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Faculty of Social Sciences
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MASTER'S THESIS

Macro-prudential policy and banks' cross-border capital flows

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, July 31, 2018

Signature

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Abstract

This thesis analyzes spillover effects of prudential policies on cross-border capital flows in the period from 2000 until 2014 for 64 countries. It estimates the size of the effect, which 9 most common prudential policy tools had on capital flows based on BIS LBS. The findings show spillover effect of general capital requirements and consumer credit capital requirements on the cross-border capital flows. This work provides analysis of spillover effects in several groups of countries with special accent on CEE countries.

JEL Classification

[F32](#), [F34](#), [G21](#)

Keywords

Macroprudential policies; Prudential and supervisory measures; Cross-border banking flows; Leakages; Regulatory arbitrage; CEE

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Abstrakt

Tato diplomová práce analyzuje přelévací dopady prudentní politiky na přeshraniční kapitálové toky v období od roku 2000 do roku 2014 v 64 zemích. Odhaduje velikost dopadu, které 9 nejčastějších nástrojů prudentní politiky mělo na kapitálové toky založené na BIS LBS. Závěry práce ukazují přelévací dopad obecných kapitálových požadavků a spotřebitelských požadavků na přeshraniční toky kapitálu. Tato práce se zabývá analýzou efektů přelévání v několika skupinách zemí se zvláštním důrazem na země střední a východní Evropy.

Klasifikace

[F32](#), [F34](#), [G21](#)

Klíčová slova

Makroprudenční politika; Prudenční a dohledové opatření; Přeshraniční bankovní toky; Úniky; Regulační arbitráž; CEE

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Acronyms

BIS	Bank for International Settlements
CBOE	Chicago Board Options Exchange
CBS	Consolidated banking statistics
CCB	Countercyclical capital buffer
CEE	Central Eastern Europe
CESEE	Central, Eastern and South-Eastern European countries
CRD	Capital Requirement Directive
CRR	Capital Requirements Regulation
DB	Database
DSTI	Debt service to income
DTI	Debt to income ratio
EC	European Commission
EMU	European Monetary Union
ESRB	European System Risk Board
EU	European Union
FSB	Financial Stability Board
GATS	General Agreement on Trade in Services
GDP	Gross domestic product
GMPI	Global Macroprudential Policy Instruments
G-SII	Globally systemically important institutions
IBRN	International Banking Research Network
IMF	International Monetary Fund
LBS	Locational banking statistics
LCR	Liquidity coverage ratio
LGD	Loss given default
LTD	Loan to deposit
LTI	Loan to income
LTV	Loan to value ratio
NPISH	Non-profit institutions serving households
NSFR	Net stable funding ratio
O-SII	Other systemically important institutions
PD	Probability of default
PDM	Prudential Defence Measures
SRB	Systemic risk buffer
SREP	Supervisory review and evaluation
WEO	World Economic Outlook
WTO	World Trade Organization

Master's Thesis Proposal

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Proposed Topic:

Macro-prudential policy and banks' cross-border capital flows.

Motivation:

In the past decades, there were many financial crises, both global crises, and domestic crises. Domestic financial crises were related to weak controls of the systemic risk in the country. Some of the countries, especially emerging economies, applied macro-prudential policies after the crisis in their country or as prevention.

Objectives of these policies were to limit excessive credit, house price growth, and risk-taking by the banks. The tools applied ranged from adjustments in the regulation (higher minimum capital requirements, higher risk weights on certain exposures, higher provisioning costs) to loan availability criteria (limits on LTV and DTI), and up to administrative ceilings on credit.

This thesis will check if banks or firms tried to arbitrage these regulatory measures by redirecting their capital flows to cross-border loans.

The theoretical part will analyze literature and empirical evidence and will try to find possible ways to arbitration which banks and other economic agents may exploit.

The empirical part will use data on domestic credit growth, cross-border flows to the economy from international banks, and a database of macro-prudential measures for emerging markets and will examine the data using econometric tools to uncover evidence of arbitration.

Hypotheses:

1. Identify if the cross-country flows increased after macro-prudential policy application from highly regulated country to low regulated country.
2. Changes in cross-country flows will start quarter before the macro-prudential application and will not last more than few quarters.
3. Identify which micro-prudential policies can be used to restrict cross-border capital outflows as a result of the macro-prudential policy.

Methodology:

For the empirical part of the thesis, the data will be obtained from publicly available sources. Domestic growth data will be obtained from IMF's World Economic Outlook. Cross-border flows to the economy from international banks data will be obtained from Consolidated BIS International Banking Statistics. Macro-prudential measures for emerging markets will be obtained IMF's survey on global macro-prudential policy instruments.

Data which will be used are IMF AREAER database, BIS database and annual reports of central banks.

The main focus of the thesis will be in BRICS (Brazil, Russia, India, China, South Africa) countries.

The Data analysis will be done using suitable econometric methods. To test first hypotheses will be used univariate OLS regression to compare market share of foreign banks (on which macro-prudential policies not apply), before policy application and after.

To test the second hypothesis will be used univariate OLS to test the significance of macro-prudential policy effects on cross-border capital flows in different countries.

To test the third hypothesis will be used VAR approach to analyzing predicted the relationship between Macro and Micro-prudential policy and arbitration using cross-border capital flows.

Expected Contribution:

The author will extend the database created by Vandebussche, J., Vogel, U., Detragiache, E., to cross-country flows and to BRICS countries. It will help to further researchers to compare macro-prudential policies effect on the global economy and will check if theoretical assumptions confirmed by empirical data.

Results can be used for better planning of international reciprocity network and adjusting global macro-prudential policies on the same level.

Outline:

1. Motivation and introduction: a brief review of the topic, the problems policies trying to solve and impact on an economy. Explanation why countries use macro-prudential policies and how they affect cross-country flows.
2. Literature review: thesis will review studies which already were conducted in the same area and other literature which can be used for the better formulation of research questions.
3. Data: a review of available data sources, explanation of extending current data sources (Vandebussche et al.), an explanation of how data will be prepared for analysis.
4. Methodology: an explanation of how regressions and VAR to test each one of the hypothesis.
5. Results and discussion: presenting the results of the research and discussing hypothesis. Comparison of results to other researches.
6. Conclusion: Summary of the finding and their implications. Explanation of practical implication and proposal of future researches.

Core Bibliography:

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1 Introduction

Macroprudential regulation as a way to control and monitor the systemic risk of financial system became a hot topic in the recent years. The financial crisis of 2007-2008 showed to all policymakers that microeconomic regulation of specific area is far from sufficient. When failure of one component of the financial system put in a deep turmoil the entire financial system and later the world, it is clear that a more systemic approach is needed. Prior to the financial crisis, we saw macroprudential policies implemented mainly in the Emerging markets and Asian countries. However, since 2007, many countries with advanced economies have implemented Macroeconomic and Macroprudential policies.

The main aim of the macroprudential policy is to decrease systemic risk, to ensure the stability of the financial system as a whole, and to reduce the loss of output, which happens as a result of a crisis. Macroprudential policy as part of its mandate, observes and protects the financial system from different perspectives. A policy of such broad spectrum is bound to overlap with existing monetary policies, capital flow regulations, sovereign risk prevention tools, and macroeconomic policy instruments as well as create an inconsistency with existing international and bilateral trade agreements. (Cornford, 2015)

The main governing body for the macroprudential policies is the Financial Stability Board (FSB), which was established in 2009 by 20 leading economies. FSB purpose is to improve international coordination, efficiency and relevance of supervision, regulation and other policies of the financial sector. (FSB, 2018)

With the help of FSB, the discussion and adjustment of macroprudential policies were done on the highest levels of central banks, the European Union, International Monetary Fund, and Bank for International Settlements. Consequently, some of the tools were included in the Basel III framework. (IMF, 2011) Even though international cooperation does exist, the current reciprocity network is still weak (with the exception of the tools included in Basel III). This means that as institutions in different countries tighten regulations and achieve the desired results domestically, but inadvertently cause spillovers on the international level and create the possibility of arbitrage. The arbitrage expected in this case would be between a regulated and an unregulated country, and this could be observed by the direction of cross-border capital flows. (Houston et al., 2012) The arbitrage, if it exists, can be harming the effectiveness of the policy, decreasing financial institutions trust in countries economy, and creating new risks from a macroeconomic perspective. In addition, existing evidence about banking tendencies, while regulatory arbitrage is possible,

is negative and suggests a possibility of a kind of race to the bottom, whereas advanced economies regulate their financial sectors but banks headquartered in those countries are willing to avoid the new regulations transferring funds to the countries, which don't yet have such regulations in place. Consequently, the extensive risk taking is not eliminated but kicked towards the less regulated countries and from there it continues to threaten all economies of the world because of financial systems interconnectedness, a situation which proved itself as one of the causes of the last financial crisis. (Houston et al., 2012)

Since the financial crisis of 2007-2008, a copious amount of empirical evidence was collected, and many research papers were published, which have empirically proven the effectiveness of the macroprudential policies for the implementing country. Furthermore, some papers showed in which way Macroprudential policies influence cross-border capital flows.

The objective of this thesis is to continue the research of prudential effects on cross-border capital flows. The main focus will be to collect more evidence about institutions which are exploiting arbitrage opportunity and check to which extent. The research will compare data from different sources in order to find which macroprudential instruments are opening more opportunities for arbitrage by redirection of capital flows. As part of this effort, model inspired by (Reinhardt and Sowerbutts 2015) and (Beirne et al. 2014) will be tested on the newer database compiled by (Cerutti et al. 2016) and directly on the International Monetary Fund and Bank for International Settlements data. One of the big problems in studying the effects of Macroprudential policies is the ability to compare these policies across different countries.

The thesis is structured as follows: Chapter 2 providing literature review in three areas of the research, presenting what was already researched and helping to understand the current situation in the International financial system, chapter 3 explaining the methodology and hypotheses of the research, chapter 4 explaining the usage of the data why it is appropriate data for such estimation, chapter 5 discussing estimation results and results of robustness checks and chapter 6 concludes the work and suggesting further steps.

2 Review of literature

This section is the review of published research. The literature review is presented in three sections corresponding to the three areas of research most closely related to the topic of the thesis. The three areas are:

1. Prudential policies – studies which examine effectivity of microprudential and macroprudential policies, ways of functioning, related spillovers, regulatory arbitrage cases.
2. Capital flows – studies examining the nature of cross-border capital flows, their types, specifications, pros and cons.
3. Prudential policies effects on cross-border capital flow – studies examining how the disparity in the implementation of prudential policies between countries affects cross-border capital flows in both directions and how those capital flows impact efficiency of the macroprudential policies.

2.1 Systemic Risk

When a financial crisis arises the government hurry up to provide the market with liquidity and to rescue financial institutions by bailing them out. Such an attitude helps in the short term, but in the long term it could weaken market discipline and increase moral hazard. Financial institutions assuming that the government is always ready to step in, could have more risky investment and risk insolvency, which could lead to the next crisis. The bailout has relatively high fiscal costs and not necessarily tend to make a recovery from crisis faster. These bailouts, using public money or providing guarantees, could be appropriate in the case of systemic risk but may not be necessary in the case of non-systemic one. Since at the moment of the crisis to could be hard for authorities to distinguish, it is important to understand the differences. The systemic financial crisis has an effect on the real economy, in contrast to non-systemic, which have limited disturbance effect. (Dijkman, 2010)

Important identifying property of systemic risk is the set of channels and instruments, through which shocks propagate from one element of the financial system to another, wherein systemic scenario contagion usually takes place. In contagion channel it is important to distinguish between information and real contagion channels, the first refers to effects of

a direct exposure, where second refers to an actual change of consumer behaviour as crisis response. (Dijkman, 2010)

A systemic crisis usually starts with triggering event which will spread inside financial system channels, until the effect of this event getting as significant that it affects the real economy. Since the strength of contagion effect depends on the level of behavioural response of the agent, it is hard to predict the consequences in advance. Treating cross-border crisis can be even more challenging since it depends on many factors, requires close cooperation with foreign authorities and measures which local authorities could take is even more limited. To get prepared for cross-border scenarios, authorities to run stress tests and simulation exercises, which could map most vulnerable parts in the local financial system. (Dijkman, 2010)

As for identification itself of the ongoing crisis, the most important are the steps required to be done by authorities in Pre-Crisis times. These include mapping potentially systemic institutions, interconnectedness between them and also the setting of economic thresholds, which could signal to worsening of the financial crisis with possible systemic effects. As for international contagions coming from cross-border capital flows dependence, it is for the country to coordinate and share information with foreign authorities, especially with those which country economy could be dependent. In the case of high foreign ownership, work with respective countries supervisor may be critical. (Dijkman, 2010)

2.2 Policy instruments

Prudential policies are types of macroeconomic policies which have a purpose of creating a framework and protecting financial system and consumers. Macroprudential policy is compliment microprudential policies and works in close interaction with other types of public policy to ensure the stability of the financial sector. Nowadays is seen more international cooperation in Micro and Macroprudential policy implementation, one of the relevant examples is Basel III. These policies are not a replacement, but an important add-on to strong supervision and broad macroeconomic and monetary policies. (IMF, 2011)

Macroprudential policies became significantly more researched and applied in the aftermath of the financial crisis of 2007. According to Ebrahimi Kahou & Lehar (2017) until the last few decades, the primary focus of policymakers was on microeconomic policies, observing individual financial institutions. Even though in the developed countries majority of financial institutions met regulatory capital standards; it was not enough to protect from

systemic collapse in 2007, therefore to cover this missing part, a macroeconomic overview of the system and macroprudential policies were needed. (Ebrahimi Kahou and Lehar, 2017)

Economic policies differ in their treatment of the systemic risk, with the microprudential point of view treating the risk as exogenous and assuming that the decision making of individual institutions does not affect the level of risk in the financial system (“risk-takers”). In contrast, the macroprudential point of view treats risk as endogenous and determined by the cumulative behaviour of financial institutions (“risk-makers”). In this case, systemic risk can be seen as a correlation between portfolios of all financial institutions in the respective system. (Ebrahimi Kahou and Lehar, 2017) present the following two dimensions in which the risk should be addressed: first is the time, in terms of risk accumulation in the financial system over time. The second is cross-sectional, which stands for risk distribution between individual institutions. (Ebrahimi Kahou and Lehar, 2017)

“Three growing crucial concerns should be addressed through macroprudential policies: financial stability, systemic risk, and procyclicality of the financial sector. “ (Ebrahimi Kahou and Lehar, 2017, p. 95) Financial stability stands for a stable financial system and payment system operation, efficient allocation of capital and ability to absorb real and financial shocks. Systemic risk stands for a drop of confidence in a significant part of the financial sector which could lead to its failure. Procyclical behaviour stands for misperception of the risk especially during economic booms and financial fluctuations which could result from it. (Ebrahimi Kahou and Lehar, 2017)

One of the issues, which Macroprudential policy is called to tackle, is risk related to the deposit insurance consequences. Deposit insurance became a popular tool which countries implemented in order to help banks regain society trust, to be a safety net and to prevent bank runs. This bank stability instrument is proven to protect unsophisticated depositors and to boost social welfare. A new wave of deposit insurance implementations and expansions came after the financial crisis when governments of hit countries used this tool to restore trust in the market and banking sector. The existence of deposit insurance made depositors monitor banks less rigorously and allowed banks to assume more risk, especially during good times. In this way “moral hazard effect” could overwhelm banks risk analysis, which could result in destabilizing financial system as a whole. Researchers found the overall effect of the deposit insurance to be negative if the years of the financial crisis are included in the analysis, because the total destabilizing effect during boom times exceeds the stabilizing effect during turbulent times. (Anginer et al., 2014)

Policy implementation brings with it benefits from stabilization prospective, but also the potential for spillover effect. The scale of spillover effect often times is hard to measure

and it could be identified only after actual policy implementation and behavioural changes which follow it. As (Anginer et al., 2014) prove empirically by working on a dataset from bank data and comparing to stability indexes in the respective countries, “We show that generous financial safety nets increase bank risk and systemic fragility in the years leading up to the crisis. However, both standalone bank risk and systemic risk are lower during the global financial crisis in countries with deposit insurance coverage. Our results suggest that deposit insurance seem to have offered significant stabilization effects during the recent banking crisis.”(Anginer et al., 2014, p.320).

“Macroprudential instruments are typically introduced with the objective of reducing systemic risk, either over time or across institutions and markets. Countries use a variety of tools, including credit-related, liquidity-related, and capital-related measures to address such risks, and the choice of instruments often depends on countries’ degree of economic and financial development, exchange rate regime, and vulnerability to certain shocks.”(C. Lim et al., 2011, p. 4) Authors conclude, after analysis of 49 countries, that tools such as caps on the loan-to-value ratio (LTV), caps on the debt-to-income ratio (DTI), reserve requirement and capital requirements are effective in moderating procyclicality. (Lim et al., 2011)

Micro and Macroprudential regulation has the purpose of protecting the financial system from two mutually exclusive points of view. Micro-prudential regulation focuses on the firm level and implements measures to protect the firm. Macroprudential policy is looking at financial systems as a whole and covering risks in between firms and all the things Micro-prudential regulation cannot cover. Up to recent financial crisis, Microprudential policies dominated since it was believed that if components of the system will be regulated the system as a whole will also be protected. In spite of proper regulation, the main causes of 2007-2008 were found in the risks in between the institutions, which presented deficiencies of the Microprudential policies. As a result, Macroprudential policies were developed and applied. In today’s practice the separation between macroprudential and microprudential policy is mostly conceptual, since some of the same instruments are used to achieve both goals. (IMF, 2011)

2.2.1 Macroprudential policies and their development

The macroprudential policies primary objective is a limitation of systemic risk build up. The targeting of this policy is to address risks arising from the nature of the financial system and those risk which amplified by the financial system; other risks are to be dealt with other public policies. Macroprudential policy is not an “off-the-shelf” product: policy framework needs to be adjusted to the local economic conditions. Analytical tools, policy

instruments and institutional arrangement, need to take into account risks and specifics of the economy and the financial sector of that specific country. (IMF, 2011)

The approach of the monitoring by Macroprudential policy should be exhaustive and include all potential risk sources. These include different approaches, models, supervisory data, quantitative and qualitative data. Country's macroprudential policy has to take into account the effects of the implementation on other countries' economies as well as other countries macroprudential policies on domestic economy to avoid unintended spillover effects.(IMF, 2011)

When calibrated to a specific country, policy should have instruments to cover liquidity, credit and maturity transformation providers, financial market infrastructure as well as individual systemic important institutions. For effective functioning of the policy, country's macroprudential authority should have full legal status, mandate, accountability and independence in order to be able to use policy instruments in case of need. From an institution perspective, macroprudential policy should have clear objectives, goals and adequate power to achieve them. (IMF, 2011)

2.2.2 Macroprudential policy objectives

Macroprudential policy purpose is protecting and stabilizing the whole financial system. Both in improving the resilience and in minimizing accumulation of negative factors to allowing to contribute to economic growth. Since the topic of countries relevant to this works regulated by EU, this part will focus on literature related to regulatory recommendations issued by European System Risk Board (ESRB).

ESRB recommends addressing the stability of financial sector by addressing the following four intermediate objectives (ESRB, 2015)

1. Excessive growth of credit and leverage, since inordinate growth of the credit was found as a significant predictor of financial crisis and leverage is it's strengthening factor.
2. Excessive maturity mismatch and market liquidity problems which can lead to the funding problem, fire sales and contagion.
3. Concentration of direct and indirect exposure, which is proven to make the system more vulnerable to common shocks

4. Moral hazards and inconsistent incentives. On the one hand, ensure that systemic important banks do not have moral hazard issues. On the other hand to ensure that government guarantees and policies not misused.

Each of the objectives has specific instruments, but it is recommended to have these instruments as part of the framework.

2.2.2.1 Excessive growth of credit and leverage tools

The countercyclical capital buffer (CCB). This instrument has a purpose to act against pro-cyclicality by requiring the banks to build up their buffer in good times of credit growth. This buffer intended to be used during the crisis or a financial downturn. The buffer to be 0% up to 2.5% of risk-weighted assets or even higher if the underlying risk could be justified. This instrument is included in Basel III framework and need to be calibrated by national authorities. (ESRB, 2015)

LTV, loan-to-income (LTI) and debt service-to-income (DSTI) caps. The purpose of this instrument is to restrict specific loan credit risk. LTV is restricting loan to underlying collateral, LTI/DSTI to borrower's income. National Macro prudential authorities to set calibrate and set the values of these caps. (ESRB, 2015)

Sectoral requirements is the type of assessing specific sectors risk and setting special regulatory requirements like restrictions on specific exposures or loss given default (LGD) values. The purpose of these is to allow banks to be more resilient in relation to the specific risky sector and to control credit growth of these sectors. (ESRB, 2015)

Use of Basel III pillar II for Macroprudential purposes. For the case Supervisory review and evaluation (SREP) procedure marked specific institution as a contributor to systemic risk, national authorities can set specific restrictions including sectoral requirement, CCB requirements or raising own funds. (ESRB, 2015)

The systemic risk buffer (SRB). Using this instrument national authority can require a specific group of banks set buffer rates up to 3%. In case rate needs to be set to a higher degree, the recommendation of ESRB and approval of the European Commission (EC) required. The usage is a decision by the national authority of systemically important banks and requesting from these banks to hold SRB. (ESRB, 2015)

Own funds requirements and capital conservation buffer. These additional instruments could be used by national authorities when other measures are not found

effective in controlling of credit growth. As part of these instruments, national authority to request bank addition of own funds and setting of conservation buffer. (ESRB, 2015)

A leverage ratio tool. This instrument limits the ratio of total assets to equity and includes both on-balance and off-balance items. This simple tool is covering all bank portfolio and acting as a type of safeguard, to error check risk assessment of capital requirement which basis of prudential regulation. (ESRB, 2015)

2.2.2.2 Market illiquidity and excessive maturity mismatch tools

Net stable funding ratio (NSFR). This microprudential tool which introduced as part of Basel III is aiming to tackle one-year liquidity to maturity mismatches, and to make banks more resilient to bank runs, fire sales and contagion. Effect of threatening of maturity mismatch problem aims to improve financial stability and because of that could be used as a Macroprudential tool. (ESRB, 2015)

Liquidity buffer ratios. Liquidity coverage ratio (LCR) and other liquidity ratios are macro-prudential measures targeting liquidity shocks. Since bank run type liquidity shock affect banks systemically, these tools can be used for macro-prudential purposes. (ESRB, 2015)

Liquidity charges, these instruments include Pigouvian levy type contribution request. Banks contributing to systemic liquidity risks will be taxed accordingly. (ESRB, 2015)

Other stable funding requirements could be imposed on the national level including a loan to deposit (LTD) limits. (ESRB, 2015)

2.2.2.3 Direct and indirect exposure concentration

Large exposure restrictions are a Micro-prudential tool which can be customized for specific sectors or classes of assets and in this way used for the macroprudential purpose. Additional areas of targeting using this tool could be excessive interconnectedness between instructions to decrease contagion risk. (ESRB, 2015)

Capital-based instruments, this instrument focuses on addressing contagion risks arising from common exposures and interconnectedness of banks. These instruments can be

applied on a sectoral basis and to enhance resilience to shocks by increasing capital buffers. (ESRB, 2015)

2.2.2.4 Misaligned incentives and moral hazard instruments

The globally systemically important institutions (G-SII) buffer. This macroprudential instrument to apply mandatory buffer of 1% which gradually to increase to 3.5% for banks which were found to have global systemic importance. (ESRB, 2015)

Other systemically important institutions (O-SII), this instrument is to impose additional buffer up to 2% to domestically important institutions. A decision on the application of the buffer is up to domestic authorities. (ESRB, 2015)

Additional liquidity requirements could be implied after SREP introduced in Basel II done. In case SREP shows that a group of banks contributing to systemic risk liquidity requirements can be applied to reduce the risk. (ESRB, 2015)

2.2.3 Macroprudential tools

According to (Reinhardt and Sowerbutts, 2015), Macroprudential policies can be divided into three broad categories:

1. Capital Regulation – capital requirements and risk analysis, like rescaling risk-weights on exposures.
2. Lending Standards – restrictions and specifications of loans such as LTV, DTI and underwriting standards.
3. Reserve requirements – financial stability instrument, which can be used as a Macroprudential tool.

To address systemic risk factors, new tools are added, and some traditional microprudential tools are recalibrated for macroprudential usage as shown in Table 1. For example, the contingent capital can be used as a microprudential, macroprudential or a crisis management tool depending on when and where it is applied. The impact of the financial crisis made evident the need for implementation of macroprudential policies on a national level. The policies need to focus on the systemic risk of the specific country and developing such policies could be challenging. Additional take away from the report is the importance

of coordination between macroprudential policy and other policies and regulations. (IMF, 2011)

Macroprudential policies can affect cross-border capital flows in a few ways. Two actions which could happen are regulatory arbitrage and exploiting unregulated status. Regulatory arbitrage is a situation when an institution after the regulation was applied to it, finds a way to avoid regulation and continue doing the same business as before the regulation. Exploiting unregulated status, in our case, is a situation when competing institutions get a regulation selectively applied to them, and those unregulated exploit their status as a competitive advantage to extend their activity. (Reinhardt and Sowerbutts, 2015)

“In general, we cannot identify whether banks adjust to regulations in an intentional way with the explicit aim to circumvent regulation or whether the policy is ineffective because global banks adjust their international activities.” (Buch and Goldberg, 2016, p. 511)

Tools	Risk Dimensions	
	Time-dimension	Cross-Sectoral Dimension
Category 1. Instruments developed specifically to mitigate systemic risk		
	<ul style="list-style-type: none"> • Countercyclical capital buffers • Through-the-cycle valuation of margins or haircuts for repos • Levy on non-core liabilities • Countercyclical change in risk weights for exposure to certain sectors • Time-varying systemic liquidity surcharges 	<ul style="list-style-type: none"> • Systemic capital surcharges • Systemic liquidity surcharges • Levy on non-core liabilities • Higher capital charges for trades not cleared through CCPs
Category 2. Recalibrated instruments		
	<ul style="list-style-type: none"> • Time-varying LTV, DTI and LTI caps • Time-varying limits in currency mismatch or exposure (e.g. real estate) • Time-varying limits on loan-to-deposit ratio • Time-varying caps and limits on credit or credit growth • Dynamic provisioning • Stressed VaR to build additional capital buffer against market risk during a boom • Rescaling risk-weights by incorporating recessionary conditions in the probability of default assumptions (PDs) 	<ul style="list-style-type: none"> • Powers to break up financial firms on systemic risk concerns • Capital charge on derivative payables • Deposit insurance risk premiums sensitive to systemic risk • Restrictions on permissible activities (e.g. ban on proprietary trading for systemically important banks)

Table 1: Macroprudential policies. Source: (IMF, 2011)

As for the implementation of the policies, even though some instruments were a part of international agreements, e.g. capital requirements of Basel II and Basel III, actual

activation and integration of these tools is very different in various countries and therefore have a different effect. (Buch and Goldberg, 2016)

Out of the instruments listed in table 1, rule-based instruments like dynamic provisioning and capital conservation are preferred and should be used more often. Use of these types of instruments during the cycle can give faster policy response when macroeconomic circumstances change, comparing to LTV and DTI. (Lim et al., 2011)

(Diamond and Kashyap, 2016) in their study modify traditional bank run model (Diamond and Dybvig, 1983) to the post-crisis environment including Basel III controls. These Basel III controls were supposed to be implemented already in 2013, but had been postponed for a few times and are now expected to be implemented in 2019. The main reason for the delay was to agree to the complete package of reforms so that banks could roll it out in all geographies simultaneously. (Dunkley and Binham, 2017) The modification by (Diamond and Kashyap, 2016) is adding to the model a possibility of bank holding a liquid asset when the run happens. The study tested whether a regulation similar to liquidity coverage ratio and net stable funding ratio would increase the incentive for the bank actually to hold the liquid asset in order to decrease the likelihood of runs. The analysis showed that Basel III type liquidity regulation could improve outcomes comparing to those which achieved purely from the bank's self-interest. As for any optimal liquidity regulation design, the bank will still need to have some amount of unused liquidity to deter a run on deposits. (Diamond and Kashyap, 2016)

2.2.4 Main systemic risk managing institutions

To coordinate policy research, adaption and implementation were founded systemic risk management institution. This institution exists on the international level, cooperate between and oversee outcomes and spillovers of the policies.

Financial Stability Board (FSB) was created in 2009 by the leaders of Group of Seven (G7) as the successor of Financial Stability Forum (FSF) founded in 1999. The purpose of creation was to coordinate between countries which responsible for significant financial centres. Additional goals were to develop common standards and codes of good practice. In late 2009, membership in the organization was widened to Group of Twenty (G20) and later membership to additional countries was offered. Nowadays the main goal of the organization is to monitor international financial system and provide recommendations for improvement. FSB is seeking vulnerabilities in the financial systems and cooperating with National authorities to treat them. As part of the proceeding Macroprudential policies researched and discussed. (FSB, 2018)

International monetary fund (IMF) is an international organization with headquarters in Washington DC. The organization was founded 1945 and has 145 member countries. The main purpose of the organization is to improve global financial stability, facilitate international trade, improve employment rates and reduce poverty. The organization founding decision was made at Bretton Woods after Second World with the purpose to cooperate between countries and avoid repetition of Great Depression which came after the First World War. (IMF, 2018a)

Regarding Macroprudential policies, IMF plays significant role both in research and publications, and development of the tools. IMF helped several member countries, especially in developing economies, to implement Macroprudential and other public policies after the domestic financial crisis occurred. IMF is closely cooperating with ESRB and BIS to develop stronger reciprocity network for macroprudential policies implementation to ensure financial stability across the globe.(IMF, 2018a)

Bank of International Settlements (BIS) is an international body which was founded after the First World War to facilitate German reparations. After the Second World War its purpose was changed to be an international body to settle cross-border claims. Nowadays it acts as a bank of central banks, and it also owned by 60 members-countries. This body processes and monitors cross-border claims. In addition, BIS hosts the Basel Committee of Banking Supervision which allows dialogue and cooperation on the international scene. This cooperation resulted in Basel I, II and III accords, which required all member countries to implement specific baseline level of regulation.(BIS, 2005a)

European Systemic Risk Board (ESRB) was established by European Central Bank (ECB) in 2010 as a response to the still ongoing Global Financial crisis. It was established as an independent body to monitor and supervise European Union's financial system. It includes representatives of supervisory committees of member states, ECB and European Commission (EC). ESRB also has an expert body of Macroprudential policies implementation, control and adjustment in EU member states. ESRB consists of three main bodies, a general board which preceded by hearing of ECB and have the main purpose of decision making. Second is an Advisory technical committee, which provides advice to all the relevant issues related to ESRB operations. And third is Advisory Scientific committee, which research body in systemic risk related research prior to its implementation.(European Systemic Risk Board, 2018)

As mentioned before ESRB is the main body governing implementation of the macroprudential policies across EU member states. Rules for Capital Requirement Directive (CRD) passed in European Parliament and the Council under directive 2013/36/EU and Capital Requirements Regulation (CRR) under EU Regulation number 648/2012 and

allowed to use these instruments starting January 2014. CRD is to be transposed into national laws, and CRR is to act as EU law. One advantage of having these rules on the EU level is that it provides a common legal framework. (ESRB, 2015)

2.2.5 Databases of Prudential policies

Cerutti et al. (2016) introduced a database (DB) of nine most common prudential tools covering sixty-four countries. The DB, covering the period from 2000: Q1 to 2014: Q4, shows that reserve requirements and LTV were tightened and loosened most commonly. DB analysis further showed that concentration limits, interbank exposures, and capital buffers were targeted more to improve bank resilience, microprudential and macroprudential objectives. On the other hand, LTV and local and foreign currency reserve requirements were targeted to countercyclical policy objectives. (Cerutti et al., 2016)

(Vandenbussche et al., 2012) presented database of all major prudential measures, grouped into 29 categories, covering 16 Central, Eastern and South-Eastern European countries (CESEE) on a quarterly basis from 2000 to 2010. Analysis of macroprudential policies impact on the inflation of housing prices has shown that standard reserve requirements had no effect, while marginal reserve requirement targeting credit growth and foreign funding had a significant effect. (Vandenbussche et al., 2012)

Ostry et al. (2012) prepared Macroprudential policy dummy variables based on IMF AREAR database. The AREAR is a very useful database since it is extensive and data is available for majority countries of the world. Researchers focus on 51 Emerging markets countries and succeed to select those specific categories which fill definitions of Macroprudential policies. The database contains two indexes, one basic and one advanced index. Usage of this database could serve great compliment when of analysis to country or region based Macroprudential policies databases.

Lim et al. (2011) database using IMF sources, it focuses on the Macroprudential policy introduction date and economic consequences which followed it. The database includes categorization of the instruments used, the intensity of their applications, their reported effectiveness. This database captures data for 49 different countries from different world regions.

Gersl & Jasova (2012) prepared DB of credit growth based on 11 countries from Central Eastern Europe (CEE) data. Over the period 2003 till 2008, they found 82 policy indicators and categorized them by the intensity of policy intervention. DB includes

monetary policy measures, supervisory measures, prudential measures and other administrative measures.

2.3 Capital Flows

Capital flows evolved in the global economy in the last few decades. Political openness together with technological infrastructure enabled fast growth of the amount of capital being transferred across borders. Capital flows allowed countries to develop faster and increase their welfare, while also catalyzing financial crisis in some countries. The majority of the flows were in debt financing, direct foreign investment and in debt transfer. In 1980-1990 the majority of capital transfer was from western countries to post-soviet, Latin American, and Asian countries. Many of these countries were moving towards the capitalist regime and allowing to privatize state companies to foreign investors. Meanwhile, debt financing of Latin American countries facilitated their debt crisis. There a country would receive cheap debt financing from the US at the beginning. Those same countries became insolvent later on when the interest rates on the loans grew faster than their possible GDP returns. That crisis affected both sides by putting Latin American countries into high inflation and pushing these countries towards many years of recovery. A big part of the recovery was a transfer from costly foreign credit to a domestic one. Western countries creditor banks suffered as well, because of portfolio risk increase and need to write off insolvent debts. (Feldstein, 1999)

2.3.1 Types of capital flows

In today economy where cross border transaction could be accomplished immediately and in countries part of the European Monetary union even in the same currency. It is important to stand for five most common cross border capital flow types.

1. Flows from bank institutions to financial institutions:
 - Loans and Deposits are a common type of flows, for which banks contribute. Banks trigger these flows by depositing and taking loans on the interbank market, and the sources could vary and included transactions with their subsidiaries in other countries; loans to other banks and non-banks. (IMF, 2010)
 - Repo is another common usage in today economy, where bigger banks use international repo and collateral markets for daily activity purposes. International

agreements between both countries and banks opened global and regional debt securities markets both for financial and institutional investors much easier to access. (ICMA, 2018)

2. Flows related to the official sector are between governments or governmental structures and Central banks. For example, a country could refund ally country on some purchase from this country, for example, humanitarian or military agreements. It also includes claims between corporations and governments, for example, Holocaust survivors' compensations or payments related to international arbitrage. Other international organisations including multilateral development banks.
3. The non-bank financial sector is another source of flows and includes related to fund management, including brokers, hedge funds, special purpose vehicles, unit trusts, credit agencies and other institutions.
4. An additional big chunk of flows related to private non-financial institutions which basically sources from any corporations and firms, those which privately or public owned. It includes enterprises, foreign branches and other. Any purchase and agreement with a foreign counterparty is triggering capital flow in this category.
5. The last category is private sector households which as BIS specifies includes „Individuals, families, unincorporated enterprises owned by households, and non-profit institutions serving households (NPISHs) such as charities, religious institutions, trade unions and consumer associations.“ (BIS, 2013, p. 13)

It worth to give few examples of capital transfer examples which playing an important role in the economy.

Direct investment is another form of capital transfer. To the developing country, it brings technology and access to global markets. It brings benefits to investors among which are access to new markets with cheaper inputs, and a higher yield than in industrialized countries. (Feldstein, 1999)

Investment in international index funds is yet another type of capital transfer. This instrument made an investment in foreign countries available to individual investors at a relatively low cost and in a small amount. Hedging also becomes more available as (Feldstein, 1999, p. 2) explains “Derivative markets allow investors to separate cross-border equity or interest rate risk from cross-border currency risk by hedging the currencies associated with equity or bond positions. This hedging may help to explain an important but still inadequately understood the feature of the international capital market: the contrast

between the very large volume of gross flows and the very small volume of net flows.” (Feldstein, 1999)

2.3.2 Challenges of capital flow

Knowing the fact that cross-border capital flows volume in the world increased significantly in the last decades, it is important to state that different countries experience it differently. As mentioned bellow, capital flows are to blame for challenges in some regions. Challenges are different, (IMF, 2010 p. 7) present them in the following way “...five perceived challenges with cross-border capital flows—volatility, interconnectedness, size, their global drivers, and information gaps—none of which can be handled exclusively at the recipient country level. The case for collective action to address these challenges and thus preserve and extend the benefits of capital flows is strong.”

The volatility of the flows is directly connected to economic cycles of the countries especially talking in consideration that economic cycles in different regions could be pretty different. „While inflows played a role in the era’s prosperity in many countries, persistent surges during 2003–07 were also a factor (among others) in large real appreciations, unmanageable credit expansions and even misallocated investments and asset price bubbles. The process unwound quickly and disruptively with the sudden stop of capital inflows in 2008“ (IMF, 2010 p. 7) Some of these flows stopped because of source country crisis (examples of Nordic countries and Iceland), and in this suddenly disrupted financing to the recipient country. Both recipient countries and source countries learned from these negative externalities and situation changed after the 2007 financial crisis. Author adding „However, strengthened economic fundamentals and more robust external positions—with more domestic-currency denominated debt—have increased resilience in many emerging markets, contributing to their better weathering the crisis and avoiding the worst consequences of the capital flow reversal. Some low-income countries also became recipients of private capital flows during the mid-2000s, suffering a marked contraction during the crisis.“ (IMF, 2010, p. 7)

Procyclical bank funding is another factor in making capital flows more volatile. As during cyclical upswings bank lending increase faster than solid funding from deposits. Emerging economies get funding from wholesale markets, which is for companies with small economy usually cross-border funding from global financial centres. In such way, large cross border positions can build up over time, open it to counterparty risk in a similar way how European countries were relying on short-term funding from US based counterparties. This situation is also leading to the point where significant outflow occurs,

in same cases as the response of controlling counterparty risk or as part of the downturn of domestic economy which leading to deleveraging. (IMF, 2010)

Interconnectedness is another property of challenges which brings with it an element of shock transition. This was demonstrated clearly during the 2007 financial crisis where the world saw that capital flows between countries carry vulnerabilities in addition to efficiencies. In pre-crisis times capital flows between advanced economies dominated, transferring liquidity shocks when crisis arise. Even that portion of capital flows to emerging economies was relatively low, liquidity shocks which affected borrowing to domestic banks and domestic capital markets shock felt well also in these countries. In contrast, this limited reliance on the flows for emerging market countries, made stabilization response easier and faster, comparing to policy response needed by big global banks. (IMF, 2010)

Size of the flows is another challenge. As for the trends, „Capital flows between advanced economies reached unprecedented levels in the years before the crisis, with the accumulation of flows leading to very high cross-border asset and liability positions in relation to GDP for many countries ... Net capital inflows to emerging markets also accelerated through this period peaking in 2007, at US\$550 billion ... In relation to GDP, similarly sized net flows occurred in the mid-1990s, but gross inflows reached double their previous peak at over 11 percent of emerging market GDP... A strong resumption in flows appears to be under way.“ (IMF, 2010, p. 8)

In absolute size from systemic prospective, reliance on flows between the main financial centres required a lot of international cooperation and coordination during the crisis to stabilize the state of the economy and gain resources to address liquidity shock. For example, only United States Federal Reserve contribution for liquidity shocks response was US\$600 billion. (IMF, 2010)

Absorption constraints are additional challenge of size, in the countries with less developed local banking and relative shallowness of the market, foreign capital allocation is less efficient. These efficiency problems are contributors to boom-bust cycles in credit and other areas of the economy. „Findings also suggest that financial integration is associated with greater volatility in domestic consumption for countries below certain thresholds in financial depth and institutional development in areas such as financial supervision or corporate governance. Low income recipients of flows may face particular weaknesses. And while ensuring strong “fundamentals” (or at least stronger than those of peer countries) can strengthen capacity to handle capital flows and avoid sudden stops, they also risk attracting yet more inflows.“ (IMF, 2010, p. 12)

Global drivers of capital flow impose additional challenges. The following are the most important of these drivers and their factors.

Structural factors include well known economic factors which underline cross-border capital investment:

- General population aging – population growth in advanced countries is limited, and with the improvement of healthcare, life expectancy keeps growing.
- Growth potential of Emerging markets comparing to advanced economies – most industrialized economies utilized their biggest growth rates during industrialization. This fast growth period is still expected to happen for the developing countries where agriculture is the main source of GDP.
- Accessibility of information – since the access to the internet, information agencies and countries' economies getting more open, it is easier for investors to study potential investment opportunity and have a better risk assessment.
- The decline of home bias – in the last decades more and more investors decline to believe in investment only in to the local market or regional markets but open themselves to investing in global markets. For example in Japan as a result of home bias decline institutional investors hold in foreign positions increased from 2000 with US\$3 trillion in 2006 with US\$5 trillion. In a US survey of institutional investors showed that 3-5 percent of their portfolio allocated to emerging markets. (IMF, 2010)

Those factors show that we can expect even broader expansion in cross-border investment in the future.

Global liquidity conditions are one of the drivers, those together with increasing risk appetite tend to affect positively capital flows. Global liquidity conditions are something which could be hard to measure and assess, but usually, it assumed that it defined by policy, incentives, regulations and other business decisions in global financial centres by headquarters of biggest financial institutions. Emerging markets in most cases also proxy global “push” factors using U.S. interest rates and growth in advanced economies, but the response to domestic “pull” factors is usually much weaker. (IMF, 2010)

Risk externalities is another driver which means that risk transfers from one country to another and together with it related capital flow. One bank could push risky lending activity after it being limited by policy to another country when policy still not in place. In addition within the economic cycle itself, when the price of assets grows, banks could take

too much risk and generate externality and consequence. In some cases, very small shift of asset prices could increase significantly size flow to specific debtor countries.

Global recycling is the factor which talking about the trend that emerging markets in last decades became a net exporter of capital even that they are the recipient of FDI, portfolio and inflows of banks. The reason is stronger emerging countries current account balance in recent cycles and reserve accumulation allowing them to have a more stable investment in advance economies as protection from capital volatility.

Market microstructure, includes several areas which could generate financial market volatility by design.

- Contagion – in the case of liabilities on different markets hold by the same group of investors, sale in one market could lead to sales on other markets to generate liquidity
- Herd behaviour – the case where information about some debtors hard or costly to get. Opinion by “specialist” can lead to the type of bank run which can appear s fire sale of the financial product.
- Fund managers rewards – incentives focused on short-term fund performance may generate incentives which are different from long term investment objectives.
- Regulatory arbitrage – the willingness of financial institution to keep profits despite the regulation and working on arbitrage. Regulatory arbitrage actions, especially those which trying to maximise the profit in low regulated areas, make the financial system more fragile and vulnerable to shocks. One example is in prior crisis time when in European Banks used structured U.S. housing market in order to overcome capital requirement regulation, which ended as a critical vulnerability. (IMF, 2010)

Information gap related factors are an additional challenge of flows.

- Identification of risks – getting updated information on capital flows is important for effective surveillance. During the last decades it improved, and now it exists several services for this collection: financial account of the balance payment statistics, international investment positions (IIP) data and results of exercises conducted by Coordinated Portfolio Investment Survey (CPIS). Even though crisis revealed need in additional of collecting more data addressing additional dimensions.
- Data frequency – Balance of payment data produced on quarterly and some countries produce their data on a monthly basis. Crisis reminded us that it is not enough, and

it is needed in high frequency data, that will allow to make a pro-active decision or at least have a crisis policy response on time.

- “Net” - Balance of Payment statistics reported on a net basis, which not allowed to see the split of asset and liabilities and see the magnitude of difference and identify potential fragilities.
- Level – current report focus is on the individual countries and not enough done to identification of systemic conditions and aggregate implications on financial stability. Better data could help easier learning about the affect of policy implications on capital flows. (IMF, 2010)

2.3.3 Empirical research examples of capital flow behaviour

In order to understand the impact of capital flows it is important to mention how they impact global liquidity. Researchers used the model for investigating aggregate cross-border lending in the banking sector and found that “supply push” was a component in the leverage cycle of international banks before 2008. (Bruno and Shin, 2015)

(Buch and Goldberg, 2016) study effects and spillovers of prudential policies, regardless of whether a policy was implemented for macroprudential or microprudential concerns. Their reasoning for the broader inclusion is that the same prudential policy instrument, such as interbank exposure limit or LTV cap, could be changed with either macroprudential or microprudential motivation. For example, the interbank exposure limit is used to diminish risks of loan accumulation of banks’ balance sheets. It could have achieved its domestic market goal, while also allowing unregulated foreign institutions to approach affected clients and offer them cheaper lending and in this way extend foreign institution’s lending in the country. The microprudential purpose of the regulation - to force diversification of banks portfolios - was achieved, but from the macroprudential perspective, it can be seen as policy spillover. Bank lending has been identified as a way how prudential instruments spill over. This spillover sometimes has negative and sometimes positive effect on the macroprudential goals depending on the bank activity type, as one banking activity, which is tightened by the regulation, is substituted with another one where the bank can conduct business more freely. The additional key finding was that the balance sheet condition and the bank’s business model are predictors of the intensity of policy related spill over. (Buch and Goldberg, 2016)

(Bengui and Bianchi, 2014) create and analyse a model of capital flow management for the case where we accept capital controls leakage, the presence of “shadow economy”,

and limited regulation enforcement. The analysis shows that as regulations are tightened, and regulated agents behave less risky, unregulated agents respond by taking more risk. The main finding of this paper is that stabilization benefits of macroprudential policies managing capital flows are large despite losses from the leakages. (Bengui and Bianchi, 2014)

(Cornford, 2015) in his study reviewed capital flows restrictions, which are a part of the macroprudential policies, and their incompatibility with the World Trade Organization (WTO) General Agreement on Trade in Services (GATS) and other international agreements on trade in banking services. To adapt to spreading regulatory implementations across the world in the 1990s, the Annex on Financial Services of the GATS allows members to use Prudential Defence Measures (PDM). The exact scope of the PDM was in dispute since its introduction, but the majority of concerns and claims were raised only after the financial crisis of 2007 when the majority of affected countries added macroprudential policies implementation to their agenda. The main issue was whether PDM covers only the immediate response to a crisis or also the usage of prudential tools to restructure the financial system in the long term. One such topic, introduced by Ecuador and debated at a meeting of the WTO Committee on Financial Services, concentrated on the after crisis reforms and possible harm they may cause other WTO member countries. The main concern of the WTO is how macroprudential policies would affect branches of foreign banks operating in the host country implementing the reform. Consequently, there was a new proposal by the Federal Reserve Board in the US for regulating branches of foreign banks such that the regulation would push transformation of branches into subsidiaries. Subsidiarization is creating a separate local legal entity, which falls under the host country regulation and does not fall under GATS rules. (Cornford, 2015) summarised that even though WTO member states acknowledge that macroprudential policies shape and affect capital movements and cross-border banking they take no action to test which macroprudential measures could be challenged under WTO rules. The main reason for it is that these days when macroprudential reforms are still in process in many countries and global agenda has not yet been agreed upon, members are keeping an armistice of sorts, and probably will keep doing it till GATS is revisited and updated.

2.4 Prudential policies and capital flows

Macroprudential policies are considered to be the main defence instrument in regards to any systemic risk and crises. Even though some of the prudential instruments were in place for a long time and macroprudential policy packages as those implemented in today's economy have been in place for a few decades, the legal framework was only finalised in the last few years. One of the keystones was financial crisis of 2007 where legal and operational issues were discussed broadly. Another one was Basel accords, which made

some of the prudential measures to be included into a reciprocity network. In the last years, global institutions added to their agenda surveillance and regulatory matters and have been discussing the application of different prudential tools and ways of monitoring both their efficiency and externalities. However, many decisions about policy implementation were made in economic downturns and crisis times, which did not give policymakers enough time to conduct proper theoretical and empirical analysis on the efficiency of a specific policy for the specific country, expected effects and possible externalities. (Buch and Goldberg, 2016)

To address this issue and track the performance of prudential policies on domestic markets International Banking Research Network (IBRN) was formed. The target of this network is to unite researchers from central banks of different countries, first to set and align Macroprudential policies implemented in each country and later to conduct empirical research using a similar methodology to make data comparable and to allow studying policy effects and spillovers on the aggregate level. The general conclusion of this research was that policy spillovers do exist and that it is important to set up a macroprudential framework and reciprocity network for further coordination.

(Buch and Goldberg, 2016) found that prudential instruments spill over cross-border via bank lending. In some cases, the spill over sign is positive and in some negative, and it depends on specific bank constraints and types of business activity bank trying to conduct.

Business models used by bank and balance sheet conditions affect the intensity of spill over. „Evidence from some countries suggests that some global banks with strong balance sheets responded to tightening foreign regulations by expanding their market shares abroad as local banks presumably contract their balance sheets. Spillovers of foreign regulations into home lending are more likely to arise through hosted affiliates of foreign banks. (Buch and Goldberg, 2016, p. 546-547).

International spillovers on loan growth policy were found not to be large. „One reason for this is that the analysis focuses on adjustment in loan growth along the intensive margin, excluding analysis of adjustment along the extensive margin through the entry and exit into foreign markets and mergers and acquisitions.“ (Buch and Goldberg 2016, p. 547).

As for specific countries, Germany and Italy explored the effects of the policy on the branches versus subsidiaries of Foreign banks. As the reaction to the prudential policy change in the bank's parent country, outward lending by hosted subsidiaries of related foreign banks was unresponsive to changes, while hosted branches reacted more strongly to these regulatory changes. As for Italy, inward transmission was observed when it responded to changes to local reserve requirements and sector-specific capital buffers. (Buch and Goldberg, 2016)

Empirical research conducted in Poland as part of IBRN initiative conducted on Poland data found that for foreign owned banks in the country, capital requirement instrument tightening has a significant negative effect on credit expansion in Poland when analyzed alone. When capital requirements analysis included both parent prudential regulation and local Polish regulation, the effect disappeared. Authors conclude by observing that local regulation matters more to foreign owned banks. (Gajewski and Krzesicki, 2017)

(Avdjiev et al., 2016) found that as local-currency reserve requirements tighten, bank lending is affected whether tightening is in the home country or a country of operation, but the effect was different depending on the capitalization of banks' balance sheet. (Avdjiev et al., 2016)

Empirical evidence shows that capital inflow benefits emerging markets by improving their growth, but it also fuels credit booms and over-indebtedness, contributes to maturity and currency mismatch. To address capital inflows countries used to use capital controls, which could only target non-residents, but with the Macroprudential policy, it's possible to target all participants and take more actions. As for the effectiveness of available tools, recommended counter-cyclical measures are caps on LTV, caps on DTI, limits on credit growth, reserve requirements and dynamic provisioning. In this case, LTV cap is the type of product regulation which sets a specific limit of the loan to value of corporate loan which firm can get, and it applies to all the loans sold in the country. The best tool for addressing currency mismatches of capital flows is limiting foreign liabilities to foreign assets ratio. (Beirne et al., 2014)

Empirical evidence shows that capital inflow was beneficial for emerging markets by improving their growth, but it also fuelled credit booms and over-indebtedness, aided to maturity mismatch and the evolution of currency. Before, to address capital inflows countries used capital controls which could target non-residents only, but with the Macroprudential policy, it's possible to target all participants and take more actions. As for the tools effectiveness analysis, credit pro-cyclicality decrease is recommended using caps on LTV, caps on DTI, limits on credit growth, reserve requirements and dynamic provisioning. In this case, LTV cap is the type of product regulation which sets a specific limit of the loan to value of corporate loan which firm can get, and it applies to all the loans sold in the country. For currency mismatches of capital flows best fits foreign liabilities to foreign assets ratio. (Beirne et al., 2014)

To assess it, (Beirne et al., 2014) measured the effectiveness and externalities of eight Macroprudential tools used to control capital flows in 139 countries. The research found that good predictor of effectiveness could be the structure of the domestic banking system especially high return on assets leads to high effectiveness, while high concentration non-

residential loans are leading to the opposite effect. As for spillovers in non-implementing countries, it was found that high trade integration leads to higher spillover effect and high return on assets reduces the effect. (Beirne et al., 2014)

Reinhardt and Sowerbutts (2015) analysed macroprudential policy impact on cross-border capital flows in 68 countries using data from IMF and BIS databases. Researchers found that domestic tightening of capital requirements leads to increase of lending by foreign banks to domestic non-banking financial institutions, which confirms the existence of leakages and also confirms earlier research by Beirne et al. (2014). Lending standards policy do not increase foreign borrowing because this tool applies to all lending products both domestic and foreign. But researchers also found that after tightening macroprudential policy application banks expand lending as long as the regulation is not affecting it. (Reinhardt and Sowerbutts, 2015)

Taking an example of two banks where one is domestic and is facing tightening domestic regulation while the second one, a subsidiary of a foreign bank to which regulation does not apply, could exploit its status by expanding lending in the country. Researchers found suggestive evidence that uneven application of capital regulation maybe a driver of capital flows, in the way of transferring funds to the markets with lower regulation. To tackle this risk tools and strategies have been developed such as reciprocity agreements, targeted capital management measures, and subsidiarization. One such reciprocity measure included in Basel III involves a countercyclical capital buffer. When the buffer is activated in one country, reciprocity requires supervisory authorities in other countries to apply the same buffer to their banks' exposure to that country, in case it is 2.5 percent or less of risk-weighted assets. Except for this tool, there are no other reciprocity agreements, which means that all other Macroprudential policies similar to those noted earlier from Buch & Goldberg (2016), have the potential for leakages. Research suggests that these types of externalities will disappear at the moment broader reciprocity networks are founded, and policy application will be coordinated between the countries. The important part reciprocal agreement is a high degree of automaticity, similar EU law from 2016 with requiring automatic reciprocation of CCB rates by EU member countries. (Reinhardt and Sowerbutts, 2015)

Out of all of the reviewed literature, the one closest to the subject of this thesis is a paper by Houston et al. (2012) in which researchers study the relationship between macroprudential regulations and capital flows. The basis of their research is the observation that despite a massive increase in cross-border flows over the last few decades, most supervision and regulation stayed on the national level. The research found that part of the flow is for regulation arbitrage purposes and is done by banks to avoid "regulation" tax. As

for the route, significant results suggested that capital flow direction was from a strictly regulated country to one with lesser regulations. Researches compared different types of policies, regulation, supervision and audit mechanisms, but in all the cases the results were robust and positively related to outflow from a source country (“push” effect) and negatively related to being a recipient country (“pull” effect) – which confirmed causality of the effect. As for the selection of a recipient country to transfer the capital, established legal and institutional environment is necessary for capital flow to happen. Additional important factors for the recipient country are level of economic advancement, strong property and creditor rights. (Houston et al., 2012)

In addition to capital flows mentioned previously, researchers have tested if regulation influence decisions to open branches or subsidiaries in foreign countries. Analysis of existing data for 26 countries shows strong evidence that banks domiciled in a highly regulated country have a high likelihood of opening subsidiaries or branches in low regulated countries. (Houston et al., 2012)

3 Methodology

In this section selected articles from the literature review will be described further, focusing on the differences in methodology. We will then explain hypotheses, final model and estimation methods.

Following a literature review, papers by (Beirne et al., 2014), (Houston et al., 2012) and (Reinhardt and Sowerbutts, 2015) are the most relevant to this research. All those papers study the question of regulatory arbitrage and use different approaches and datasets to test it.

Precise analysis of literature convinced us to align methodology and hypotheses with the published research in order to continue current research direction and in this way to contribute more. For this realignment we decided to choose more specific hypotheses and check various data sources to ensure that the constructed dataset is sufficient for hypothesis testing.

(Reinhardt and Sowerbutts, 2015) work is the closest both in methodology and data and in this work we test some of his results using different data sources and model. In (Reinhardt and Sowerbutts, 2015) paper the first hypothesis is “If bank capital requirements are increased, domestic agents will borrow more from abroad”. This hypothesis is tested using country specific dataset from BIS CBS for 37 countries. Data in CBS starts only from 2005 and allows to track outflows and done from the point of view of the sender. By adjusting the model we could use BIS LBS, which tracks inflows from the point of view of the receiver and is available for much longer time span. To check Macroprudential policy actions, we are using much newer and more reliable dataset by (Cerutti et al., 2016) which include updated definition of prudential policies and was prepared in cooperation with local central banks and rigorously verified. Such dataset both will extend our analysis from (Reinhardt and Sowerbutts, 2015)’ 37 countries to 64 countries, and both will reduce the influence of confirmation bias and observer expectancy bias. In this analysis we will use different control variables to control for independent variable effects, instead of exchange rate depreciation and credit growth will be used current account balance as a percentage of GDP, government debt as a percentage of GDP and global risk appetite.

(Cerutti et al., 2016) dataset have not been used for cross-border regulatory arbitrage research purposes and may lead to interesting outcomes and good comparisons. In contrast, this dataset contains very different countries, both from an economic development

perspective and both from GDP composition, running analysis on such dataset where we include advanced economies with agricultural can lead to very high variances. To address this issue, we will analyse data as well in country groups.

(Beirne et al., 2014) methodology explores on the prudential policy spillovers in overall. In his model, he analyses the relationship between each of macroprudential on flows sources from the balance of payment. In addition, he is using several datasets of prudential policies which partly overlap. In contrast in our paper, we are using the unified database and having more precise control on inflows and split into categories based on the Bank of International Settlements dataset. In such a way his methodology differs from us, but results can be relevant to compare.

(Houston et al., 2012) paper deals with a similar research question on regulatory arbitrage and spillovers. Furthermore their model is very similar to our's in the way of looking at the relationship between inflows and prudential policy, in addition to usage as independent variables many country specific financial variables such as institutional quality, creditor rights, property right and others. As a source of prudential regulation they are using survey results done in several types of research, which could suffer from response bias and could be hard to compare. (Houston et al., 2012) results are relevant to compare to our results.

Hypothesis 1: If capital requirements increased in the bank's country, domestic financial agents would borrow more from abroad

As capital requirements for local banks increase it will affect the profitability of lending and will generate less revenue and will shrink their activity in the country. Such environment will be favourable for branches and subsidiaries of foreign banks. Therefore inflow into this country will increase both overall and specifically in the loans category.

Hypothesis 2: If capital requirements increased in the bank's country located in CEE region as result of the Basel accord, domestic agents borrowing from abroad would increase significantly.

Capital requirements empirically confirmed to relate to increase of cross-border transfers and possible type of regulatory arbitrage. Looking over a homogenous group of countries with a prevalence of few big European banks could give a bigger indication of cross border borrowing in the region.

Hypothesis 3: If consumer credit capital buffer increased in bank's country, domestic agents borrowing from abroad would increase.

As consumer credit capital credit buffer will increase for local banks, they will need to set aside more money for the buffer purposes, which will push them to reduce lending to some categories of consumers. This opportunity will be taken by foreign subsidiaries and branches to whom this regulation not applies and therefore capital inflow in to country will increase both overall and both in loans category. As capital requirements and credit capital buffer tightening will shrink activity of local banks, not all the substitution will be done by foreign branches and subsidiaries but also by non-banks. Limitation of this hypothesis is that usage of this policy in years 2000 till 2014 was relatively small.

As noted for testing those our hypothesis, we will make estimation inspired by (Reinhardt and Sowerbutts, 2015) baseline model. To do so, we will estimate the effect of the prudential action in the country i on the change in the borrowed amount from all other countries using panel regression bellow:

$$\Delta Capital Flow_{i,t} = \alpha + \beta Prud_{i,t-x} + Controls_{i,t-1} + \delta_i + \epsilon_{i,j,t}$$

In this regression $\Delta Capital Flow$ is cumulative of four quarters (following base year) capital flow from all countries to country i as a percentage of nominal GDP in base year non-banks in country. $Prud$ is macroprudential indication which takes value of +1 when specific prudential policy toughened, -1 when loosened and 0 when it not changed. We run nine separate regression to test each one of the indicators. $Controls$ includes Real GDP growth, Inflation as a percentage of GDP growth, Current account balance as a percentage of GDP, Fiscal balance as a percentage of GDP, Government debt as a percentage of GDP and Global Risk appetite. δ_i are fixed effects for country taking macroprudential action. Standard errors $\epsilon_{i,t}$ are clustered at (i) level.

All the amounts will be expressed in millions USD. To test the hypothesis Pooled Ordinary Least Squares (POLS) and Fixed Effects (FE) regressions will be run.

In our work special attention will be designated to study of effects of policies in Central East European region, a special group was designated to it, and it will be presented in more details as part of robustness checks part.

4 Data

In this section described datasets, how they collected, analysis and final manipulation and merging of it to be used for empirical analysis

4.1 Prudential Policies

We will use (Cerutti et al., 2016) database which has most updated and precise data about macroprudential and microprudential policies implementation for the majority of the countries. Since it is many times hard to isolate one time of usage and especially that same instruments can be used by different countries with microprudential purpose, macroprudential purpose or both, authors created a database of prudential policy tools without a specific macro or micro designation.

Argentina	Germany	Malaysia	Singapore
Australia	Greece	Malta	Slovak Republic
Austria	Hong Kong	Mexico	Slovenia
Belgium	Hungary	Mongolia	South Africa
Brazil	Iceland	Netherlands	South Korea
Bulgaria	India	New Zealand	Spain
Canada	Indonesia	Nigeria	Sweden
Chile	Ireland	Norway	Switzerland
China	Israel	Peru	Taiwan
Colombia	Italy	Philippines	Thailand
Croatia	Japan	Poland	Turkey
Czech Republic	Kuwait	Portugal	Ukraine
Denmark	Latvia	Romania	United Kingdom
Estonia	Lebanon	Russian Federation	United States
Finland	Lithuania	Saudi Arabia	Uruguay
France	Luxembourg	Serbia	Vietnam

Table 2: List of Countries, source: (Cerutti et al., 2016, p. 501)

The database collected for a period from the beginning of 2000 till the end of 2014 on a quarterly basis and includes data on 64 countries (see Table 1). Types of included tools are capital buffers, interbank exposure limits, loan-to-value ratio limits, concentration limits, and reserve requirements (Please see table 3). Out of these five types, nine prudential tools constructed when capital buffer was divided into three sub-indexes (Real estate, Consumer credit and others) and reserve requirements were divided to two indexes (reserve requirements on foreign currency denominated accounts and reserve requirements on local currency denominated accounts).

Variable name	Explanation
sscb_res	Change in sector specific capital buffer: Real estate credit. Requires banks to finance a larger fraction of these exposures with capital.
sscb_cons	Change in sector specific capital buffer: Consumer credit Requires banks to finance a larger fraction of these exposures with capital.
sscb_oth	Change in sector specific capital buffer: Other sectors. Requires banks to finance a larger fraction of these exposures with capital.
cap_req	Change in capital requirements. Implementation of Basel capital agreements.
concrat	Change in concentration limit. Limits banks' exposures to specific borrowers or sectors.
ibex	Change in interbank exposure limit. Limits banks exposures to other banks.
ltv_cap	Change in the loan-to-value ratio cap. Limits on loans to residential borrowers.
rr_foreign	Change in reserve requirements on foreign currency-denominated accounts.
rr_local	Change in reserve requirements on local currency-denominated accounts.

Table 3: List of Prudential policies in the dataset, source: (Cerutti et al., 2016, appendix)

Dataset based on analysis of central bank reports, Global Macroprudential Policy Instruments (GPMI) conducted by IMF, IMF Exchange Arrangements and Exchange Restrictions DB and other databases related to specific countries. In addition to that researchers made an extra effort for the cases of countries where data was missing and took it from other papers. When the database was finalized, researchers worked with representatives of central banks to check that data reflect reality and corrected indexes accordingly.

Seven of the nine indexes contains data about tightening (+1), loosening (-1) or not taking any action (0). This type of entry in aggregated form allows comparison of the strength of prudential policy across the countries in the specific time frame, simply by summing values from Q1:2000 till needed quarter we can compare the intensity of the changes.

Three remaining instruments contain different indexes as mentioned by author "For some policy instruments, we are able to record the intensity of the changes more precisely. This is the case for those instruments that can be summarized by a single numerical indicator. An example of these instruments is reserve requirements on local- or foreign currency deposits. Although there is some variation across countries." (Cerutti et al., 2016)

Some indexes have specifics as General Capital Requirements which included in Basel I, II and III. For this instruments after implementation not exists losing phase and the index never takes the value of -1 since it is assumed Basel regulation will not be removed. Basel related indexes also documented of changing relatively frequently according to each new Basel Accord implementation deadline.

In addition to that dataset contains special columns to have an easier mapping to two common data sources to help researchers to keep consistency with other papers using the

same dataset: International Monetary Fund, International Banking Statistics and Bank of International Settlements database.

Beside it, dataset contains cumulative variables of two types

- Quarterly cumulative: Capital buffer cumulative for all three sectors, and two cumulative indexes for all instruments (taking in consideration the actual index and taking inconsideration if any index can be between -1 and +1)
- Cumulative for all period, cumulative indexes which accumulate from beginning 2000 till the end of 2014

4.1.1 Data manipulation

Cerutti et al released his database and online appendix to open access. Files are available in Microsoft Excel format. During the research, we imported files to Stata application. Some observation in this DB had values of “.a” which stands for that information about the specific instrument is not available and “.b” which stands for that this instrument not available in the country as following „Note that the total number of episodes varies across instruments. As explained in the previous section, instruments that are not available to policymakers due to the absence of legislation that authorizes their use are coded as missing in the database. For some countries, instruments that are introduced during the sample period are coded as of the date the legislation to authorize them is passed. In these cases, if the introduction of the instrument is considered a tightening of the policy stance, it is coded as 1 in the index. There are other instances when the introduction of the instrument does not affect the policy stance, such as introducing reserve requirements and setting them at 0, which are coded as 0 in the index.“ (Cerutti et al., 2016, p. 492) In our dataset, those are marked in Cerutti dataset as .b we be recoded as 0. Those who marked as .a we marked as missing. Further, we reshaped the date and constructed it in a way that it will be one row per country and specific country of the year, in this way it makes easier to analyse data from other sources for this specific quarter of the year.

As noted before in Cerutti dataset there are some values which are bigger than +1 and smaller than -1, these values in our dataset recoded to +1 and -1, to keep same min and max for all prudential variables. To keep the consistency also cumulative variables were recalculated for affected indicators (Please see Table 4). It affected several variables:

- Reserve requirements on foreign currency denominated accounts, change in many occurrences.

- Reserve requirements on local currency denominated accounts, change in many occurrences.
- Specific capital buffer: Other sectors, where Brazil had +2 and -2, during several occurrences of the debt crisis.

VARIABLES	N	mean	sd	min	max
sscb_res	3,840	0.00599	0.117	-1	1
sscb_cons	3,840	0.00156	0.0559	-1	1
cap_req	3,420	0.0292	0.169	0	1
Concrat	2,400	0.0125	0.118	-1	1
Ibex	2,100	0.0110	0.109	-1	1
ltv_cap	3,840	0.0122	0.158	-1	1
sscb_oth_f	3,840	0.00286	0.0739	-1	1
rr_foreign_f	3,840	0.0102	0.191	-1	1
rr_local_f	3,840	-0.00911	0.278	-1	1
PruC2	3,840	0.0508	0.386	-1	1
cum_sscb_res	3,840	0.122	0.653	-3	4
cum_sscb_cons	3,840	0.0323	0.264	-1	2
cum_sscb_oth_f	3,840	0.0794	0.349	-1	2
cum_rr_foreign_f	3,840	0.237	1.530	-8	12
cum_rr_local_f	3,840	-0.509	2.217	-11	13
cum_cap_req	3,420	0.264	0.575	0	2
cum_concrat	2,400	0.362	0.743	-1	4
cum_ibex	2,100	0.310	0.676	-1	4
cum_ltv_cap	3,840	0.188	1.062	-3	8
cum_sscb_oth_f	3,840	0.0794	0.349	-1	2
cum_rr_foreign_f	3,840	0.237	1.530	-8	12
cum_rr_local_f	3,840	-0.509	2.217	-11	13
cum_PruC2	3,840	0.780	3.951	-15	25

Table 4: Summary statistics prudential variables in the dataset, source author computation.

To be able to compare the data efficiently we decided to split 64 analysed countries into three groups:

1. Advanced economies which include 24 countries: United Kingdom, France, Germany, Italy, United States, Canada, Japan, Austria, Belgium, Luxembourg, Netherlands, Finland, Greece, Ireland, Malta, Portugal, Spain, Denmark, Norway, Sweden, Switzerland, Iceland, Australia, New Zealand.
2. Emerging markets and developing countries of Asia, Africa and Latin America which included 24 countries: Brazil, Chile, Colombia, Mexico, Peru, India, Indonesia, Malaysia, Philippines, Thailand, Vietnam, China, Mongolia, South Africa, Argentina, Uruguay, Kuwait, Lebanon, Saudi Arabia, Taiwan, Hong Kong, South Korea, Singapore and Nigeria.
3. All Central Eastern Europe and other which included 16 countries: Turkey, Israel, Bulgaria, Russian Federation, Ukraine, Czech Republic, Slovak Republic, Estonia, Latvia, Hungary, Lithuania, Croatia, Slovenia, Poland, Serbia and Romania.

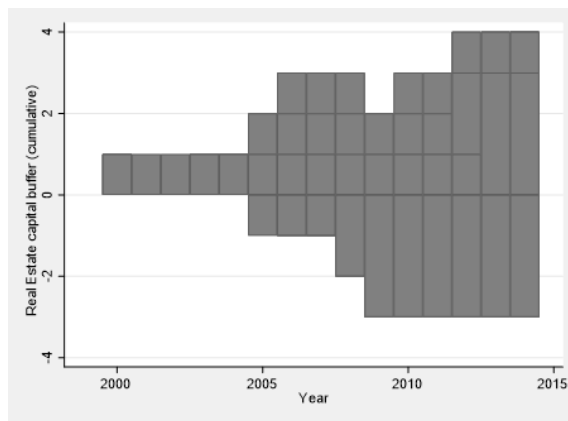


Figure 1: Development of Real estate capital buffer. Source: author computations.

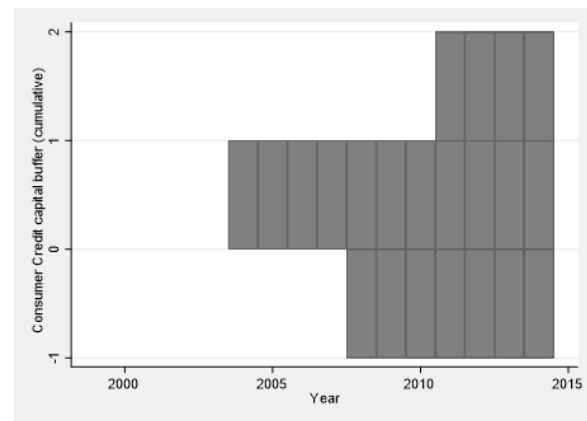


Figure 2: Development of Consumer credit capital buffer. Source: author computations.

To explore prudential policy data, please see selected graphs visualizing the data on prudential policy. Following figures show data for all 64 countries in the dataset and for the time span from 2000:Q1 till 2014:Q4. Real estate capital buffer increase (see graph 3) in regulation during the crisis in 2007 with the trend of decrease to level on Basel II in post crisis time (after Basel II was applied to these countries). Consumer credit capital buffer only slowly started implementation in India in 2004, and other countries implemented them as 2007 Financial crisis response in 2008 (see graph 4).

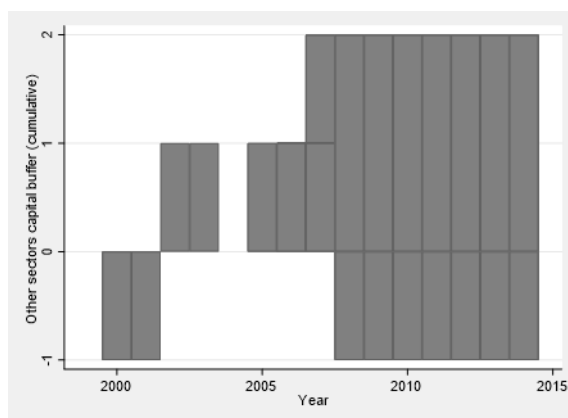


Figure 3: Development of Other sectors capital buffer. Source: author computations.

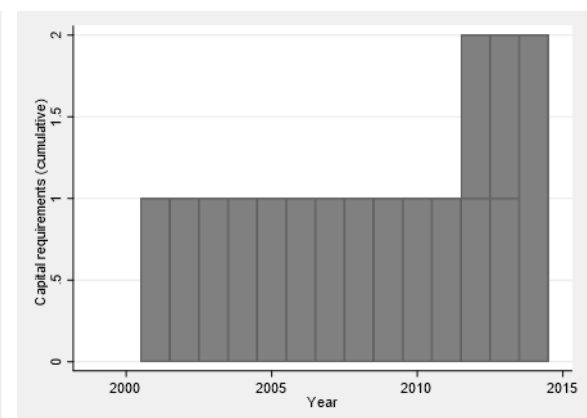


Figure 4: Development of Capital requirements. Source: author computations.

Regulation in other sectors is a mixed category which contains all sector specific capital rudiments which not included in the real estate and consumer credit category and were implemented by policymakers. Types included are regulation on exchange exposures, foreign currency loans, unhedged borrowing, public sector loans, retail exposures, shares purchase and more (see Figure 3). The decrease in the beginning of 2000 can be explained by Brazil making steps to recover from the crisis and attract foreign investment by lowering

capital requirement on exchange exposures. In the later years, trend was increasing of capital requirements with decrease mainly for adjusting purposes. Most of these instruments in observation years still not broadly used on contrast to general capital requirements (see Figure 4) which are the point of regulation from Basel I and getting tightened and adjusted both in Basel II, Basel II part 5 and Basel III. As seen in the graph there is no loosening, since even Basel accord adjustments which could be seen in absolute terms as loosening is considered as no action rather than loosening (Basel II).

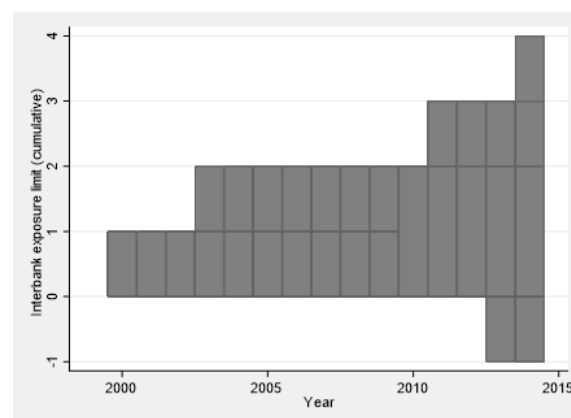
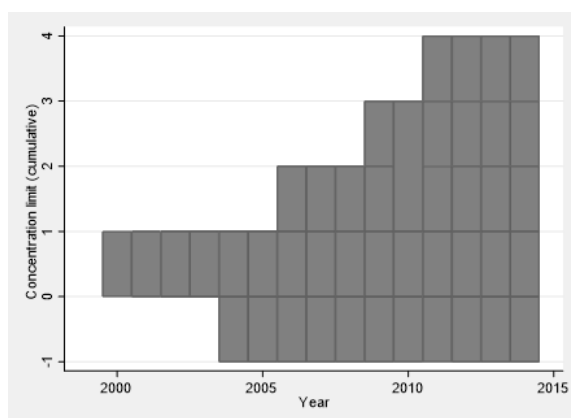


Figure 5: Development of Concentration limit.
Source: author computations.

Figure 6: Development of Interbank exposure limit.
Source: author computations.

Concentration limit regulation varies among the countries, but as seen on the graph (Figure 5) the tendency is tightening with awareness of authorities, most tightening here were done on the law making side but specifying concentration limit and setting legislation to serve decrease of related systemic risks. One episode worth mentioning is in Poland, of loosening country laws to the level of CRD II in 2011. As for the interbank exposure limit (see Figure 6), in this period it was seen mainly tightening of this instrument in some cases as the response of local financial crisis, as a response to a global financial crisis or as a preventive act to limit country economy exogenous factors. Only loosening episode is related to Croatia when interbank exposure toward European banks was loosened as part of joining EU in 2013.

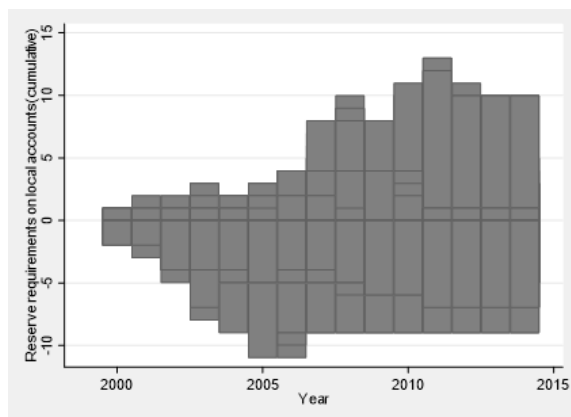


Figure 7: Development of Reserve requirement on local currency denominated accounts. Source: author computations.

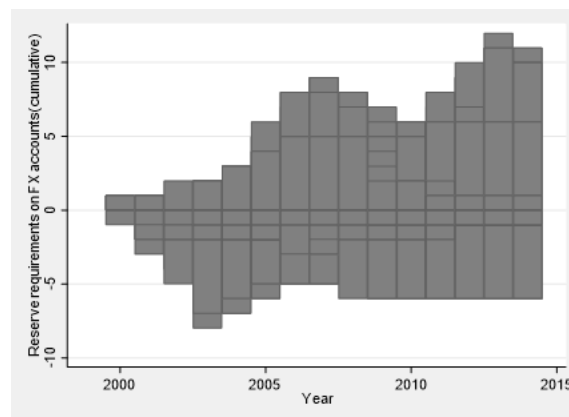


Figure 8: Development of Reserve requirement on foreign currency denominated accounts. Source: author computations.

Reserve requirements tools are very frequently used tool by in majority of countries central banks. Furthermore, this tools is mainly Monetary policy tool; even that can be adjusted for prudential purposes. Since foreign denominated accounts (Figure 8) could be considered as riskier, we see more tightening action than local currency accounts (Figure 7).

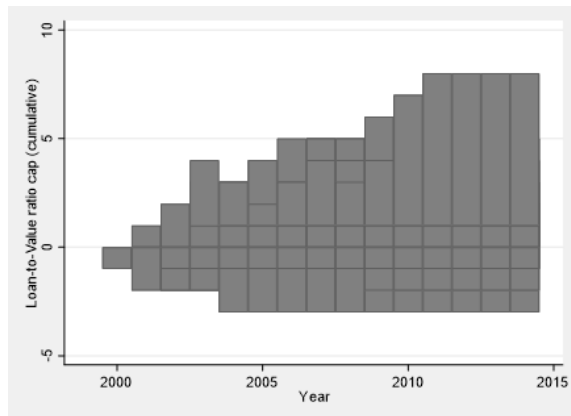


Figure 9: Development of the Loan-to-Value cap. Source: author computations.

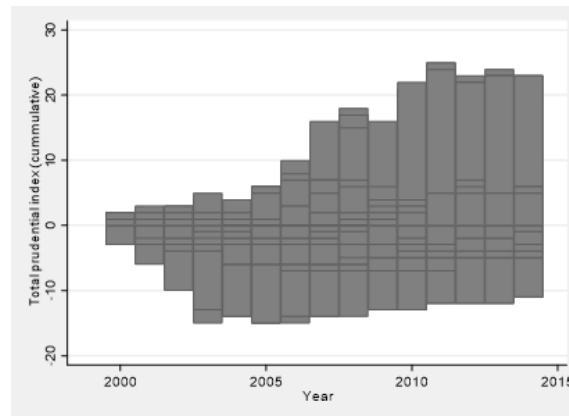


Figure 10: Development of total prudential index. Source: author computations.

Loan to value cap is an instrument which is an active tool which used in many countries not only for prudential purposes. The general trend of tightening of this instrument related firstly to response to the Sub-prime crisis and increased attention to real estate and other credit bubbles on domestic markets. In contrast, as global economies were recovering from the 2007 crisis, this regulation was loosened and replaced by more targeted legislation and policy tools. If we look on cumulative rates of policy usage across discussed 64 countries, we see trend first of more usage and in general of tightening. That trend can be explained by that current generation of policy makers are trust more prudential policies and benefits it

brings, in addition, empirical research and wide spread of practice helpful in decision making towards policy application.

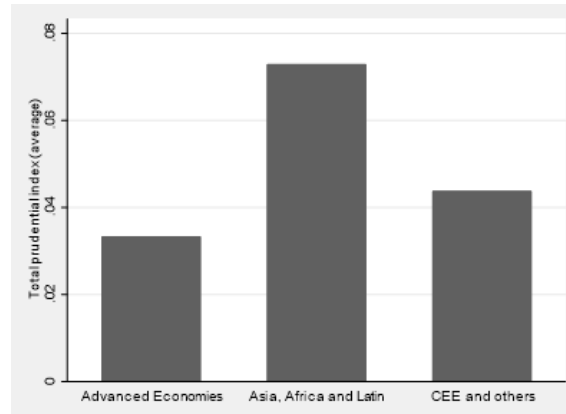


Figure 11: Average of total prudential index comparison between country groups. Source: author computations.

When comparing country groups on basis of total prudential index average (see Figure 11) we see that Asia, Africa and Latin are leading, since this group contains many emerging markets countries where economic system not yet developed enough and lacking fundamentals which advanced countries already have. As for CEE developed and developing countries, we see that the usage of prudential tools is seen as good fundamental which can help in fast economic development and growth.

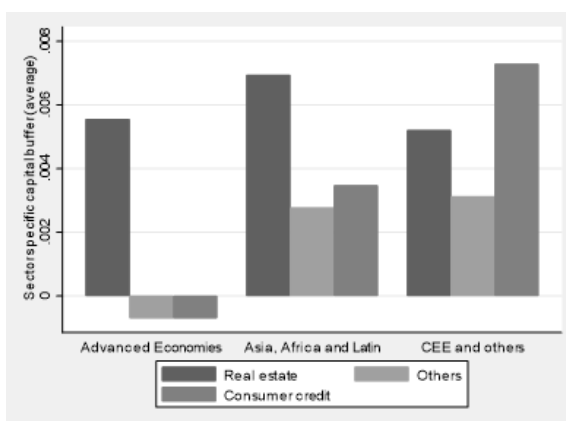


Figure 12: Average of sector specific capital buffer, the comparison between country groups and types. Source: author computations.

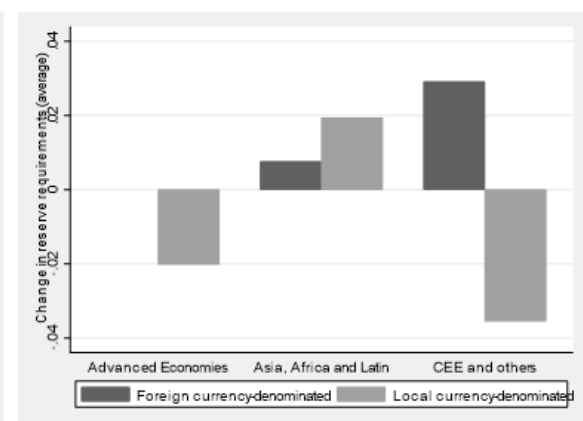


Figure 13: Average of reserve requirements, the comparison between country groups and types. Source: author computations.

This comparison looking on different types of sector specific capital requirements among groups of countries (see Figure 12), and we could see tendency that real estate is used among

all three group and other two usages is limited, main reason seems in record of efficiency of this capital buffer and secondly of more awareness after mortgage crisis in 2007-2008. If we look at reserve requirements averages comparison (see Figure 13), we can see in Asia, Africa and Latin tightening trend which comes from the tendency of developing countries to stabilize their economies. As for reasons of loosening of local denominated accounts in CEE it could be explained by the fact that observed period is including Stage III of European Monetary Union implementation and those countries were moving to Euro currency, which affected other advanced economies outside EMU deregulating local currency for strengthening purposes against Euro.

4.2 Capital Flows

We use International Banking Statistics database published on a quarterly basis by BIS investigate the influence on capital flows. As part of covering international banking activity by Committee on the Global Financial System data published on the country level. Reports collected following unified guidelines and key discrepancies highlighted in country summaries. Datasets published on the BIS website quarterly in January, April, July and October with a lag of 16 weeks, revised data published in March, June, September and December. Data contain two types of datasets: locational banking statistics (LBS) and consolidated banking statistics (CBS). Location banking statistics for reporting country contain currency composition of bank' balance sheets and geographical breakdown of reporting country counterparties. (BIS, 2013)

CBS measure countries risk exposures and consolidated claims of internationally active banks operating in reporting countries, a position between country A and country B. LBS measure positions from bank residence perspective, from the bank in country A to all rest countries. This paper will use only data generated from LBS. To understand it the better reason why LBS was chosen, please see the following the short description of these two data sources.

As part of CBS database contains data about 31 reporting countries mostly for Organisation for Economic Cooperation and Development (OECD) countries and 120 recipient countries. In this source data starts from last quarter of 1983, but since data of most countries became available only, later than 2000, we were to use in the analysis only countries for which we have available prudential data at the same time span, similar to limitations of (Reinhardt and Sowerbutts, 2015) paper. CBS contains data reported by local head offices and includes foreign affiliates (such as branches and subsidiaries) and

consolidated before publishing by netting with inter-office positions. Claims data includes loans, debt securities, equities and other financial assets. (BIS, 2013)

Claims data posted as part BIS Quarterly review and updated in the database located on the website of the organization. For analysis, we could use Report 9B from CBS, where are getting a list of claims based on reporting bank nationality. In this report what is important is bank reporting nationality and not a geographical location. For example branch of a Japanese bank in Germany issuing a loan to a German bank, will be recorded as a foreign loan. However, the same bank when issuing a loan in Japan to another Japanese bank will be categorized as domestic loan and will not be recorded in the BIS database. (BIS website)

The CBS is made by the ultimate risk way and by the immediate counterparty. Ultimate risk includes components which can mitigate credit risk as guarantees, collateral, and purchased credit protections (used to transfer bank credit exposure to another counterparty). The immediate counterparty is the entity with whom bank borrowing or lending. For example, if we will take the Russian bank which provides a loan to a Czech company and this loan guaranteed by Polish bank. In case of immediate counterparty basis, this loan will be reported by Russian and claim on the Czech Republic. In contrast, on an ultimate risk basis discussed loan would be reported as loan Poland since, for the case of Czech company not meeting obligations, Russian bank will be exposed to Polish bank as a guarantee of the loan. Ultimate risk basis is a good measure of exposure since risk transfers could create gaps. Nevertheless, since in this paper focus on capital flows immediate counterparty is the right indicator in a similar way how it was done in other papers related to this topic including (Beirne et al., 2014) research.

In contrast, LBS view is from point of location of the banking office, and it captures a net of inflows and outflows to all other countries. It includes all banks located in BIS reporting countries and their counterparties and includes outstanding claims (financial assets) and liabilities of this banks. All dataset included 200 countries and believed to capture 95% of all cross-border banking activity, including intragroup positions (position between the offices of the same banking group) of banks. Positions reported calculated using exchange rate-adjusted changes and appear in \$US million. For this paper, we will use report "A6.1" which reports cross-border positions by instruments, a sector of counterparty and currency and outputs in \$US millions. This report has very detailed split to currencies and instruments including split to banks, non-banks, intragroup, loans and deposits, financial and non-financial. Unfortunately, most of these split not available for a period of our dataset, since than we will use only "All instruments" and "Loans and Deposits", the only available

from 2000. We ended to having for each country following information for all instruments and for loans and deposits: stock and flow for the selected quarter (see Table 5). (BIS, 2005b)

Variable name	Explanation
B_S_All	All instruments. Amounts outstanding / Stocks
B_S_LD	Loans and deposits. Amounts outstanding / Stocks
B_F_All	FX and break adjusted change (BIS calculated). All instruments
B_F_LD	FX and break adjusted change (BIS calculated). Loans and deposits

Table 5: List of Flow variables in the dataset, source: author notation

4.2.1 Data manipulation

Full dataset of LBS was downloaded, and only 64 countries from (Cerutti et al., 2016) dataset were merged.

We had a problem with data was with Serbia and Montenegro, since during the period 2000 till 2014. Since Montenegro economy is relatively small, we merged “Serbia and Montenegro” with “Serbia” and represented this as Serbia and keeping 2006 Q4 as a missing value since it was a quarter of data change.

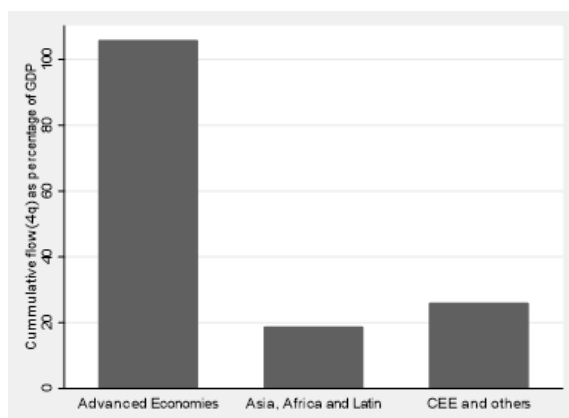


Figure 14: Cumulative flow over four periods as a percentage of GDP. All instruments.

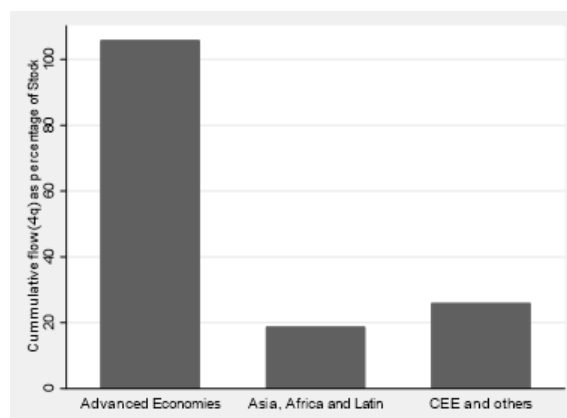


Figure 15: Cumulative flow over four periods as a percentage of total stock. All instruments.

In the graph above we look on cumulative flow over four quarters for all countries between 2000:Q1 and 2014:Q4. On left graph (see Figure 14) we see cumulative flow as a percentage of nominal GDP and on right graph (see Figure 15) as a percentage of total stock.

As literature review suggest the share of flows in advanced economies significantly higher. As comparison as a percentage of GDP to stock, we see that trends on the graphs are very similar.

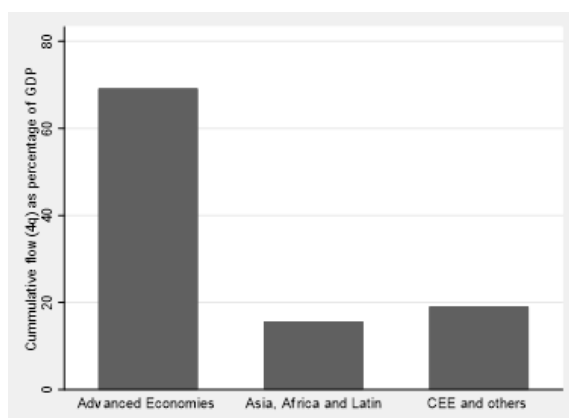


Figure 16: Cumulative flow over four periods as a percentage of GDP. Loans and deposits.

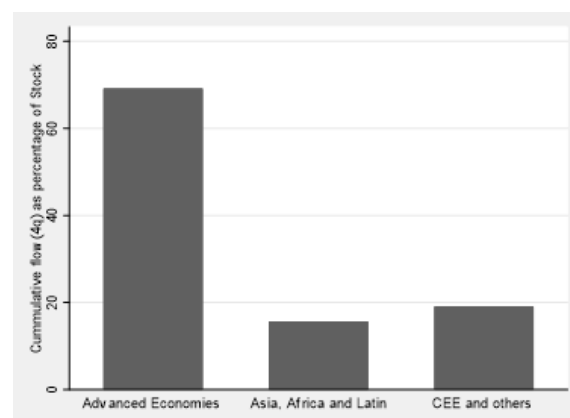


Figure 17: Cumulative flow over four periods as a percentage of loans and deposits stock. Loans and deposits.

When we compare loans and deposits only, we can see the leadership of advanced economies remains, but gap is getting closer. When comparing as a percentage of GDP (see Figure 16) similar to Figure 14, but as the stock we take loans and deposits stock (see Figure 17) chunk, it keeps the similar ratio.

4.3 Control Variables

Following literature review we decided to construct control variable in a counterfactual way, to allow us capturing determinants of capital flows and predict them even when it is no policy intervention during the estimated quarter. Following variables were constructed:

1. Inflation – year on change, source World Economic Outlook (WEO) DB by IMF.
2. Current account balance – as a percentage of GDP, source WEO DB by IMF.
3. Government debt – as a percentage of GDP, source WEO DB by IMF.
4. Fiscal balance – as a percentage of GDP, source WEO DB by IMF.

5. Real GDP growth – year on year change, source WEO DB by IMF.
6. Global risk appetite – index, source Chicago Board Options Exchange (CBOE).

WEO DB is updated twice a year (April and September/October) and contain selected macroeconomic data series for 193 countries. This data collected based IMF methodology and is known by the correctness of data, this making in a good source for control variable for estimation on my topic. Data in this database available on end of year frequency and strats from 1980. In addition to mentioned above variables, Nominal GDP value was extracted from this DB for Capital Flows calculation purposes. Bellow you can see summary statistics of variables (see Table 6) which were used for control purposes and nominal GDP. (IMF, 2018b)

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Inflation	3,900	4.488	6.388	-3.953	85.74
Current account	3,900	0.515	8.337	-27.35	45.46
Government debt	3,779	52.35	35.97	0.0650	236.1
Risk appetite	3,904	20.95	7.350	11.51	48.78
GDP growth	3,896	3.384	3.479	-15.14	17.34
Nominal GDP	3,900	799.2	1,939	1.236	17,428
Fiscal Balance	3,872	-1.471	5.908	-32.05	43.30

Table 6: Summary statistics of all control variables used in this work

4.4 Final data structure and estimation

In addition to data manipulation already noted before we had to prepare control variables. WEO had data for all 64 countries in the dataset, however in several occurrences for specific years data where missing. Only exception government debt which did not have data on Mongolia. Countries for which data was missing related mainly to periods of the beginning of 2000 and desirable alternatives not found, these periods marked as missing in our dataset.

Prudential policy variables and capital flow data was in quarterly frequency, as for desired control variables several countries had no data available in quarterly form, especially for first part 2000s. To have all controls calculated in the same way, we used linearly interpolated year end data from WEO DB. For risk appetite we used volatility index (VIX) from CBOE which was available in daily closing terms for trading days, for estimation it converted to quarterly periods using mean based collapsing.

For estimation and preparation econometrical software Stata 15.1 was used. Final dataset was panel data, where *ifscod*e (a numerical representation of country) as a panel variable and *qdate* (quarterly date) used as time series variable. The panel found to be balanced. In the first Pooled OLS and FE estimations on especially an aggregate level results not showed good fit and satisfactory significance. Based on analysis structures of regression, we found that usage of cluster-robust standard errors improves estimation results. For further Pooled OLS estimations, we used cluster-robust error option clustered by country. In FE it did not improve estimation, but the opposite made some estimation not significant, since that we did not use it the estimation.

To analyse endogeneity problem, we compared fixed effects and random effects and checked using the Hausman test and validated need in FE. Endogeneity problem discussed in the results part.

5 Results

Following our model specifications and estimators choice in this part, we will interpret the results and discuss the hypothesis.

Hypothesis 1: If capital requirements increased in the bank's country, domestic financial agents would borrow more from abroad

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Capital requirements	-63.66*** (22.12)	-122.9** (48.99)	-52.88*** (7.865)	31.40* (17.86)
GDP growth	3.910 (2.656)	39.88* (20.75)	6.660*** (1.053)	-1.772 (2.814)
Inflation	-1.236 (1.150)	30.57 (44.63)	0.347 (0.255)	-1.432 (1.689)
Current account	3.176 (6.075)	14.91 (19.40)	-4.340*** (1.058)	4.836** (1.883)
Fiscal Balance	6.456 (5.344)	-10.41 (19.45)	0.232 (1.473)	3.530 (2.606)
Government debt	-1.130 (1.102)	-2.326 (1.896)	-0.405** (0.175)	-0.243 (0.461)
Risk appetite	-6.092*** (2.100)	-10.59** (4.480)	-3.192*** (0.563)	-1.628* (0.916)
Constant	253.7** (116.4)	320.9* (155.3)	68.91*** (12.60)	73.35 (42.99)
Observations	3,143	1,330	880	933
R-squared	0.072	0.156	0.491	0.189

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: POLS estimation results. All instruments included. Source: author computation.

In estimation above we test the relationship between dependent variable cash flow and independent variable capital requirements, the negative value of the coefficient is tightening of this regulation, and positive is loosening. Based on results for all instrument (see Table 7) and for loans and deposits (see Table 8) for all countries we reject the null hypothesis on significance level $P < 0.01$ and conclude that as domestic agents borrow more as a response to capital requirements increase. Bellow, we see that fit (R-squared) is very low at 0.072 and at 0.064, which is making sense since countries are very different in this dataset. Effect of macroprudential policy on advanced industrialised economy very different than on agriculture economy country. We can assume that putting in the same regression in such countries as the United Kingdom and Germany on one side and Nigeria and Lebanon on other generating very different variances. Another reason for bad fit is that these years include the global financial crisis of and several local economic crises of several countries in the dataset. These results both from estimation significance and both from a fit perspective

consistent with (Reinhardt and Sowerbutts, 2015) results and confirm the possibility of arbitrage on a larger set of countries.

Based on the literature, list of countries for advanced economies overlap with (Reinhardt and Sowerbutts, 2015) dataset and can be seen as direct confirmation of methodology especially with strongly significant results when looking of loans and deposits part. Looking on Asia, Africa and Latin countries we see positive coefficient which not reject Null hypothesis and could indicate lack of policy spillovers in this group. Furthermore, it confirms in research (Buch and Goldberg, 2016) discussing both positive and negative effects. These effects were more prevalent when regressing done for smaller groups of countries as part or robustness checks.

Hypothesis 2: If capital requirements increased in the bank's country located in CEE region as a result of the Basel accord, domestic agents borrowing from abroad would increase significantly.

Second hypothesis related to discussed tables (see Table 7 and Table 8) only the "CEE and others" countries group we could see both high significance and both high fit, we will reject Null hypothesis and conclude that in a group of this countries potential probability of regulatory arbitrage as the response of capital requirements tightening.

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Capital requirements	-42.11*** (14.86)	-86.54*** (29.53)	-39.11*** (6.419)	32.01* (15.76)
GDP growth	5.103** (2.403)	32.85 (20.28)	6.206*** (1.036)	-1.461 (2.600)
Inflation	-1.013 (0.784)	15.59 (23.05)	0.310 (0.264)	-1.194 (1.542)
Current account	1.326 (3.816)	7.688 (11.94)	-3.717*** (0.873)	4.175** (1.741)
Fiscal Balance	5.290 (3.673)	-5.267 (12.47)	0.680 (1.038)	3.270 (2.432)
Government debt	-0.591 (0.629)	-1.246 (1.023)	-0.259 (0.161)	-0.227 (0.407)
Risk appetite	-4.581*** (1.431)	-7.745** (2.824)	-2.445*** (0.521)	-1.397 (0.819)
Constant	167.4** (66.48)	210.4** (91.49)	45.60*** (11.62)	62.73 (38.41)
Observations	3,143	1,330	880	933
R-squared	0.064	0.128	0.505	0.170

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: POLS estimation results. Loans and deposits. Source: author computation.

Analysing both *Hypothesis 1* and *Hypothesis 2*, we should look on effects of endogeneity, to do so we explore results of FE regression on all instruments (see Table 9)

and on loans and deposits (see Table 10). All countries and other groups except to CEE are not found significant, that confirm the degree of reliance on those results and decrease the degree of reliance on CEE results. To understand the relationship between CEE countries capital requirement and cross-border capital flows we research it further using other estimation techniques or different estimators.

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Capital requirements	-37.08 (30.90)	-55.22 (68.92)	-49.21*** (13.29)	21.51 (16.91)
GDP growth	6.043*** (1.852)	18.80*** (5.663)	6.206*** (0.580)	-2.016 (1.247)
Inflation	3.646*** (1.067)	4.944 (10.92)	1.389*** (0.266)	-0.759 (1.261)
Current account	1.354 (1.515)	6.057 (4.049)	-6.187*** (0.498)	2.789*** (1.056)
Fiscal Balance	8.614*** (2.097)	6.392 (4.175)	0.0669 (0.972)	2.699 (1.645)
Government debt	-3.176*** (0.386)	-4.308*** (0.845)	-0.658*** (0.160)	-0.815*** (0.258)
Risk appetite	-6.375*** (0.641)	-11.14*** (1.485)	-3.538*** (0.259)	-1.791*** (0.367)
Constant	340.6*** (26.38)	587.7*** (70.86)	72.81*** (9.717)	105.6*** (16.74)
Observations	3,143	1,330	880	933
R-squared	0.098	0.132	0.527	0.049
Number of countries	57	24	16	17

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 9: FE estimation results. All instruments included. Source: author computation.

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Capital requirements	-24.37 (26.32)	-44.08 (58.75)	-35.67*** (11.05)	23.94 (15.97)
GDP growth	6.450*** (1.578)	20.08*** (4.827)	5.732*** (0.482)	-1.791 (1.177)
Inflation	2.554*** (0.909)	0.597 (9.312)	1.169*** (0.221)	-0.880 (1.191)
Current account	0.219 (1.290)	2.609 (3.452)	-5.425*** (0.414)	2.735*** (0.997)
Fiscal Balance	6.718*** (1.786)	4.932 (3.559)	0.779 (0.808)	2.962* (1.553)
Government debt	-2.133*** (0.328)	-2.512*** (0.720)	-0.469*** (0.133)	-0.772*** (0.244)
Risk appetite	-4.804*** (0.546)	-8.074*** (1.266)	-2.736*** (0.216)	-1.517*** (0.347)
Constant	234.1*** (22.47)	374.8*** (60.41)	49.32*** (8.077)	93.57*** (15.80)
Observations	3,143	1,330	880	933
R-squared	0.084	0.110	0.550	0.048
Number of countries	57	24	16	17

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 10: FE estimation results. Loans and deposits. Source: author computation.

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Consumer credit capital buffer	-55.54* (32.33)	147.5** (58.78)	-32.55** (14.06)	-37.93 (26.50)
GDP growth	5.126** (2.167)	40.01* (20.73)	6.740*** (1.045)	1.111 (1.870)
Inflation	-2.122* (1.171)	29.90 (44.43)	0.367 (0.262)	-2.718** (1.078)
Current account	0.776 (4.566)	14.69 (19.35)	-4.376*** (1.080)	1.870 (1.589)
Fiscal Balance	1.170 (5.544)	-10.20 (19.40)	0.262 (1.501)	-0.964 (1.159)
Government debt	-1.013 (0.907)	-2.353 (1.906)	-0.405** (0.181)	0.0651 (0.337)
Risk appetite	-5.575*** (1.846)	-10.40** (4.431)	-3.120*** (0.564)	-1.374** (0.607)
Constant	219.6** (96.49)	317.6* (154.9)	66.06*** (12.64)	47.00 (34.48)
Observations	3,466	1,330	880	1,256
R-squared	0.052	0.154	0.483	0.080

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11: POLS estimation results. All instruments included. Source: author computation.

Hypothesis 3: If consumer credit capital buffer increased in bank's country, domestic agents borrowing from abroad would increase.

In the following estimation, we research relationship dependent variable cash flow and independent variable consumer credit capital buffer. When looking at the regression results both for all instruments (see Table 11) and for loans and deposits (see Table 12). We find it significant on the level of $p < 0.05$ both for all countries, therefore we reject the Null hypothesis and conclude with consumer credit buffer tightening increase foreign borrowing will increase. We see a decrease in significance when estimating loans and deposits which support our hypothesis since consumer credit is not in this group. We see even higher estimation significance in CEE, but it could be biased since in dataset we have values only for four countries: Poland, Russian Federation, Bulgaria and Turkey. Results of endogeneity analysis using FE, independent variable found to be exogenous. Since (Cerutti et al., 2016) dataset had only 12 entries for this instrument degree of reliance on the estimation limited and required further research.

VARIABLES	(1) All countries	(2) Advanced Economies	(3) CEE and others	(4) Asia Africa and Latin
Consumer credit capital buffer	-45.42* (23.15)	73.55* (40.55)	-23.29* (12.38)	-35.69 (25.38)
GDP growth	5.588** (2.311)	32.94 (20.26)	6.264*** (1.027)	1.042 (1.734)
Inflation	-1.576* (0.836)	15.14 (22.96)	0.325 (0.269)	-2.355** (0.929)
Current account	-0.159 (2.939)	7.540 (11.92)	-3.744*** (0.889)	1.545 (1.417)
Fiscal Balance	1.731 (3.633)	-5.123 (12.44)	0.703 (1.059)	-0.650 (1.054)
Government debt	-0.549 (0.522)	-1.264 (1.029)	-0.259 (0.164)	0.0683 (0.294)
Risk appetite	-4.234*** (1.277)	-7.616** (2.798)	-2.392*** (0.521)	-1.188** (0.545)
Constant	147.0** (56.03)	208.0** (91.45)	43.49*** (11.69)	39.51 (30.61)
Observations	3,466	1,330	880	1,256
R-squared	0.049	0.126	0.499	0.071

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: POLS estimation results. Loans and deposits. Source: author computation.

5.1 Robustness checks

This part further analyse effects capital requirements and second *hypothesis*, to do so we decided to run robust estimation and express dependent variable in alternative ways. Based on reviewed literature and taking consideration heterogeneity of the dataset we created lag variables following methodology section (see Table 13), in result section, we reported based on the dependent variable “Flow%GDP All 4Q” which in tables below in column number two. Robustness checks in this section will include a group of all 64 countries and group of “CEE and others”.

Variable name	Explanation
B_F_P_S_All	All instruments. Flow as a percentage of total stock (Example: flow 2000q2/stock 2000q1).
B_F_P_GDP_All	Loans and deposits. Flow as a percentage of nominal GDP. (Example: flow 2000q2/nominal GDP 2000q1)
B_F_P_S_LD	Loans and deposits. Flow as a percentage of loans and deposits stock.
B_F_P_GDP_LD	Loans and deposits. Flow as a percentage of nominal GDP.
B_F_P_S_All_4Q	All instruments. Flow as a percentage of total stock (Example Flow 2000q2/Stock 2000q1).
B_F_P_GDP_All_4Q	All instruments. Cumulative flow for four quarters as a percentage of nominal GDP (Example: flow sum [2000q2:2001q1]/nominal GDP 2000q1).
B_F_P_S_LD_4Q	Loans and deposits. Cumulative flow for four quarters as a percentage of loans and deposits stock.
B_F_P_GDP_LD_4Q	Loans and deposits. Cumulative flow for four quarters as a percentage of Nominal GDP.

Table 13: List of final variables for estimation, source: author notation

VARIABLES	(1) Flow%GDP All	(2) Flow%GDP All 4Q	(3) Flow%Stock All	(4) Flow%Stock All 4Q
Capital requirements	-9.962 (6.165)	-63.66*** (22.12)	-0.0264*** (0.00548)	-0.0955*** (0.0208)
GDP growth	1.687** (0.703)	3.910 (2.656)	0.00528*** (0.000655)	0.0209*** (0.00304)
Inflation	-0.354 (0.289)	-1.236 (1.150)	-0.000898*** (0.000331)	-0.00191* (0.00108)
Current account	0.485 (1.365)	3.176 (6.075)	-0.00122*** (0.000385)	-0.00428** (0.00187)
Fiscal Balance	2.154 (1.359)	6.456 (5.344)	0.00104* (0.000566)	0.00238 (0.00256)
Government debt	-0.222 (0.236)	-1.130 (1.102)	-0.000155* (8.59e-05)	-0.000811** (0.000370)
Risk appetite	-1.440*** (0.512)	-6.092*** (2.100)	-0.00140*** (0.000174)	-0.00556*** (0.000810)
Constant	55.43** (24.98)	253.7** (116.4)	0.0484*** (0.00680)	0.212*** (0.0270)
Observations	3,314	3,143	3,314	3,143
R-squared	0.043	0.072	0.131	0.214

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 14: POLS estimation results. All instruments. All countries. Source: author computation.

Using alternative definition in column (see Table 14) number (3) and (4) improving fit. However, as seen in FE results (see Table 15) – this fit results from endogeneity and not improving estimation quality overall.

VARIABLES	(1) Flow%GDP All	(2) Flow%GDP All 4Q	(3) Flow%Stock All	(4) Flow%Stock All 4Q
Capital requirements	-5.185 (9.812)	-37.08 (30.90)	-0.0221*** (0.00710)	-0.0811*** (0.0243)
GDP growth	1.925*** (0.693)	6.043*** (1.852)	0.00541*** (0.000501)	0.0205*** (0.00146)
Inflation	0.896** (0.397)	3.646*** (1.067)	-0.000554* (0.000287)	-0.00276*** (0.000840)
Current account	0.317 (0.546)	1.354 (1.515)	-0.000611 (0.000395)	0.000385 (0.00119)
Fiscal Balance	3.184*** (0.777)	8.614*** (2.097)	0.000877 (0.000562)	0.00373** (0.00165)
Government debt	-0.793*** (0.137)	-3.176*** (0.386)	-0.000750*** (9.95e-05)	-0.00251*** (0.000304)
Risk appetite	-1.574*** (0.238)	-6.375*** (0.641)	-0.00148*** (0.000172)	-0.00547*** (0.000505)
Constant	83.69*** (9.686)	340.6*** (26.38)	0.0787*** (0.00701)	0.304*** (0.0208)
Observations	3,314	3,143	3,314	3,143
R-squared	0.055	0.098	0.140	0.214
Number of ifscodes	57	57	57	57

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 15: FE estimation results. All instruments. All countries. Source: author computation.

VARIABLES	(1) Flow%GDP All	(2) Flow%GDP All 4Q	(3) Flow%Stock All	(4) Flow%Stock All 4Q
Capital requirements	-12.84*** (2.656)	-52.88*** (7.865)	-0.0574*** (0.00949)	-0.251*** (0.0416)
GDP growth	1.681*** (0.214)	6.660*** (1.053)	0.00757*** (0.00156)	0.0315*** (0.00685)
Inflation	0.0663 (0.0799)	0.347 (0.255)	-0.000373 (0.000354)	-0.000599 (0.00149)
Current account	-1.222*** (0.296)	-4.340*** (1.058)	-0.00145 (0.00130)	-0.00388 (0.00696)
Fiscal Balance	0.211 (0.324)	0.232 (1.473)	-0.000527 (0.00164)	-0.000529 (0.00781)
Government debt	-0.0869 (0.0508)	-0.405** (0.175)	-0.000533* (0.000266)	-0.00190 (0.00138)
Risk appetite	-0.670*** (0.132)	-3.192*** (0.563)	-0.00194*** (0.000349)	-0.00933*** (0.00194)
Constant	13.18*** (3.036)	68.91*** (12.60)	0.0640*** (0.0119)	0.320*** (0.0606)
Observations	931	880	931	880
R-squared	0.364	0.491	0.227	0.324

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 16: POLS estimation results. All instruments. CEE and others. Source: author computation.

The following drill down on CEE and other countries, we are getting endogeneity (see Table 16 and Table 17) on the independent variable for all variation we tried.

VARIABLES	(1) Flow%GDP All	(2) Flow%GDP All 4Q	(3) Flow%Stock All	(4) Flow%Stock All 4Q
Capital requirements	-10.63*** (3.394)	-49.21*** (13.29)	-0.0532*** (0.0160)	-0.238*** (0.0654)
GDP growth	1.490*** (0.185)	6.206*** (0.580)	0.00747*** (0.000872)	0.0330*** (0.00285)
Inflation	0.366*** (0.0850)	1.389*** (0.266)	0.000118 (0.000400)	-0.000923 (0.00131)
Current account	-1.764*** (0.156)	-6.187*** (0.498)	-0.000236 (0.000734)	0.00375 (0.00245)
Fiscal Balance	0.281 (0.303)	0.0669 (0.972)	0.000432 (0.00142)	0.00287 (0.00478)
Government debt	-0.175*** (0.0493)	-0.658*** (0.160)	-0.00130*** (0.000232)	-0.00393*** (0.000786)
Risk appetite	-0.793*** (0.0831)	-3.538*** (0.259)	-0.00202*** (0.000391)	-0.00877*** (0.00128)
Constant	15.98*** (3.054)	72.81*** (9.717)	0.0994*** (0.0144)	0.420*** (0.0478)
Observations	931	880	931	880
R-squared	0.406	0.527	0.239	0.337
Number of ifscodes	16	16	16	16

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 17: FE estimation results. All instruments. CEE and others. Source: author computation.

VARIABLES	(1) Flow%GDP LD	(2) Flow%GDP LD 4Q	(3) Flow%Stock LD	(4) Flow%Stock LD 4Q
Capital requirements	-8.601** (3.501)	-42.11*** (14.86)	-0.0200*** (0.00660)	-0.0937*** (0.0241)
GDP growth	1.848** (0.783)	5.103** (2.403)	0.00564*** (0.000651)	0.0226*** (0.00314)
Inflation	-0.274 (0.195)	-1.013 (0.784)	-0.000874*** (0.000305)	-0.00219** (0.00108)
Current account	0.115 (0.825)	1.326 (3.816)	-0.00178*** (0.000416)	-0.00698*** (0.00210)
Fiscal Balance	1.678* (0.925)	5.290 (3.673)	0.00168** (0.000672)	0.00508* (0.00299)
Government debt	-0.103 (0.127)	-0.591 (0.629)	-0.000116 (9.07e-05)	-0.000668* (0.000393)
Risk appetite	-1.042*** (0.357)	-4.581*** (1.431)	-0.00143*** (0.000215)	-0.00636*** (0.000971)
Constant	34.67** (13.94)	167.4** (66.48)	0.0474*** (0.00774)	0.226*** (0.0318)
Observations	3,314	3,143	3,314	3,143
R-squared	0.034	0.064	0.109	0.214

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 18: POLS estimation results. Loans and deposits. All countries. Source: author computation.

Loans and deposits for all countries, similar situation as for the overall. Different representation (see Table 18 and Table 19) improving estimation, but adding endogeneity.

VARIABLES	(1) Flow%GDP LD	(2) Flow%GDP LD 4Q	(3) Flow%Stock LD	(4) Flow%Stock LD 4Q
Capital requirements	-5.143 (8.549)	-24.37 (26.32)	-0.0157* (0.00857)	-0.0824*** (0.0278)
GDP growth	2.029*** (0.603)	6.450*** (1.578)	0.00574*** (0.000605)	0.0222*** (0.00167)
Inflation	0.629* (0.346)	2.554*** (0.909)	-0.000362 (0.000347)	-0.00217** (0.000961)
Current account	0.106 (0.475)	0.219 (1.290)	-0.00166*** (0.000477)	-0.00443*** (0.00137)
Fiscal Balance	2.361*** (0.677)	6.718*** (1.786)	0.00145** (0.000679)	0.00571*** (0.00189)
Government debt	-0.527*** (0.120)	-2.133*** (0.328)	-0.000681*** (0.000120)	-0.00229*** (0.000347)
Risk appetite	-1.136*** (0.207)	-4.804*** (0.546)	-0.00155*** (0.000208)	-0.00645*** (0.000578)
Constant	55.50*** (8.439)	234.1*** (22.47)	0.0761*** (0.00846)	0.313*** (0.0238)
Observations	3,314	3,143	3,314	3,143
R-squared	0.043	0.084	0.114	0.208
Number of ifscodes	57	57	57	57

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 19: FE estimation results. Loans and deposits. All countries. Source: author computation.

VARIABLES	(1) Flow%GDP LD	(2) Flow%GDP LD 4Q	(3) Flow%Stock LD	(4) Flow%Stock LD 4Q
Capital requirements	-7.924*** (2.020)	-39.11*** (6.419)	-0.0542*** (0.0111)	-0.264*** (0.0480)
GDP growth	1.512*** (0.210)	6.206*** (1.036)	0.00800*** (0.00128)	0.0344*** (0.00604)
Inflation	0.0588 (0.0796)	0.310 (0.264)	-0.000367 (0.000334)	-0.000827 (0.00138)
Current account	-1.058*** (0.258)	-3.717*** (0.873)	-0.00212* (0.00114)	-0.00655 (0.00602)
Fiscal Balance	0.356 (0.257)	0.680 (1.038)	0.000965 (0.00169)	0.00361 (0.00804)
Government debt	-0.0496 (0.0494)	-0.259 (0.161)	-0.000425 (0.000280)	-0.00167 (0.00132)
Risk appetite	-0.472*** (0.120)	-2.445*** (0.521)	-0.00187*** (0.000455)	-0.00989*** (0.00215)
Constant	7.499** (2.853)	45.60*** (11.62)	0.0602*** (0.0155)	0.326*** (0.0676)
Observations	931	880	931	880
R-squared	0.360	0.505	0.189	0.330

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 20: POLS estimation results. Loans and deposits. CEE and others. Source: author computation.

Loans and deposits for CEE and others, not removing endogeneity problem from the estimation.

VARIABLES	(1) Flow%GDP LD	(2) Flow%GDP LD 4Q	(3) Flow%Stock LD	(4) Flow%Stock LD 4Q
Capital requirements	-5.928** (2.898)	-35.67*** (11.05)	-0.0496** (0.0196)	-0.250*** (0.0736)
GDP growth	1.317*** (0.158)	5.732*** (0.482)	0.00785*** (0.00107)	0.0363*** (0.00321)
Inflation	0.308*** (0.0726)	1.169*** (0.221)	0.000347 (0.000491)	-0.000284 (0.00147)
Current account	-1.558*** (0.133)	-5.425*** (0.414)	-0.00105 (0.000900)	0.000974 (0.00276)
Fiscal Balance	0.505* (0.258)	0.779 (0.808)	0.00196 (0.00175)	0.00600 (0.00538)
Government debt	-0.124*** (0.0421)	-0.469*** (0.133)	-0.00120*** (0.000285)	-0.00359*** (0.000884)
Risk appetite	-0.577*** (0.0709)	-2.736*** (0.216)	-0.00201*** (0.000480)	-0.00948*** (0.00144)
Constant	10.15*** (2.607)	49.32*** (8.077)	0.0952*** (0.0176)	0.414*** (0.0538)
Observations	931	880	931	880
R-squared	0.409	0.550	0.195	0.331
Number of ifscodes	16	16	16	16

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 21: FE estimation results. Loans and deposits. CEE and others. Source: author computation.

As part of these robust test, we saw how different expression of flow variable inspired by literature review helped to improve estimation significance and fit, but suffered from endogeneity problems. In addition to these tests, we did the following

- Estimation on a country by country basis, in some it showed impressive significance and fit. It also confirmed several cases of policy arbitrage which was known.
- Usage different control variables
- Running estimation without clustering
- Dropping countries where much data lack and running estimation on them
- Limiting time range
- Combining independent variables which know based on literature on similar effect on the flows
- Using original dataset macroprudential variables instead of normalised
- Estimating based on cumulative effects

6 Conclusion

Present thesis studies the effects of macroprudential policies on cross-border capital flows over 14 years of available data for a large set of countries.

Growing popularity of prudential policy tools and accumulated empirical data stimulate more and more countries to include macroprudential tools in the systemic risk and stability toolkit. International cooperation and reciprocity networks, like Basel accord, allow collection of empirical data and observation of the behaviour of these policy instruments in very different economic environments.

However, along with all the benefits to financial stability, we observe policy spillovers, both intentional and unintentional, when financial institutions take advantage of regulatory arbitrage. Dangers of regulatory arbitrage go far beyond the reduction in tax collection or equity loss. Any regulatory arbitrage transfers profits and equity from one country to another. Arbitrage against a prudential policy transfers wealth not from a rich to a less developed country, but from a well-run economy to one with less control and risk monitoring. This builds up local systemic risk, which could be a catalyst for a future global crisis.

Recent BIS survey uncovered cases of regulatory arbitrage in South African Republic right after CCB was introduced. Similar cases were recently proved to be true in Singapore, Chile and other countries, involving both banks and non-banks. On the other hand evidence of positive spillover exists as well, even though it is usually harder to identify them from the econometric perspective. Positive spillovers are hard to see since financial stability is hard to measure (Patel, 2017).

Present thesis continued research of the spillover effects of macroprudential policies by extending the analysis to the newest data available, to larger set of countries, and by using an alternative model. We confirmed the results of several important papers in the field including (Reinhardt and Sowerbutts, 2015) and (Buch and Goldberg, 2016). However, our model was not able to observe LTV effect displayed by (Avdjiev et al., 2016). We found statistically significant results in regards of policy spillover in CEE region, which will require further research to investigate. Also, we noted CCB related spillover effects in the consumer credit segment, which will require more research when a bigger dataset is available.

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Appendix A: Graphs

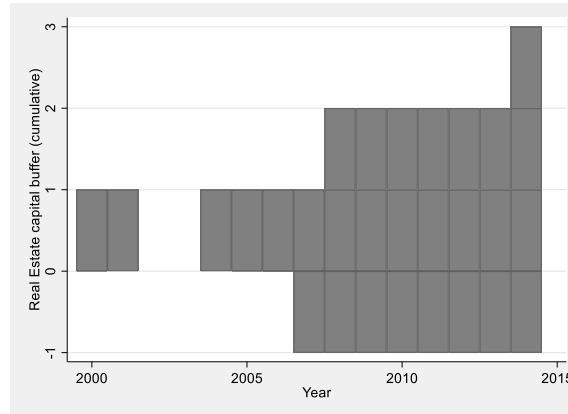


Figure 18: Development of Real estate capital buffer. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

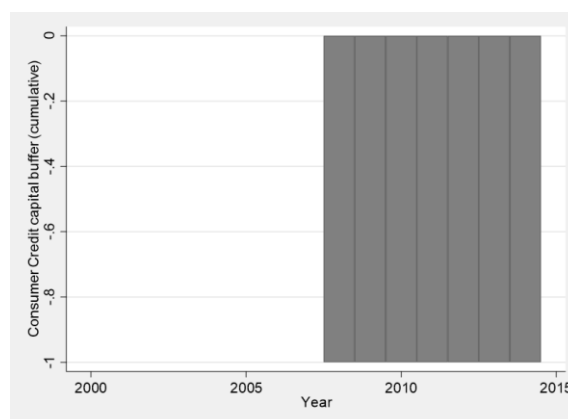


Figure 19: Development of Consumer credit capital buffer. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

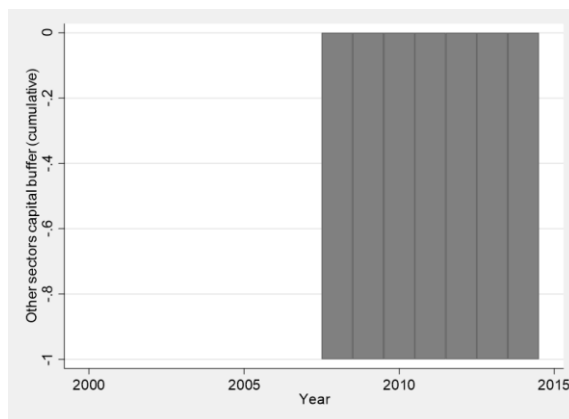


Figure 20: Development of Other sectors capital buffer. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

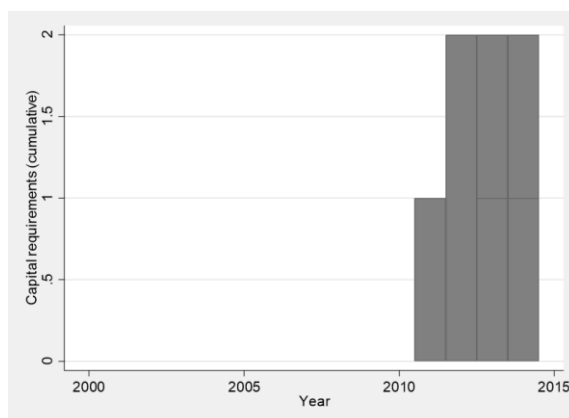


Figure 21: Development of Capital requirements. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

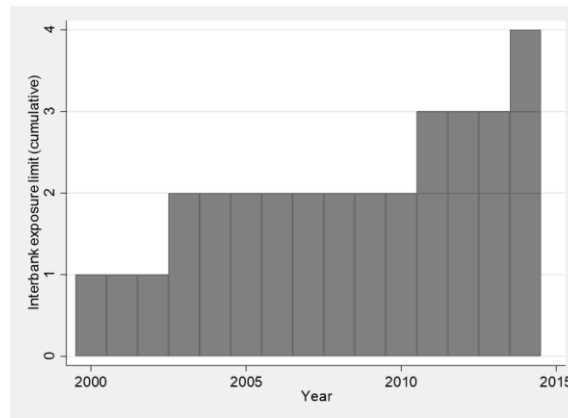


Figure 22: Development of Interbank exposure limit. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

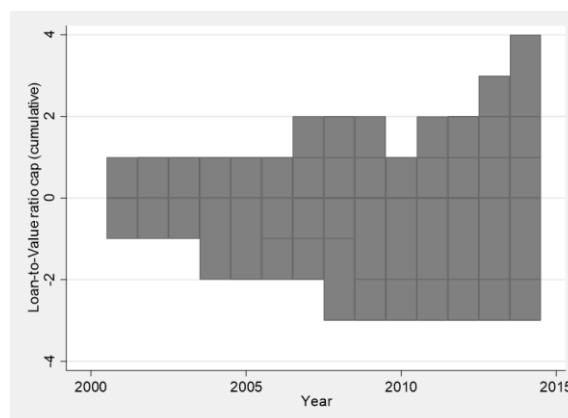


Figure 23: Development of the Loan-to-Value cap. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

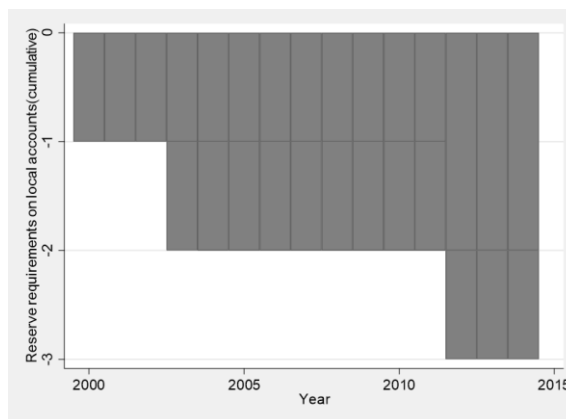


Figure 24: Development of Reserve requirements on local currency denominated accounts. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

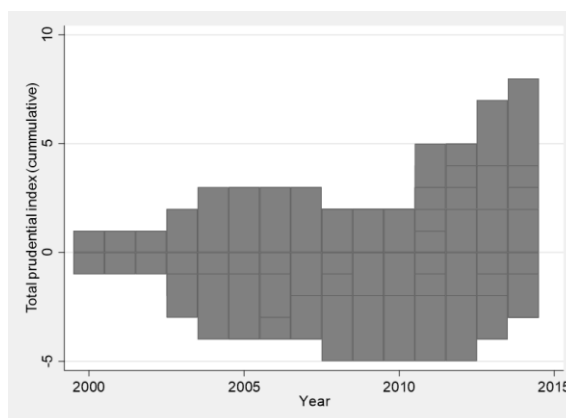


Figure 25: Development of total prudential index. Advanced Economies. Between 2000:Q1 till 2014:Q4. Source: author computations.

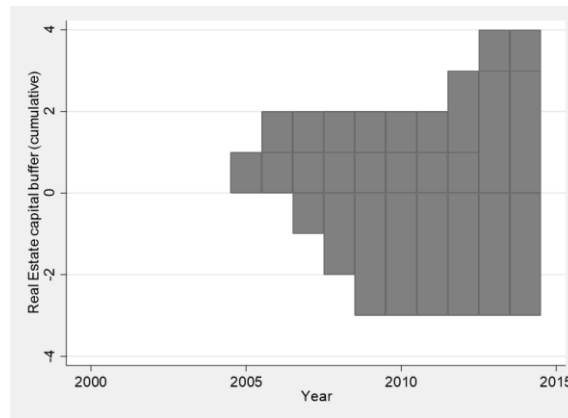


Figure 26: Development of Real estate capital buffer. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

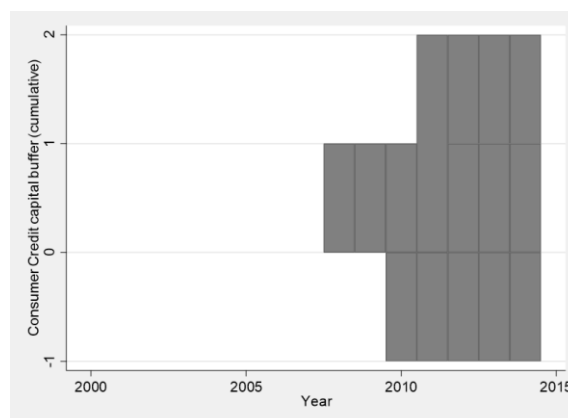


Figure 27: Development of Consumer credit capital buffer. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

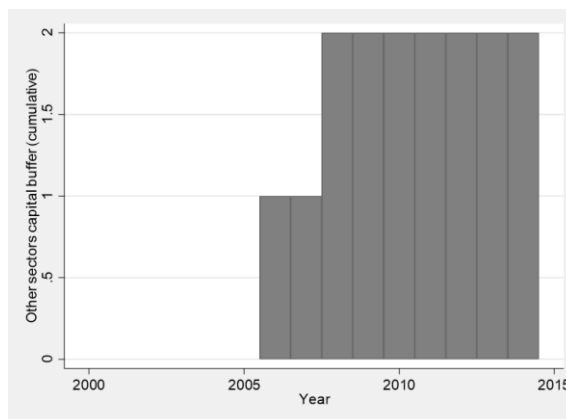


Figure 28: Development of Other sectors capital buffer. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

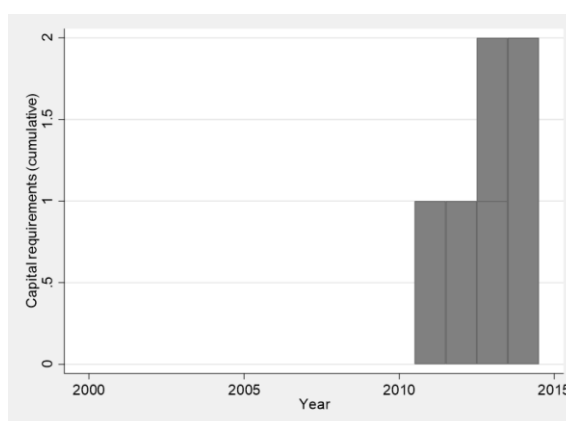


Figure 29: Development of Capital requirements. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

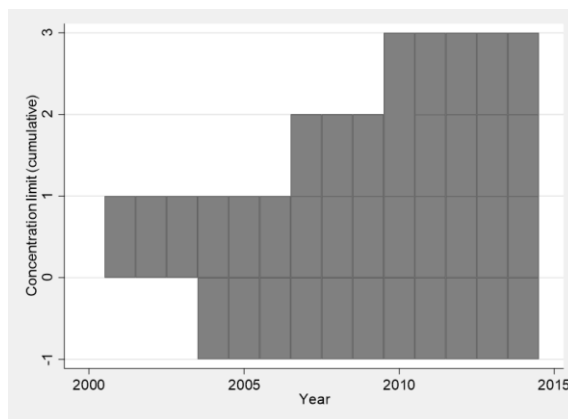


Figure 30: Development of Concentration limit. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

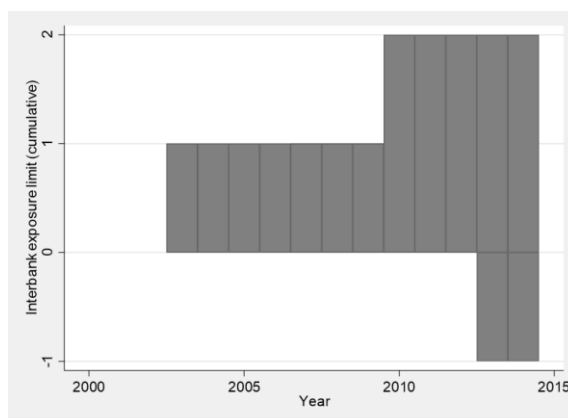


Figure 31: Development of Interbank exposure limit. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

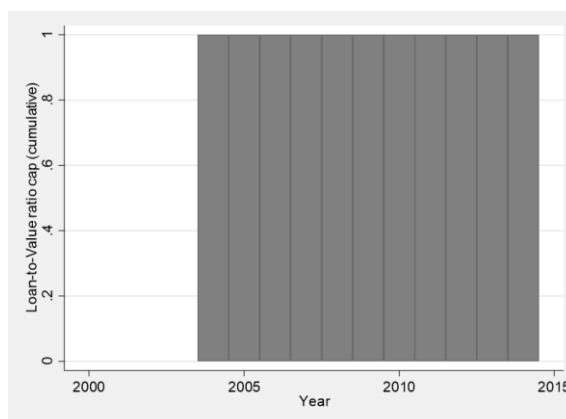


Figure 32: Development of the Loan-to-Value cap. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

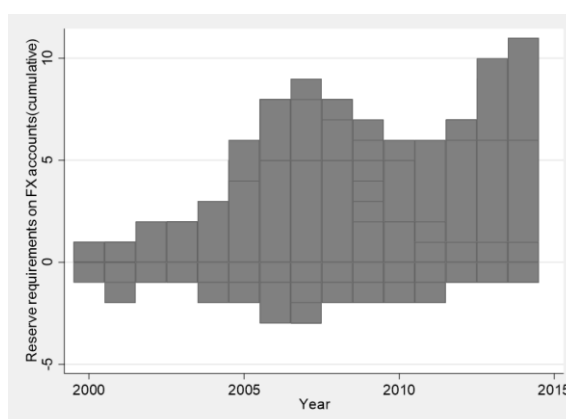


Figure 33: Development of Reserve requirements on foreign currency denominated accounts. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

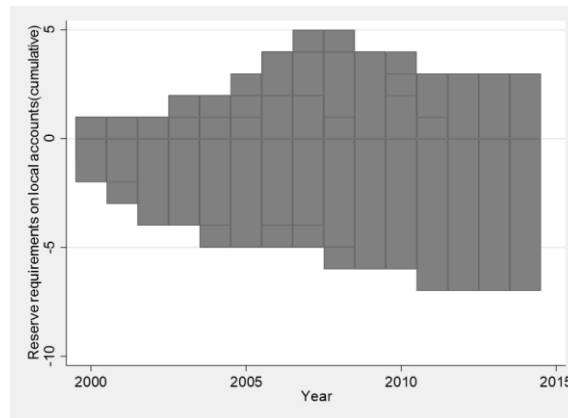


Figure 34: Development of Reserve requirements on local currency denominated accounts. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

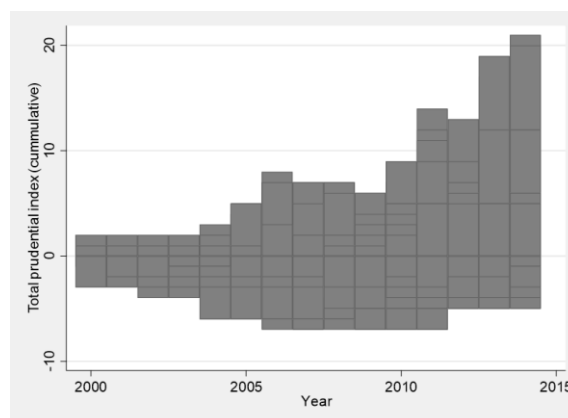


Figure 35: Development of total prudential index. CEE and others. Between 2000:Q1 till 2014:Q4. Source: author computations.

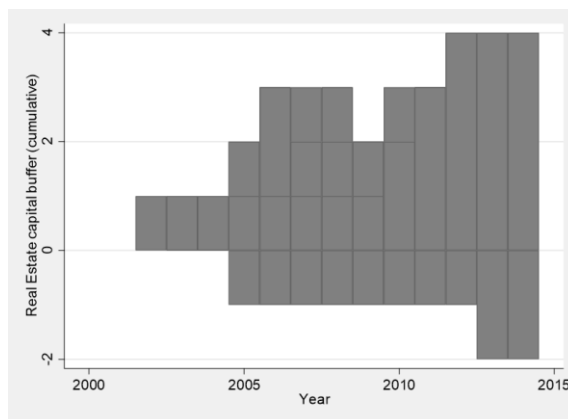


Figure 36: Development of Real estate capital buffer. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

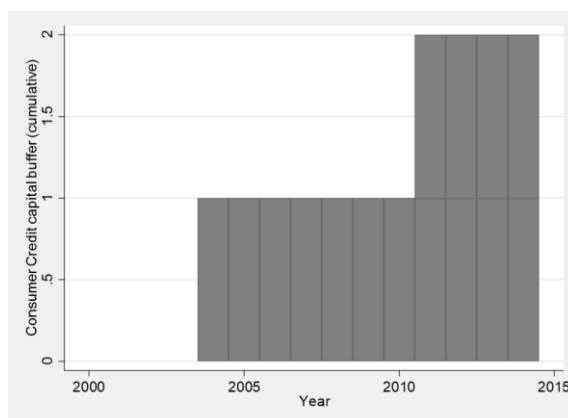


Figure 37: Development of Consumer credit capital buffer. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

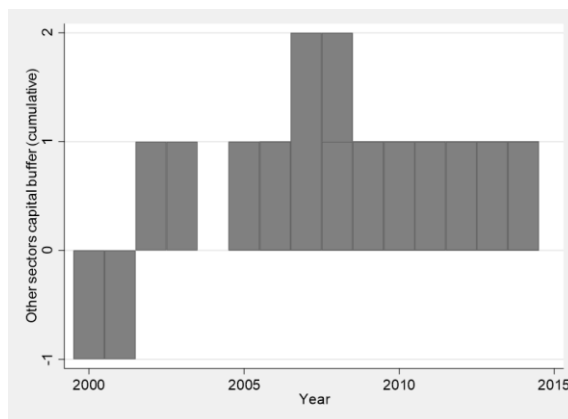


Figure 38: Development of Other sectors capital buffer. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

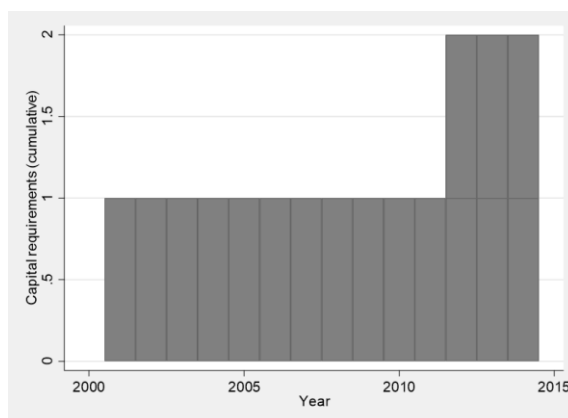


Figure 39: Development of Capital requirements. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

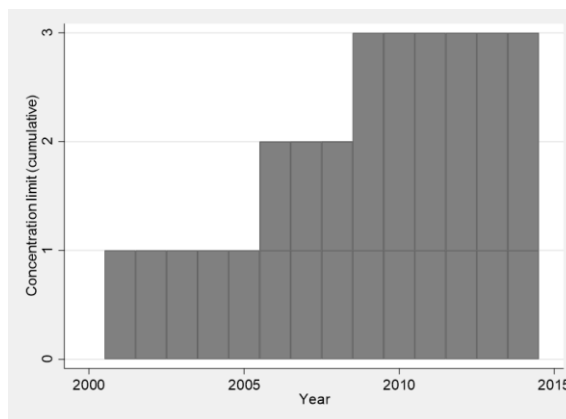


Figure 40: Development of Concentration limit. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

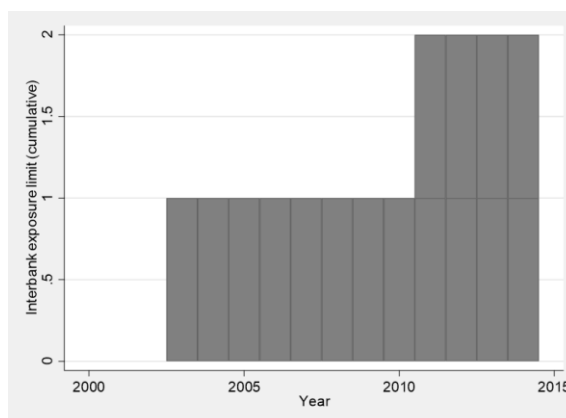


Figure 41: Development of Interbank exposure limit. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

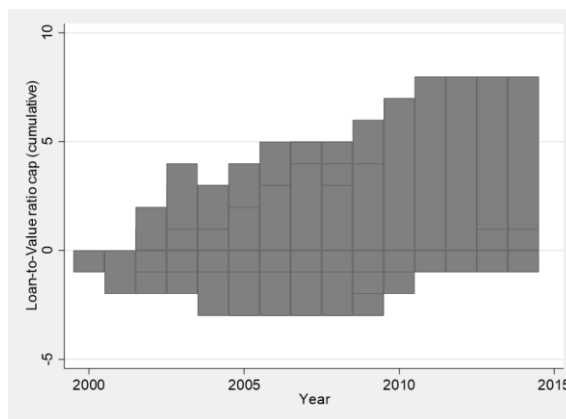


Figure 42: Development of the Loan-to-Value cap. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

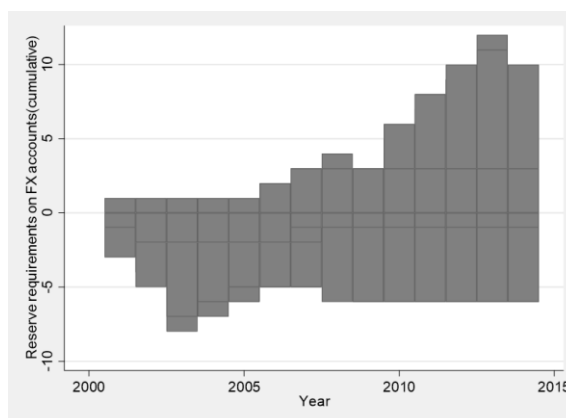


Figure 43: Development of Reserve requirements on foreign currency denominated accounts. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

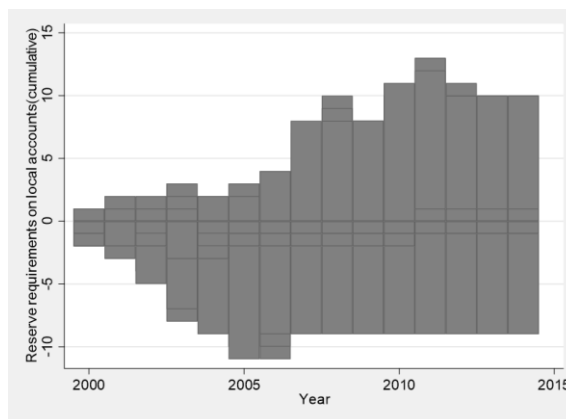


Figure 44: Development of Reserve requirements on local currency denominated accounts. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

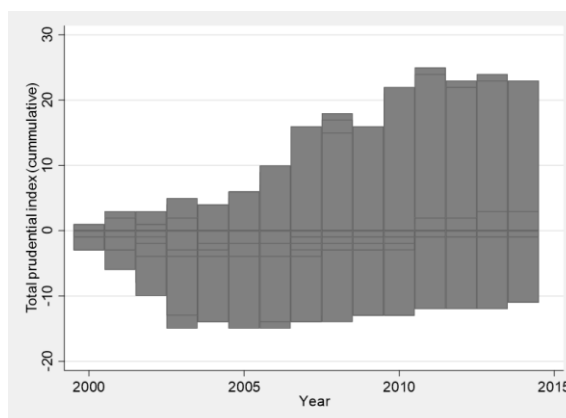


Figure 45: Development of total prudential index. Asia, Africa and Latin countries. Between 2000:Q1 till 2014:Q4. Source: author computations.

Appendix B: Summary statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
year	3,904	2,007	4.404	1,999	2,014
quarter	3,904	2.525	1.125	1	4
qdate	3,904	17,258	1,608	14,518	19,997
ifscode	3,904	451.5	321.9	111	968
sscb_res	3,840	0.00599	0.117	-1	1
sscb_cons	3,840	0.00156	0.0559	-1	1
sscb_oth	3,840	0.00313	0.0883	-2	2
sscb	3,840	0.0107	0.182	-3	3
cap_req	3,420	0.0292	0.169	0	1
concrat	2,400	0.0125	0.118	-1	1
ibex	2,100	0.0110	0.109	-1	1
ltv_cap	3,840	0.0122	0.158	-1	1
rr_foreign	3,840	0.00937	0.240	-3	5
rr_local	3,840	-0.00859	0.318	-3	5
cum_sscb_res	3,840	0.122	0.653	-3	4
cum_sscb_cons	3,840	0.0323	0.264	-1	2
cum_sscb_oth	3,840	0.0880	0.374	-1	2
cum_sscb	3,840	0.242	0.953	-3	6
cum_cap_req	3,420	0.264	0.575	0	2
cum_concrat	2,400	0.362	0.743	-1	4
cum_ibex	2,100	0.310	0.676	-1	4
cum_ltv_cap	3,840	0.188	1.062	-3	8
cum_rr_foreign	3,840	0.236	1.428	-6	12
cum_rr_local	3,840	-0.490	2.049	-7	13
core_country	3,840	0.891	0.312	0	1
PruC	3,840	0.0508	0.386	-1	1
cum_PruC	3,840	0.808	3.646	-8	25
PruC2	3,840	0.0508	0.386	-1	1
cum_PruC2	3,840	0.780	3.951	-15	25
sscb_oth_f	3,840	0.00286	0.0739	-1	1
rr_foreign_f	3,840	0.0102	0.191	-1	1
rr_local_f	3,840	-0.00911	0.278	-1	1
sscb_f	3,840	0.00911	0.138	-1	1
sscb_total	3,840	0.0104	0.175	-3	3
cum_sscb_f	3,840	0.202	0.767	-3	4
cum_sscb_oth_f	3,840	0.0794	0.349	-1	2
cum_rr_foreign_f	3,840	0.237	1.530	-8	12
cum_rr_local_f	3,840	-0.509	2.217	-11	13
B_S_LD	3,903	230,965	570,627	3	5.434e+06
B_S_All	3,903	318,597	765,488	3	6.215e+06
B_F_LD	3,903	2,249	30,956	-483,823	653,639
B_F_All	3,903	3,409	34,787	-486,620	692,709
WEO_CPI_YoY	3,900	4.488	6.388	-3.953	85.74
WEO_Current_Account	3,900	0.515	8.337	-27.35	45.46
WEO_GOV_DEBT	3,779	52.35	35.97	0.0650	236.1
CBOE_VIX_Close	3,904	20.95	7.350	11.51	48.78
WEO_GDP_YoY	3,896	3.384	3.479	-15.14	17.34
WEO_Nominal_GDP	3,900	799.2	1,939	1.236	17,428
WEO_Fiscal_Balance	3,872	-1.471	5.908	-32.05	43.30
B_F_All_L1	3,839	3,438	35,061	-486,620	692,709
B_F_LD_L1	3,839	2,283	31,199	-483,823	653,639
B_F_P_S_All	3,839	0.0242	0.109	-0.867	2.410
B_F_P_GDP_All	3,835	11.84	98.03	-1,922	1,356
B_F_P_S_LD	3,839	0.0242	0.112	-0.867	2.076
B_F_P_GDP_LD	3,835	7.883	81.41	-1,991	1,254
B_F_All_4Q	3,644	13,843	92,975	-964,441	1.198e+06

B_F_LD_4Q	3,644	9,517	78,271	-1.090e+06	1.062e+06
B_F_P_S_All_4Q	3,644	0.113	0.283	-0.803	4.279
B_F_P_GDP_All_4Q	3,640	52.91	295.3	-2,203	4,676
B_F_P_S_LD_4Q	3,644	0.115	0.298	-0.803	4.279
B_F_P_GDP_LD_4Q	3,640	36.11	228.9	-2,187	4,493
econ_dev_n	3,840	2	0.866	1	3
meancum_PruC2	3,904	0.780	0	0.780	0.780

Table 22: Summary statistics of all variables in dataset