The “patriotic” hypothesis HH4, that Ragusa’s fleet equaled that of much larger Venice, should be rejected, even though technically at the peak the fleets were equal in a very narrow sense. Indeed, in the late 16th century this was literally true, but only for this period and only because Venice had suffered naval defeats decimating its fleet. Over the centuries, the Venetian fleet was certainly greater albeit not by multiples, as one might expect given their relative size. The inherent pride of this hypothesis can therefore be justified: that Ragusean merchants came even close, were considered by Venetian authorities as its main rivals, and were known to “snatch goods from under the eyes of Venetians,” is a testament to great commercial success.

Last, HH5 posits the consensus that decline came with opening of the Cape of Good Hope route to the East. The quantitative evidence in the long-run is consistent with this, but as already noted, the timing points to a nuanced interpretation. Trading by Portugal via the new route began early in the 16th century, followed by Netherlands and England, yet Ragusa’s fleet and wealth continued to grow considerably for nearly a century. This hints at **the resilience hypothesis**: Ragusean elites and merchants succeeded for a long time in maintaining competitiveness against the overwhelming cost advantage of the new route. But it is too weak and indirect a test to make a firm conclusion- only further research could do this.

Four hypotheses on the “wise policies” were addressed but given the very partial “hard” data and the need to rely on fragmentary “soft” data plus qualitative judgments by historians, the conclusions are best considered as indicative and still conjectural. HH6 -that Ragusa pursued good governance, rule-of-law, and institutions favorable to commerce- was impossible to test quantitatively, but innumerable instances of historians’ arguments lend very strong support. HH7 -that the state conducted prudent and conservative financial policies- is strongly confirmed by the one set of budget data available. Perhaps most striking here is the 1.7% of expenditures for interest on loans, far below the 20%+ seen in other states. Unfortunately, no budget data was found for earlier periods, and arguments can be made on both sides on how representative the 1800 budget might be. It is true but not sufficient that the qualitative evidence on earlier centuries shows a nearly universal consensus by historians that Ragusean finances were very conservative and prudent.

That military expenditures were low, and instead diplomatic efforts were substantial, are complementary hypotheses HH8 and HH9, and available evidence appear consistent with both.

Certainly the 1800 budget Figure 8 shows this, with expenditure shares for diplomacy being four times greater than for military ones. For earlier years, the evidence is supportive but much weaker, with some soft data on naval fleet size as well as most historical interpretations pointing to the same conclusion. But it is not inconceivable that for very early periods e.g. before 1200, defense expenditures on walls, vessels, armed soldiers may have needed to be proportionately larger until Ragusa's wealth and reputation permitted a greater reliance on diplomacy.

Indeed, the last is one of the several general directions for future research. Another general area would be to re-test some of the above hypotheses using primary data from the very rich and under-exploited Dubrovnik Archival material on commercial activity. Thus the budgetary prudence reflected in the 1800 source could be investigated for earlier periods. Of particular relevance for current global issues might be a deeper investigation of **the resilience hypothesis**, focused on short-term movements of trade, shipping, budgets around the time of some external shock episodes. Both the recent retrospective of Reinhart and Rogoff and a lot of earlier economic history literature makes clear that there were many such episodes which must have affected little Ragusa, like the current global crisis has affected many small "tiger" economies, be they Celtic, Baltic or other.

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Tables and Figures

TABLES

TABLE 1. Classification of economic periods

Economic period	Year	Nature of Economic Activity
Foundational Period	To 1100	Agriculture, fishing, short-distance maritime trade
Silver Period	1100-1350	Above, and hinterland trade especially Balkan silver and other minerals, including Adriatic entrepot trade
Golden Years	1350-1575	Above, and increasing long-distance maritime trade- mostly to Levant
Cape Hope, Gradual Decline	1575-1750	Levant trade gradually lost to Western European competitors, efforts to trade in West Mediterranean and Atlantic
Revival Interlude	1750-1806	Balkan trade continues, hire-out ships and sailors to new big powers
Post-Independence	1806-1900	Decline sharpens, maritime activity is undermined by railroads; late-19 th c. beginning of tourism-economy

TABLE 2. Correlation matrix: GDP, ship capacity and population

	GDP (in million 1990 USD)	Tonnage of Ragusan ships	Population (in 000)
GDP (in million 1990 USD)	1	0.53	0.88
Tonnage of Ragusan ships		1	0.64
Population (in 000)			1

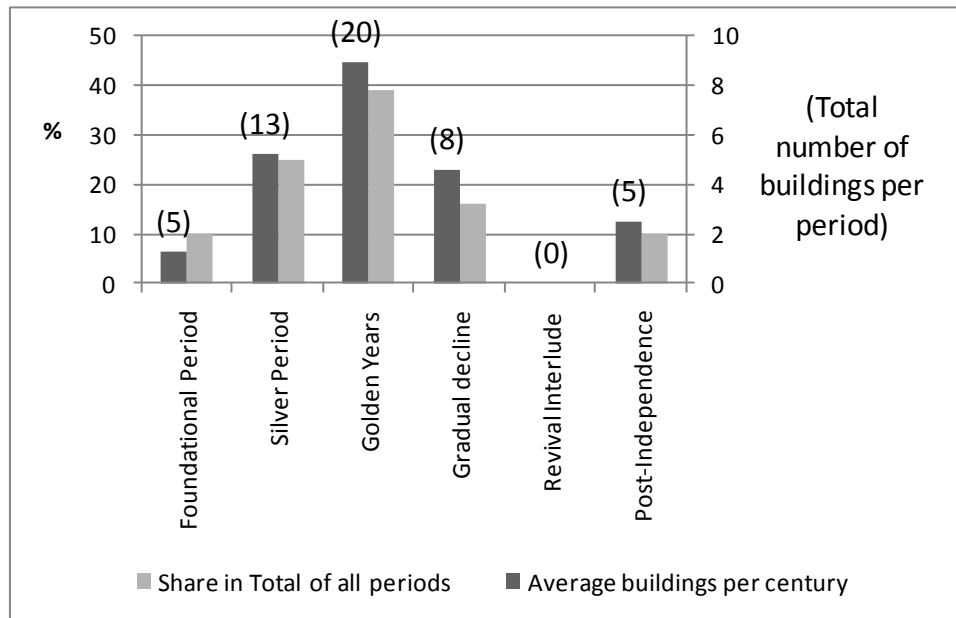
Source: The correlation analysis has been done using values in Figure 5 with interpolation

TABLE 3. Findings

HISTORICAL HYPOTHESIS	CONSISTENCY OF EVIDENCE AND HYPOTHESIS	EXPLANATION FOR QUALIFICATIONS
HH1: Golden Years of Prosperity (about 1350-1550)	Strongly consistent	The most ample and the most robust dataset
HH2: Silver Period was also very dynamic	Weakly consistent	Only one limited dataset examined
HH3: Carrying capacity below 100,000	Weakly consistent	Only population data examined
HH4: Ragusa fleet equal that of Venice	Consistent only for one period, but not for long-run	Strong data, direct measure of shipping
HH5: Ragusa decline begins (early 16 th century)	Mixed result	Data consistent with long-term decline but exact timing unclear
HH6: Laws, institutions favorable to commerce	Weakly consistent	No data examined, only qualitative evidence
HH7: Ragusa had prudent state finances	Strongly consistent for one time point	Only 1800 examined; otherwise only qualitative evidence
HH8: Enlightened social policies	Weakly consistent	Only qualitative evidence so far
HH9: Military expenditures relatively low, diplomacy high	Strongly consistent for one time point	Data on 1800 budget, supported by fragmentary soft data and qualitative evidence

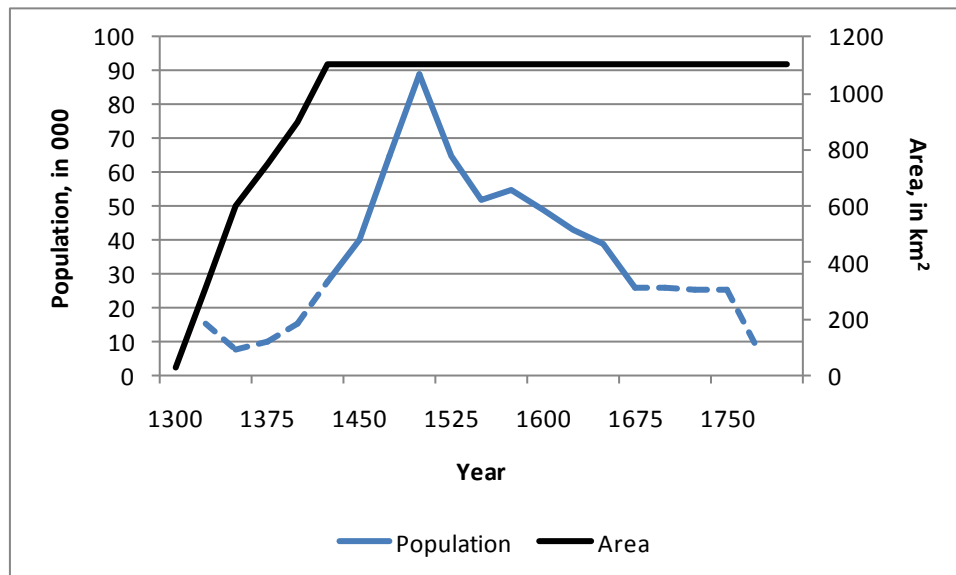
FIGURES

FIGURE 1.: Principal buildings in Dubrovnik by period 9th-19th century



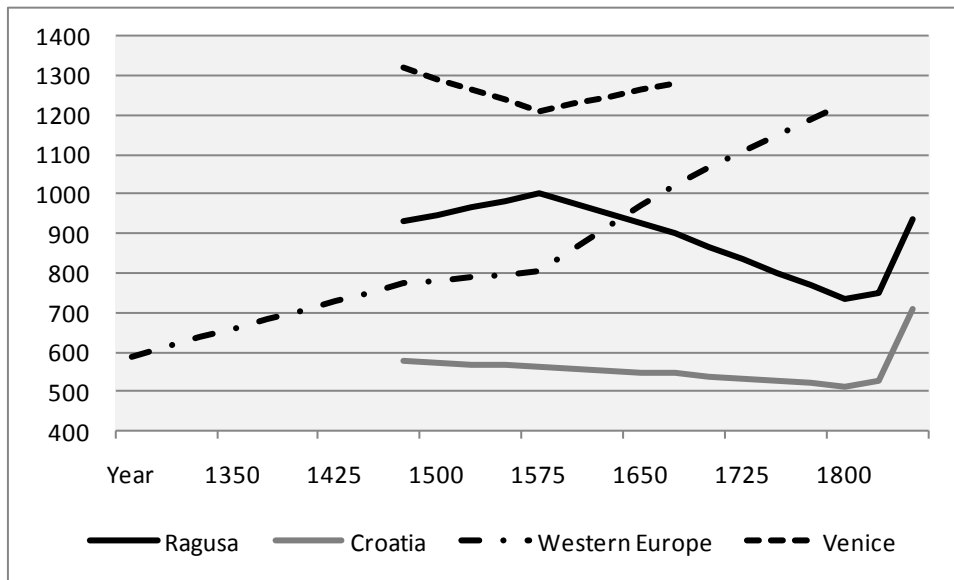
Sources: from Chart XIII Carter (1972) and authors' calculations

FIGURE 2.: Population and area: Ragusa 1300-1800



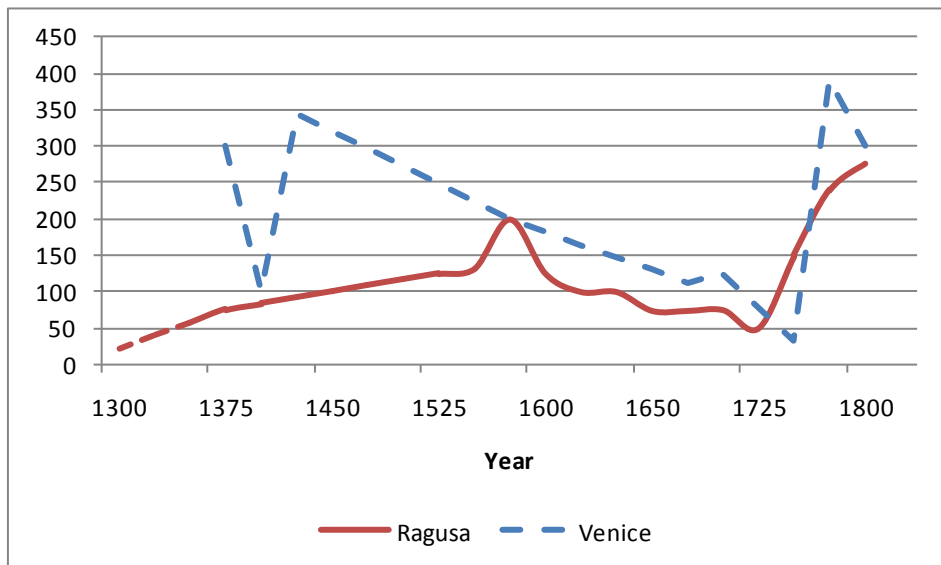
Source: Appendix tables in Havrylyshyn, O. and N. Szentic. "Economy of Ragusa, 1300-1800 The Tiger of Mediaeval Mediterranean", 2012

FIGURE 3.: GDP *per capita* Ragusa and comparators (in 1990 USD)



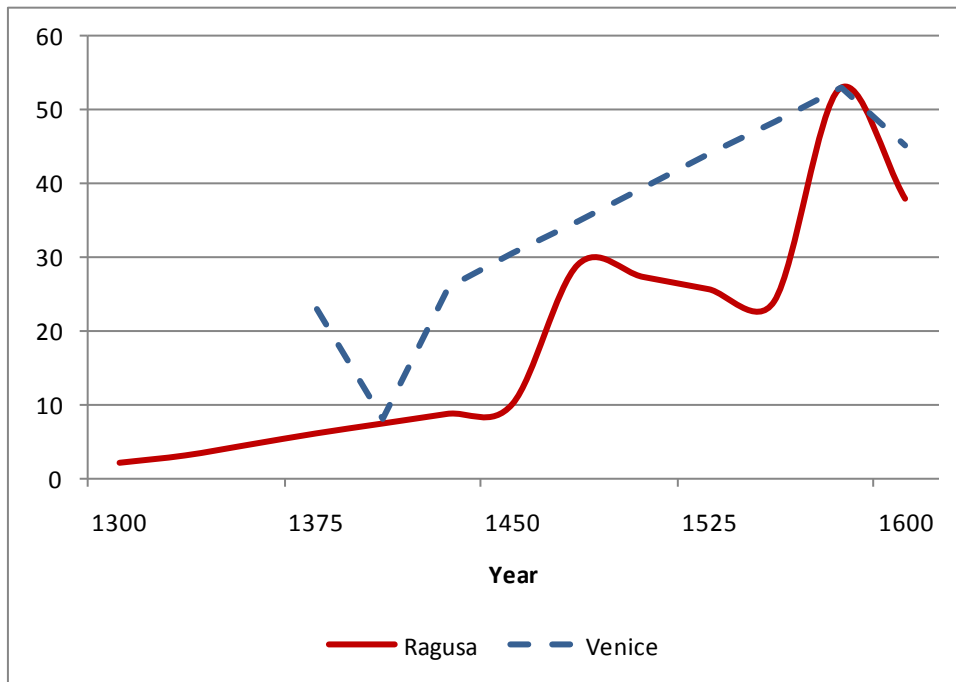
Source: As for Figure 2

FIGURE 4.: Number of ships: Ragusa and Venice 1300-1800



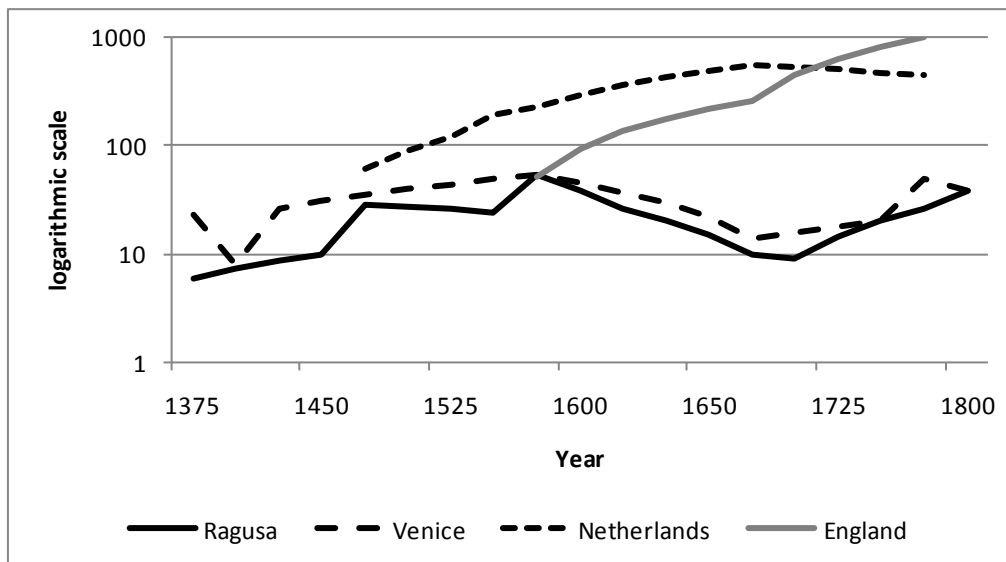
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FIGURE 5.: Ship capacity (in 000 tons): Ragusa and Venice 1300-1600



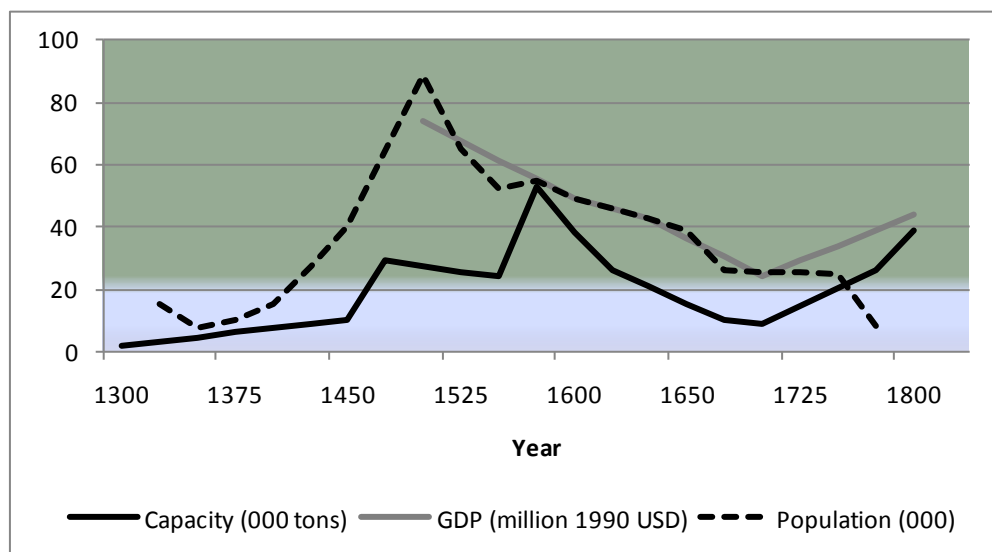
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FIGURE 6.: Ship capacity (in 000 tons): Ragusa, Venice, Netherlands and England (1375-1800)



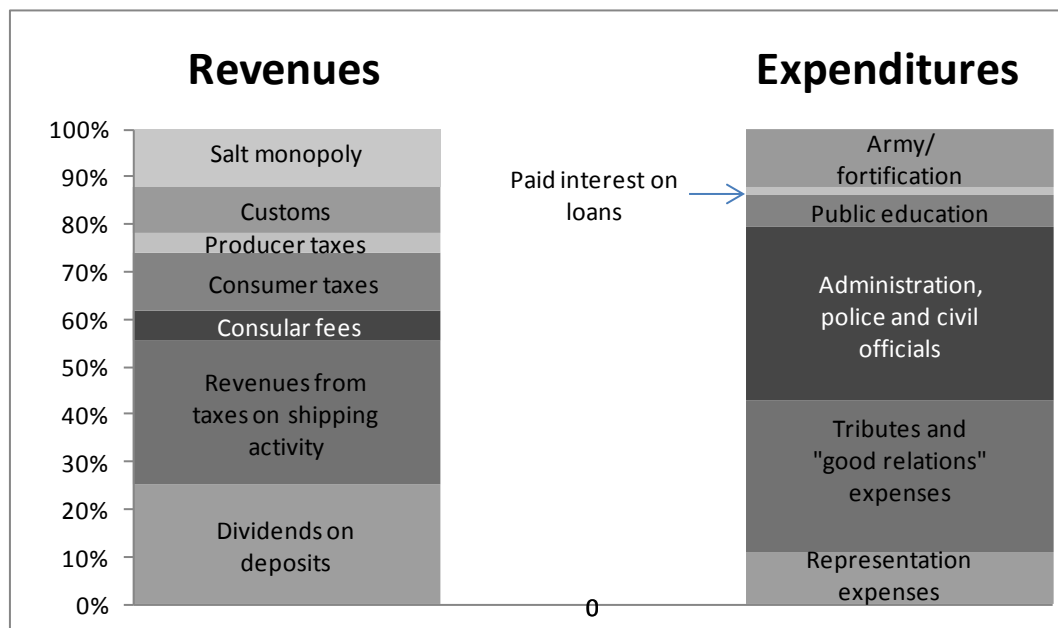
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FIGURE 7.: Comparison of GDP and a GDP proxy (ship capacity): Ragusa 1300-1800



Source: As for Figure 2

FIGURE 8.: Structure of Ragusa budget about 1800.



Sources: Shares are calculated using absolute ducat values in Bjelovucic (1970, p.44-45)

