MEASURING THE EFFECT OF FINANCIAL REGULATION ON OUTPUT VOLATILITY DURING THE 2008 GLOBAL FINANCIAL CRISIS

By

Andre Kaspar Warken

THESIS

Submitted to
KDI School of Public Policy and Management
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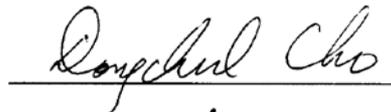
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ABSTRACT

MEASURING THE EFFECT OF FINANCIAL REGULATION ON OUTPUT VOLATILITY DURING THE 2008 GLOBAL FINANCIAL CRISIS

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The offset of the 2008 Global Financial Crisis rekindled the discussion on the role financial regulation must play in preventing such events. Traditionally, it is believed financial liberalization is correlated with higher growth rates, at the cost of increased instability of the whole system. The literature asserts the existence of an effect of finance on growth, as well as its part on the deflagration of the aforementioned crisis. Based on regulatory data collected by the World Bank, I conducted regression analysis of regulatory variables on growth. Although results are limited due to missing data, a statistically and economically significant relationship between financial industry conglomeration, loose capital requirements and increased growth volatility has been found. Also of note is the fact that no meaningful relationship was found between these indicators and growth itself: in the present study, liberalization in the regulatory areas under investigation does not amplify growth, while increasing systemic instability. Hence, there appears to be no tradeoff, meaning that a stricter approach is generally recommended.

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1. Introduction

The 2007-2008 financial meltdown ground the world economy to a halt, accentuated by the bankruptcy of Lehman Brothers, and still has its ripples felt during the current European debt catastrophe. This calamity, not in small part caused by the actions of financial actors, rekindled the discussion on financial regulation: could stricter regulation have prevented the crisis, or, at least, measurably impacted its effects?

Conventional economic wisdom states that growth and liberalization go hand in hand: economies whose financial sectors are freer are expected to exhibit higher growth rates. There is some empirical evidence that only private monitoring, and not strict government regulation and intervention in areas such as capital requirements or separation of financial and non-financial activities, lead to increased financial system stability and efficiency. It does not tell us, however, how it affects the economy as a whole or how stable this growth is. Although there might be a positive relationship between financial liberalization and growth, we suggest that this comes at the expense of increased risk exposure for the whole economy.

I tentatively propose that, while liberalization might lead to higher long-term growth, it is achieved through a bumpy road. Adopting stricter regulatory policies in key sectors might, indeed, not lead to such large numbers, but, on the other hand, it could lead to an overall trend of much lower fluctuation, presumably paving the road for smoother growth. Thus the question is: where should policymakers stand in this possible trade-off? The first step here is a review of the literature concerning the linkage of financial regulation and growth, by showing the main objectives of financial systems and how regulation affects reaching them. While there isn't a theoretical consensus on the existence of a positive relationship, recent empirical findings provide evidence of causality, even when controlling for simultaneity bias, under the explanation of easing external financing constraints on industrial growth.

Next is a review of reports on how financial regulatory policy helped shape the deflagration of the crisis. Throughout the decade before the crisis, and perhaps even earlier

than that, policymakers acted to loosen regulations and curtail supervisory powers, which caused financial agents to increase risk-taking, expanding short-term profits but compromising the long-term stability of not only their institutions, but of the whole economy.

I then set out to explore the existence of a relationship between growth fluctuation and financial regulation using data collected from surveys conducted by the World Bank over the last 15 years, as well as growth rate data made available by the same institution. Although it was not possible to include all regulatory indicators surveyed due to the incompleteness of the dataset, since participation was voluntary, a statistically and economically significant relationship between financial industry conglomeration, loose capital requirements and increased growth volatility is apparent. It is also of note that I was not able to find a relevant relationship between these indicators and growth itself; that is, stricter regulation in this area does not seem to hamper growth. I used deductive reasoning to fit the conclusion of the generalized analysis of the regression output to specific countries and give them policy considerations. While analyzing the breakdown of the financial regulation system in the United States we also use inductive reasoning to derive general advice applicable to other economies.

2. Literature Review

2.1 Financial Regulation as a Factor of Growth

The impact of the structure of the financial sector of an economy on its growth prospects has been a subject of contention in the traditional literature, despite some advances on its research, especially during the last couple of decades. According to Levine,

> Finance is not even discussed in a collection of essays by the "pioneers of development economics" (Meier and Seers, 1984), including three Nobel Prize winners, and Nobel Laureate Robert Lucas (1988, p.6) dismisses finance as an "over-stressed" determinant of economic growth. Joan Robinson (1952, p. 86) famously argued that "where enterprise leads finance follows." From this perspective, finance does not cause growth; finance responds to changing demands from the "real sector." At the other extreme, Nobel Laureate Merton Miller (1988, p.14) argues that, "[the idea] that financial markets contribute to economic growth is a proposition too obvious for serious discussion." Drawing a more restrained conclusion, Bagehot (1873), Schumpeter (1912), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973) reject the idea that the finance-growth nexus can be safely ignored without substantially limiting our understanding of economic growth.[1]

The main function of financial systems is to improve information asymmetries, between investors and companies, managers and the board of directors, insiders and outsiders. Levine establishes five main objectives of a functioning financial system: (a) providing information about future investments; (b) monitoring the use of these resources; (c) curtailing risk through diversification; (d) efficient allocation of savings; and (e) facilitating trade.[2] Since the economy is so complex, it is unfeasible for investors to collect enough information on all available investment opportunities. Hence, there is an opportunity for intermediaries who collect and analyze such information to rise, leading to a better allocation of capital and increased efficiency of markets.

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[1] Ross Levine, Working Paper No. 10766, National Bureau of Economic Research, September 2004, 1.
[2] Ibid., 6.

In a market with many small shareholders, high costs of monitoring might keep them from effective policing whether the actions of management truly pursue their best interest by seeking value maximization. Due to high cost and complexity, a form of the free-rider problem might ensue, as shareholders take no action, expecting others to do so, leading to insufficient supervision. A well-functioning stock market can ameliorate this, as intermediaries pool resources from investors and save on supervision costs due to economies of scale.

People are generally risk-averse. However, higher-return investments tend to have higher risk. Financial systems help allocate capital in a more efficient manner, finding the highest return projects compatible with investors' risk profiles and increasing overall returns at an investor's preferred risk exposure level through diversification. This is called cross-sectional risk sharing. Markets also offer inter-temporal and liquidity risk sharing. The former refers to the smoothing of investment patterns, where long-lived intermediaries can help share risks such as macroeconomic shocks, which affect the whole economy at a single point in time, throughout a longer time scale, providing yet another form of diversification. The latter, on the other hand, is related to the speed of conversion of assets into money; some projects may require long-term investment, longer-term than most investors would be comfortable being separated from parts of their holdings.

Financial intermediation can improve that by allowing investors to freely trade their positions through financial instruments, increasing the liquidity thereof, thereby making investors more comfortable and confident in investing in long-term projects. The allocation of savings into investments is also an important function of the financial sector. This can be divided into two steps: minimizing the costs of pooling resources from numerous investors; and assuring them of the safety of trusting their resources to third parties. Although this can happen privately between parties (such as in a partnership or a non-traded company), due to friction costs, intermediaries provide a net benefit.

By pooling resources, they can make investment in a scale impossible to individual investors due to either indivisible costs or very high economies of scale possible. Intermediation also makes it possible for investors to hold a smaller stake in many different projects, increasing risk diversification across all kinds of savers, which has positive effects on economic growth. The financial system facilitates the trading of goods, by making specialization feasible, and fomenting technological breakthroughs. Specialization implies a larger number of transactions, due to the relationships carried between producers of each different, specialized part of a larger product.

Therefore, a system that lowers transaction costs foments increased specialization in the overall economy. It also reduces information costs related to the pricing of goods. Such costs are likely to keep dropping on the long term due to financial innovation. Finally, empirical tests have shown evidence of existence of a link between the state of the financial environment in a nation and economic growth. Levine, Loayza and Beck (2000) demonstrated evidence of causality between finance and growth, even when controlling for simultaneity bias. Moreover, they also found a relationship between the characteristics of the supervisory and legal systems and the development of the financial sector.

Rajan and Zingales (1998) went further and brought empirical evidence to one of the possible theoretical explanations to the causal relationship between finance and growth, by showing that industries heavily reliant on external financing for their operations presented larger growth where the financial system was further developed. Arcand, Berkes and Panizza (2012) show that there is a statistically significant relationship between capital regulations and growth, especially in economies with well-developed financial sectors. While financial development seems to be positively correlated with economic growth in countries with small financial sectors, there is a point over which financial depth has negative effects on growth. The point where this reversion takes place coincides with where in previous analyses financial development started increasing macroeconomic instability.

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2.2 Financial Regulation as a cause of the 2007-2008 economic crisis

The direct causes of the crisis were an unsustainable asset price bubble that started with the American housing market, a credit boom that led to an excessive debt load to borrowers and the spread of low-quality loans, and a failure of financial regulation. House prices rose upwards of 30% a year on the years previous to the crisis. The core issue of regulatory failure was a problem of distorted incentives in the financial regulation frameworks that led to increased risk-taking in response to moral hazard issues. The increasing complexity of the supervisory system decreased the transparency of institutions and made it much more difficult for resource-constrained regulators to oversee them. The speed with which the crisis spread from the mortgage sector to other securities markets revealed how hard it was to measure risk, and who was exposed to it, in consequence of the adoption of novel, unregulated financial instruments caused by increased rigidity only in part of the activities of the financial industry. The World Bank 2013 Global Financial Development Report states that these issues were exacerbated in the countries where the crisis originated.

Levine claims that the 2007-8 meltdown wasn't merely caused by the burst of the American housing bubble, and neither exclusively by the introduction of ever-more-complex financial instruments that left even their operators dumbfounded, but also by conscious policy decisions from key government institutions that eroded the country's financial regulatory framework, which had global repercussions.[6]

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[6] Ross Levine, *An autopsy of the US financial system: accident, suicide, or negligent homicide,* Journal of Financial Economic Policy, 2 - 3. 3, 2010, 196-213.

[7] Barry Eichengreen 2012, p. 182.

This is the culmination of a larger belief in the sanctity of the freedom of the markets and in the government as a mere hindrance that led to a long-term process of deregulation that started with the Reagan administration.[7] Against this backdrop of lax supervision, financial institutions proceeded to profit immensely from extremely risky businesses that increased the fragility of the whole system, leading to its eventual failure. Analyzing the policies adopted by U.S. regulatory agencies, he points to the directives that contributed to the set-off of the crisis. The Securities Exchange Commission contributed with its policies regarding the supervision of credit rating agencies, investment banks and over-the-counter (OTC) derivatives; the Federal Reserve, by authorizing banks to use Credit Default Swaps as capital reserves, leading them to displace other assets, decreasing their holdings of money, and also through its policies towards OTC derivatives; and the federal government through its policies regarding Fannie Mae and Freddie Mac, the state-sponsored home financing agencies.

The incentive distortion was not exclusive to the US: it spread over to the rest of the world through the adoption of the Basel protocols. This principle of capital requirements by credit ratings and internal models for larger institutions spread throughout the world via the adoption of the Basel II protocols as response to the increased securitization caused by the adoption of Basel I, due to the lower capital charges it assigned to securities in comparison to loans. External ratings are not the best available determinant of reserve capital requirements: ratings measure expected losses, while reserve capital is a stronghold against unexpected losses. These measures were considered to misrepresent the solvency of banks, contributing to systemic risk.

The countries most affected by the crisis had more liberal definitions of capital and were twice as likely to allow banks to model their own credit risk, with obvious moral hazard implications. Since 1975, risk assessment by credit rating agencies is one of the requisites for determining capital requirements for institutions regulated by the SEC, which

led to a considerable increase in the demand for credit ratings. Since the analyzed institutions pay for their own ratings, there is a clear conflict of interest for the rating agencies: positive rankings mean repeat business, as better-regarded securities command higher prices. As the ratings segment is strictly regulated and there are ample barriers to entry, institutions felt comfortable giving out inflated ratings at the cost of their long-term credibility. This situation was exacerbated by the introduction of highly complex derivative products that required the rating of numerous underlying assets, as well as the final product itself, meaning a new, hugely profitable revenue stream for rating agencies. There is evidence of pressure from clients being able to change the preliminary ratings issued to more favorable ones. Even though regulators were aware of this situation, they did nothing to combat it. Puzzlingly, the 2006 Credit Rating Agency Reform Act explicitly prohibited the SEC from auditing the methods used for assigning ratings.

The next piece of regulation to take part on the setup of the meltdown was the authorization by the Federal Reserve to allow banks to use Credit Default Swaps as replacement for reserve deposits in 1996. These instruments are similar to insurance policies, where the seller guarantees payment in case the counterparty of the underlying contract defaults. Despite the similarities, they are not, however, insurance contracts; unlike insurance, there is no specific regulatory legislation concerning this kind of swap. None of the parties of this kind of derivative contract are required to be a party to the underlying contract; the risk exposure of the transaction was not based on the risk of the principal, but that of the seller; thus, no matter how risky the underlying contract, as long as the seller of the derivative had good reputation, it would receive a good rating. The Fed's decision allowed banks to reallocate reserve capital and invest it into riskier, but more lucrative assets by merely purchasing CDSs on them.

However, due to their unregulated nature, it could be difficult to exactly determine the party liable for compensating in one of these contracts; also, some of them had huge

exposures, most notably AIG, having close to 100 billion dollars in reserves for all its businesses, had a exposure to around US$500 billion in derivatives. This was exacerbated by the fact that, due to the tightening of its monetary policy the Fed took starting 2004, banks sought opportunities for asset growth, which ended up being mainly subprime and alt-A mortgages. Even though these issues were widely known, and regulators were aware of them, according to internal Fed documents, they did not try to limit this sort of exposure. Even though the Fed is not responsible for regulating capital markets, one of its duties is maintaining the stability of the banking system, which could have been helped by increasing capital reserve requirements. This is corroborated by an increase, in this period, in risk-weighted assets that was much higher than the increase in total assets, implying a regulatory failure in capturing this increased risk of leveraging.

The SEC's policies in relation to investment banks also contributed to the development of the crisis. In 2004, the commission waived the major investment banks from the net capital rule, allowing them to use internal risk models to determine the capital levels they would need to hold themselves. This caused a dramatic rise in leveraging, meaning that the banks could invest much more in riskier ventures without having to put a comparable amount of their own capital on the line. Another policy change was acquiescing to lobbying on the part of the banks for them to become Consolidated Supervised Entities, which made the SEC responsible for supervising the whole firm, including even unregulated businesses (as, for instance, some of the derivative trading) and foreign partners.

Due to the sheer complexity of this proposition, as well as understaffing (there were only seven analysts responsible for supervising all these companies, which held more than US$ 4 billion in assets), it's no wonder that not a single inspection of these new entities was completed, which also fostered increased risk taking by the banks. The Federal Government contributed through its policies to foster home ownership. Through the Congressionally-chartered Freddie Mac (Federal Home Loan Mortgage Corporation) and Fannie Mae (Federal

National Mortgage Association) the government intended to reduce the cost of home financing by making the mortgage market more liquid. These Government-Sponsored Entities would purchase home loans from banks, package and guarantee them, and sell them on the market to investors as mortgage-backed securities. Since these entities were government-founded, investors assumed they were backed by the Treasury, should they fail to honor their commitments. They were also incentivized to increase the activity in the mortgage market, as it would further enhance their profits. Their semi-governmental status ensured low interest rates for them to borrow, regardless of the risk level of their mortgages, which they could use to buy even more high-return mortgages.

In order to expand the reach of housing programs, the federal government pushed them to increase lending to disadvantaged areas and low-income families through the Community Reinvestment Act and a general policy push for affordable housing. This pressured the entities to loosen their financing standards, causing them to lend to more riskier borrowers than before. Between 2005 and 2007, 45% of their mortgage purchases could be classified as subprime, which lead to a boom of low-quality, high-risk mortgages, especially since issuers were certain that Fannie and Freddie would purchase them and bear all the risk. Since these policies were popular with voters and both agencies were large campaign contributors, Congress was quite comfortable with not interfering with the ever-increasing destabilization of the mortgage market. Despite their status as semi-governmental entities, the agencies provided campaign funding to Congress in order to protect their soaring profits from meddling regulators, who already in 2000 were throwing allegations of accounting fraud.

3. Data Presentation and Methodology

I decided on OLS multiple linear regressions as the tool to be used in the present analysis. As it is the simpler method of showing the relationships between indicators. Analysis was conducted on cross-country data, based on availability. In total, the sample was comprised of data on 89 countries; the full list thereof indicated on table V. Information on all sizes of economies was available, which enables the discussion of the effects of regulation on output fluctuation across the board. Economic data was taken from the World Bank database. Economic growth was measured through yearly Gross Domestic Product growth, expressed as a percentage change related to the previous year, thus enabling us to see the change in a way that allows comparison between different economies, unrelated to their respective size.

Since each survey covers a multi-year period, it was necessary to find a way to combine this yearly information in a way that can be related to the entire interval under each survey. I have arrived at two transformations of interest: the geometric average of growth during the period, and the corresponding standard deviation. The geometric average was chosen because it more accurately covers the effect of compounding sequential growth periods, which tends to produce overstated results under the arithmetic mean. The standard deviation, on the other hand, is used to convey how much fluctuation there was inside that period: the higher the deviation, the bumpier the growth in that observation. As a potential control variable the real GDP per capita of each economy at the beginning of each surveyed period was included, this allows controlling for convergence. The real value indicator was chosen as growth rate information is also based on real GDP values. Regulation data was extracted from the database compiled by Barth, Caprio and Levine,[15] based on surveys conducted by the World Bank, as well as data collected from the Journal of Financial Intermediation.

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[15] James R. Barth, Gerard Caprio, Jr., and Ross Levine. 2013. *"Bank Regulation and Supervision in 180 Countries from 1999 to 2011."* National Bureau of Economic Research Working Paper 18733. Accessed January 15, 2013. http://faculty.haas.berkeley.edu/ross_levine/Papers/Copy%20of%20BCL_Sup_Reg_Dat a_13JAN2013.xls,

Surveys were conducted in 2000, 2003, 2007 and 2011, which is of clear value, as it paints a picture of the regulatory environment in each of the participating countries before, during, and after the crisis. Participation was voluntary, however, meaning that it's not a cross-country analysis of the whole globe that's being conducted, rather, a sample of the world's financial regulatory context during this period, which nonetheless can bring valuable insight on the role supervision might have played on the deflagration, control and recovery from the crisis. Besides the valuable work done on collecting such a large amount of information, a very important part of this data was expressing the qualitative answers to the different kinds of questions present on the survey as useful quantitative data. In order to use, and more importantly understand, what this database contains, a carefully study of what each index conveys and what the information included therein is must be conducted. Although the indices are focused on the banking sector of the financial industry, some indicators can shed light on the entire financial sector, such as the ones pertaining to concentration of activities under a single entity and concentration of ownership of different kinds of institutions.

The voluntary nature of participation in this survey meant that not all countries provided answers, and even those who did, did not answer all questions and took part in all periods. In fact, there are only 9 complete observations in the entire dataset. This is clearly not enough to conduct any kind of worthwhile analysis, hence a compromise between completeness and volume of observations had to be found. Because of this, I decided to focus on a small number of variables that allowed the study of the whole financial sector, and not merely supervision of the banking sector. The process for selection is described in the following section. The dataset is divided into ten different sections, each concerned with a different aspect of financial regulation. Even inside each section, indices might contain different measurements, requiring separate and careful measurement.

Table VI contains a brief description of all the indices. In this text, I'll focus on observing overarching trends and take a closer look into a few measurements of interest during the crisis period (2007-2010). For an in-depth explanation and analysis on the indices, refer to Barth, Caprio, and Levine (2001, 2006, 2008) and Čihák, Demirgüç-Kunt, et.al. (2012). There is no clear trend in regulatory policy throughout the decade. In regards to separation of different segments of the financial sector, there has been a movement in the direction of liberalization of miscegenation between the banking, securities, and insurance and real estate activities. Foreign participation does not seem to be a threat to the financial system under the eyes of the regulators, there being a trend of liberalization of foreign participation in the banking system.

All indices were on average at their highest before and during the crisis, on the period between 2007 and 2010, and went lower in the subsequent period, that is, the response to the crisis seemingly did not cause regulators to become more stringent in this aspect, but more lenient. The same did not happen when it comes to the separation of ownership, however: there was a push for stricter separation between the financial and non-financial sectors of the economy, as well as between different parts of the financial industry itself. Requirements for entry and the definition of capital assets have likewise gotten stricter. It appears that regulators and policymakers have focused on these aspects of regulation as fundamental to maintain stability of the financial system. Regulators seem to have gained more power and independence, as well. Supervisors have been given on average a significantly higher amount of discretion to take swift action when a potential failing has been observed.

They also seem to have been granted more discretion on whether to act or not when an irregularity has been detected, which is not completely a positive development, since, as remarked on the previous section, American regulators chose not to interfere in the market until the situation was unsustainable. During the crisis period, most countries freely allowed

the mixing of commercial banking and securities activities. Only 11 countries of the 138 surveyed kept them completely separated: Belize, Botswana, China, Dominican Republic, El Salvador, Ethiopia, Guyana, Indonesia, Papua New Guinea, Tajikistan and Thailand. The United States placed no restrictions on the breadth of operations, only requiring that part of them to be conducted through subsidiaries. In regards to the separation of banking and insurance, the absolute majority of countries placed restrictions or outright forbade them, including the United States; only the United Kingdom and Hong Kong are fully liberalized in this respect. The situation is very similar when it comes to real estate investment and development; only the following regions allow its mingling with banking: Algeria, Aruba, Austria, Belarus, Belgium, Germany, Hong Kong SAR, Ireland, Kyrgyz Republic, Liechtenstein, Macedonia FYR, Mexico, the Netherlands, New Zealand, Spain, Suriname, Switzerland and the United Kingdom.

In regards to conglomeration both inside the financial sector and between financial and non-financial firms, most countries have at least some restrictions in place. Only the Cayman Islands, Mexico and New Zealand freely allow cross-ownership between financial and non-financial firms. They also freely allow conglomeration between financial and non-financial firms, in which they're joined by Belarus, Belgium, Cambodia, Cameroon, the Central African Republic, Chad, Republic of Congo, Costa Rica, Equatorial Guinea, Finland, Gabon, Maldives and Morocco. On the opposite side of the spectrum, Algeria, Bolivia, Colombia, El Salvador and Nicaragua completely forbid cross-control between the financial and non-financial sectors. More countries prevent concentration of different segments of the financial segment: Algeria, Bangladesh, Bolivia, Botswana, Colombia, Fiji, Jamaica, Lesotho, Mozambique, Nicaragua, Seychelles and Suriname.

Most countries have a very strict risk weighting of capital requirements, in accordance to Basel II regulations. The following have very lax definitions: Aruba, Belgium, Canada, Congo, Egypt, Equatorial Guinea, Ireland, Lithuania, Mozambique, Seychelles and

the Slovak Republic. When measuring capital asset definitions, most countries are strict. The ones with very lax definitions (rather, that accept a larger variety of assets as reserves) are: Austria, Bosnia and Herzegovina, Burundi, Denmark, Ethiopia, Greece, Hong Kong SAR, Ireland, Israel, Macedonia FYR, Morocco, Mozambique, Peru, Philippines, Singapore, Sweden and the United Kingdom. Financial regulators are granted wide powers of supervision in most countries. Even in countries where their actions are subdued, they're still granted relatively large privileges. The countries that restrict the actions of supervisors the most are Bhutan, Botswana, Canada and Suriname.

On the other hand, in the following regions they have been granted practically the full range of powers measured in this index: Belize, Brazil, Colombia, Hungary, Indonesia, Lithuania, Malaysia, Malta, Mauritius, Nigeria, Pakistan, Portugal, Singapore, Slovenia, Switzerland, Uganda and the United States. Most countries allow regulation a very large amount of discretion on using these powers on seemingly failing institutions. The countries with the strictest conduct legislations are: Algeria, Israel, Malaysia, Maldives, New Zealand, Portugal, Sweden and the United Kingdom. The United States is amongst those that grant their supervisors with the largest amount of discretion. As seen on the previous section, it wasn't that the supervisory structure had its hands tied on dealing with the increasing complexity and undermining of the whole financial system that contributed to the moral hazard issues that set off the crisis, but that they actively chose not to interfere in the market.

4. Results

4.1 Balancing the trade-off between the number of explanatory variables and observations

The first difficulty when working with this dataset was the amount of missing values. In fact, there are only 9 complete observations in regards to regulatory data, throughout all four surveyed periods, which is definitely not enough to conduct worthwhile analysis. I had thus to discover a way of balancing the tradeoff between having a valuable number of variables for analysis and having enough observations so that econometric analysis would provide insightful results. Automated methods of variable selection such as stepwise selection were not used as the different number of observations in each test would not lead to consistent results to be used in specification tests.

For the initial analysis, I focused on the standard deviation of growth as the response variable, since the main interest on the present research lays on figuring out whether there is any significant relationship between how strict financial regulation is (or, conversely, how liberalized the sector is) and the degree of economic output fluctuation, how smooth or bumpy it is. It is assumed that, although liberalization does indeed seem to lead to higher growth, this growth comes at the expense of increased risk and instability in the system, which would result in a larger fluctuation of output, due to subsequent, intermittent recessions, while countries under stricter regulatory systems might achieve lower overall growth, but since they are exposed to less risk, their economies are more stable, hence there should be less variation in output compared to the former case.

In order to narrow down the possible variables of interest, a series of simple regressions of each regulatory indicator on the standard deviation of growth followed, and those that by themselves produced coefficients statistically significantly different from zero were selected. Initial GDP per capita was not used as a control variable at this step, since the size of output has no significant role in how regulation could affect its fluctuation in this model. Since the focus is on the role of regulation under the crisis, analysis was conducted for the period covering the years 2007 to 2010 in this step. Concentrating on a single period allowed the use of pure cross-country regression analysis, conveniently avoiding having to figure out country-specific effects and autocorrelation over time, due to the relatively short period data is available for, as well as the incompleteness of the data set. The model considers regulation to be exogenously determined, so the dependent variable was formed from data collected from the year the respective survey was published (in this case, 2007) up to but not including the year of publication of the following questionnaire (2011). The following results were obtained:

Dependent'variable	Independent'variable	Coefficient	T4value	P4value	R^2
GDP.Growth.StdDev	*secur_act*	.0.2285	.2.5427	0.0122	0.0481
GDP.Growth.StdDev	*own_firm*	.0.2697	.3.6809	0.0003	0.0925
GDP.Growth.StdDev	*Nonbankfin_own_bank*	.0.2804	.3.3875	0.0009	0.0817
GDP.Growth.StdDev	*Overall_restrict*	.0.1323	.3.3524	0.0011	0.0831
GDP.Growth.StdDev	*ovr_cap_string*	.0.2176	.3.1082	0.0030	0.1494
GDP.Growth.StdDev	*cap_reg*	.0.1706	.2.4714	0.0166	0.1000
GDP.Growth.StdDev	*Court_Involve*	0.3241	2.5839	0.0109	0.0492

All indicators seem to behave consistently with our expectations: higher values of the independent variables mean stricter regulations in those areas, so the negative correlation with the dependent variable is interpreted as the tighter the regulation, the lower the fluctuation in growth; or, conversely, that liberalization in these areas are correlated to higher

fluctuations in output. The only exception is *court_involve*, where interpretation is reversed: higher values mean less independence from a priori judicial decisions; in other words, regulators have less power to act independently. Before proceeding with any further econometric analysis, it should be noted that some aggregate variables and also their components are included, namely *own_firm, nonbankfin_own_bank* and *overall_restrict*, as well as *ovr_cap_string* and *cap_reg*. In order to control if the inclusion of these aggregates is due only to their correlation to their included components, they have been in further analysis replaced by their missing components, *firm_own_bank* and *init_cap_strin*, respectively.

4.2 Measuring the effect of regulation on output fluctuation

In order to figure out the individual effect of each regulatory aspect on fluctuation, I then proceeded to run multiple regression analysis on the previously mentioned variables. After getting the preliminary results, we decided to drop the variable related to judicial involvement on bank supervision. First, because of the previously mentioned tradeoff due to missing values; second, because it was so far away from statistical significance under any reasonable significance level: its p-value was of 0.62, which was also much higher than that of any other explanatory variable, which was also corroborated by conducting F-testing between both regression specifications (Table IV); finally, it does not measure any direct aspect of regulation, rather, the relationship between regulatory agencies and the courts.

Running a multiple OLS regression on the remaining explanatory variables provides results consistent with what was expected for all independent variables, except for *firm_own_bank* and *init_cap_strin* (Table I). However, since these coefficients are not statistically significantly different from zero in the 95% confidence interval I have chosen to operate under, this is not a cause for concern.

The first information I can extract from this analysis is that, independently from the aspects of regulation measured, there is a large expected fluctuation in output during this turbulent period. What we can also see is that, consistently with the preliminary hypothesis, there is a statistically significant, positive correlation between regulatory liberalization in regards to conglomeration of the financial sector and oscillations in growth. Economies that fully allow financial firms to control other financial firms are expected to have standard deviation of their growth rates more than three percentage points higher than others that forbid such concentration.

Likewise, allowing cross-ownership between financial and non-financial firms also increase fluctuations by a similar amount. This is a significant amount, when seen under the light that the mean deviation was of 3.65 percentage points. Due to the key role that the failure of certain banks played on the deflagration of the crisis, it's not surprising that capital adequacy rules also appear to have a significant effect on fluctuation. Once again, liberalization is correlated to higher volatility: here there is also an expected difference of 3 percentage points between the extremes. After having evidence of a strong possible relation between these aspects of financial regulation and output volatility under the aforementioned crisis, I then checked whether this behavior also holds on other timeframes. None of the relevant explanatory factors are of statistical significance in explaining growth fluctuations during the previous periods, comparing unfavorably in explanatory power to an empty model. Since there is only growth rate data for a single year on the period following the crisis, as data for 2012 is not available as of yet, there is no way of measuring its standard deviation.[16]

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[16] With a single data point, the observation is equal to the mean; therefore deviation is always equal to zero.

4.3 Measuring the direct effect of regulation on growth

In order to measure whether tighter regulation in these areas would hamper output growth as expected, the current model was then adjusted to have the average growth rate as the response variable, while also introducing initial GDP per capita in the period as a control, in order to check for economic convergence (Table II). Once more, no significant correlation was found in the pre-crisis periods. During the crisis, a statistically significant positive correlation only between liberalization of the kinds of assets used to inject capital in a bank and output growth emerges. None of the other observed variables seem to hold a statistically significant effect on output growth. This might be explained by the fact that allowing flexible capitalization to institutions in periods of instability might assist their recovery or prevent their failure.

4.4 Multi-period analysis

I also conducted panel data analysis on this model, using dummy variables to control for the specific effects of differing periods (Table III). Doing so enables checking the possibility for any sort of overarching trend throughout all the differing periods. In regards to the direct effects of regulation on growth rate, results are consistent with previous observations: none of the regulatory factors are significantly different from zero. When measuring the cross-period trend on volatility, however, new information arises: deregulation of securities activities and liberalization of capital adequacy directives are correlated with higher standard deviation of growth rates throughout all measured periods.

Having these results at hand, I can infer that restrictive regulatory measures in regards to financial activity concentration and conglomeration both inside the financial sector and between the industry and non-financial entities do not seem to directly affect growth; opposing what common economic sense might say, tighter regulation, at least in these areas,

does not hamper economic performance. When it comes to their effect on volatility, however, there is strong evidence that keeping distinct areas of the financial industry apart leads to a smoother growth. Separating commercial banking and securities underwriting and sales appears to play a role on reducing fluctuations on output throughout all observed periods, even though its effect cannot be observed individually on the pre-crisis terms.

When examining the crisis period specifically, other facets of regulation appear to be of relevance: keeping segments of the financial sector separate from each other and from other parts of the economy are now strongly associated with a significant reduction in instability, while once more not affecting growth itself negatively. Having stricter controls on the types of assets used to capitalize banks did, indeed, seem to hamper growth in this period, however.

The most likely explanation for the effects observed seem to be that they prevent the issues of moral hazard and information asymmetry the literature alludes to, since it allows risk sharing between branches of the same company and use of information for private gain, while preventing others from assessing the real situation of the institution.

5. Conclusion

In the present paper, I set out to try to figure out the relationship between strictness of financial regulation and fluctuations of output growth. Although economic common sense and some empirical evidence point to the direction that strict regulation might hamper economic development, there has not been much analysis on how smoothly this progression presents itself. I started out under the hypothesis that, while it might be true that liberalization leads to faster growth, it is under the expense of increased risk, and, therefore, larger fluctuations in output. Even though there is not enough information available to study all the different facets of financial regulation included in the dataset I used to base my research, due to the tradeoff between the number of explanatory variables and sample size I had to balance, I was still able to successfully isolate some aspects that seem to have played a statistically and economically significant role on the oscillations of production during the crisis timeframe (2007–2010).

Preventing conglomeration between distinct sectors of the financial industry as well as their collusion with non-financial economic agents apparently has lead to more stable growth. The same is the case when discussing the rigidity of banking capital definitions and the classes of assets allowed in required reserves. For instance, I suppose that countries that do not allow mortgages to be part of an institution's reserve capital have had fewer issues in comparison to those whose banks had toxic assets the worth thereof disappeared overnight when that bubble popped. This is not to say that other aspects of financial regulation are less relevant: selecting a few measures of interest was strictly a matter of pragmatism in order to have a relevant amount of data to conduct useful analysis. In opposition to the common sense, tighter rules in regard to these aspects did not hinder growth, either during the crisis period, or the previous periods, when analyzed individually. Stricter capital definitions were actually

correlated with larger growth in the crisis period. The lack of response from either growth or its standard deviation outside the crisis period seem to point to the fact that, at least in regards to the variables currently under analysis, there is no direct benefit to liberalization, which, should an external shock such as the one that started in 2007-2008 happen, appears to be correlated to a destabilization of the whole economy. This is not to say, however, that liberalization does not produce any positive outcomes: it's possible it could lead to higher productivity inside the financial sector itself, at least until the instability it nurtures takes its toll on the larger economic panorama.

Moreover, when assessing the effects of these variables on a longer-term basis, I have shown that they still do not seem to interfere with growth. Under this lens, stricter capital definition laws and separation of the banking and the security underwriting and trading industries seem to have a positive effect on smoothing output fluctuation. In accordance to what was shown in the literature review, allowing the consolidation of the different segments of the financial industry hampers efficient supervision, just as happened in the United States, where the introduction of Consolidated Financial Institutions made oversight all but impossible: no inspection took place between their introduction and the crisis. This now seems to be corroborated by empirical evidence, as I have shown that financial conglomeration is associated with increased output fluctuation.

In conclusion, as a suggestion to policymakers, I can say that, under the light of the present analysis, I advise the adoption of regulation that maintains the separation between segments of the financial industry; that separates the ownership of financial and non-financial institutions; and that institutes strict reserve capital definition and that clearly states its allowed constituting asset classes. Adopting these measures is a valuable precaution against external economic shocks with apparently no tradeoff in productivity.

APPENDICES

TABLE I: STANDARD DEVIATION REGRESSION RESULTS

	2007-2010	2000-2002	2003-2006
Constant	9.1698	-0.4559	2.8722
	(5.057)	(-0.272)	(1.529)
secur_act	-0.5993	0.2136	-0.2725
	(-1.678)	(0.746)	(-0.763)
own_firm	-1.0927	0.1148	0.2362
	(-2.220)	(0.335)	(0.638)
firm_own_bank	0.5475	0.3409	-0.2687
	(1.137)	(1.067)	(-0.505)
Nonbankfin_own_bank....	-1.0989	0.6979	0.1199
	(-2.057)	**(2.068)**	(0.255)
ovr_cap_string	-0.5504	0.1967	-0.2608
		(-2.495)	(1.207)(-1.482)
init_cap_strin	0.7656	-0.1169	0.3171
	(1.764)	(-0.367)	(0.886)

n	56	49	65
Adjusted R^2	0.3394	0.0853	-0.0072
F-t.p-value	0.0001465	0.1342	0.4848

Numbers in parenthesis are t-values; bolded numbers indicate statistical significance at the 5% level.

N is the number of observations in each regression.

F.p-value is the p-value of the F-test comparing that regression to an empty model. The dependent variable is the standard deviation of growth rates in each period.

TABLE   II: GROWTH RATE REGRESSION RESULTS

	2007–2010	2000–2002	2003–2006
Constant	1.021E+00	1.038E+00	1.071E+00
	(43.749)	**(34.398)**	**(41.136)**
Secur_act	4.006E-03	6.681E-03	1.170E-03
	(0.964)	(1.235)	(0.241)
Own_firm	1.008E-02	-4.628E-04	-4.142E-03
	(1.754)	(-0.074)	(-0.825)
Firm_own_bank	2.101E-03	-7.091E-03	-7.354E-03
	(0.375)	(-1.234)	(-1.041)
Nonbankfin_own_bank....	8.298E-05	6.713E-03	3.452E-03
	(0.014)	(1.043)	(0.554)
ovr_cap_string	-3.658E-04	-1.906E-03	4.097E-04
	(-0.145)	(-0.588)	(0.167)
init_cap_strin	-1.004E-02	-1.207E-03	-2.154E-03
	(-1.978)	(-0.208)	(-0.426)
init_GDP_pcap	-9.059E-07	-7.284E-08	-4.167E-07
	(-2.783)	(-0.191)	(-1.297)

n	56	49	65
Adjusted R^2	0.2561	-0.01158	-0.06107
F-t.p-value	0.002793	0.5001	0.8495

Numbers in parenthesis are t-values; bolded numbers indicate statistical significance at the 5% level.

N is the number of observations in each regression.

F.p-value is the p-value of the F-test comparing that regression to an empty model. The dependent variable is the geometric average of the growth rate index for each period (multiply each coefficient by 100 to get percentage point values).

TABLE III: PANEL   DATA REGRESSION RESULTS

	Std-dev	**Geo-Growth**
Constant	4.8012	1.043E+00
	4,760	**(77.664)**
secur_act	-0.3987	3.687E-03
	(-1.996)	(1.407)
own_firm	-0.2689	8.158E-04
	(-1.107)	(0.259)
firm_own_bank	0.2719	-3.604E-03
	(1.036)	(-1.082)
Nonbankfin_own_bank....	-0.1710	3.744E-03
	(-0.635)	(1.086)
ovr_cap_string	-0.3432	-2.734E-04
	(-3.262)	(-0.196)
init_cap_strin	0.1044	-4.842E-03
	(0.481)	(-1.679)
init_GDP_pcap	--	-5.195E-07
	--	**(-2.173)**
dummy_2003	-0.1349	1.230E-02
	(-0.330)	**(2.373)**
dummy_2007	1.1677	-7.015E-03
	(2.778)	(-1.316)
Adjusted R^2	0.1387	0.1469
F-t.p-value	0.00007826	0.00006181

Numbers in parenthesis are t-values; bolded numbers indicate statistical significance at the 5% level.

N is the number of observations in each regression.

F.p-value is the p-value of the F-test comparing that regression to an empty model.

Dummy_2003 and dummy_2007 are dummy variables corresponding to the four-year period starting at the aforementioned years.

Std-dev is the panel data regression ran on standard-deviation of the growth rate per period;

geo-growth is the regression ran on the geometric average of the growth rate of each period.

At The Crisis Period

	Restricted	Unrestricted
Constant	9.1698	9.9214
	(5.057)	**(4.695)**
secur_act	‑0.5993	‑0.7151
	(‑1.678)	(‑1.764)
own_firm	‑1.0927	‑1.2217
	(‑2.220)	**(‑2.194)**
firm_own_bank	0.5475	0.5285
	(1.137)	(1.012)
Nonbankfin_own_bank....	‑1.0989	‑1.0188
	(‑2.057)	**(‑1.810)**
ovr_cap_string	‑0.5504	‑0.5504
	(‑2.495)	**(‑2.433)**
init_cap_strin	0.7656	0.8050
	(1.764)	(1.654)
court_involve	...	‑0.2882
	...	(‑0.493)
df	49	46
RSS	235.782	232.443
Adjusted R^2	0.3394	0.3185

F-test	0.01436481	<	2.806845
	Failed to reject H0 at the 95% confidence interval		

Df is the number of degrees of freedom for each model.

RSS is the residual sum of squares.

The null hypothesis under the F-test is that the additional independent variables do not significantly add to the explanatory power of the model.

APPENDIX B: COUNTRY LIST

TABLE V: LIST OF COUNTRIES INCLUDED IN THE FINAL REGRESSION ANALYSIS

|		
Algeria	Germany	Netherlands
Antigua and Barbuda	Ghana	Nicaragua
Argentina	Greece	Niger
Armenia	Grenada	Pakistan
Aruba	Guatemala	Papua New Guinea
Australia	Guinea-Bissau	Paraguay
Azerbaijan	Guyana	Poland
Belarus	Honduras	Portugal
Belgium	Hong Kong SAR, China	Romania
Belize	Hungary	Russian Federation
Benin	Indonesia	Senegal
Bhutan	Ireland	Seychelles
Bolivia	Isle of Man	Singapore
Bulgaria	Israel	Slovak Republic
Burkina Faso	Italy	Spain
Burundi	Jordan	St. Kitts and Nevis
Cambodia	Korea, Rep.	St. Lucia
Canada	Kyrgyz Republic	St. Vincent and the
Colombia	Latvia	Grenadines
Congo, Rep.	Lebanon	Sweden
Cote d'Ivoire	Liechtenstein	Togo
Croatia	Lithuania	Tonga
Cyprus	Luxembourg	Trinidad and Tobago
Czech Republic	Macedonia, FYR	Tunisia
Dominica	Malawi	Turkmenistan
Egypt, Arab Rep.	Malaysia	Ukraine
El Salvador	Mali Morocco	United Kingdom
Equatorial Guinea	Mozambique	United States
Estonia	Namibia	Uruguay
Gambia, The		Venezuela, RB

APPENDIX C: SUMMARY OF DATA

TABLE VI: REGULATORY INDICES SUMMARY

| Section I: Banking Activity Regulation		
Indicator	Explanation	Measure
secur_act	Securities underwriting industry	No restrictions and selling, on direct entrance in the involvement mutual fund
insur_act	Insurance and selling	At least part underwriting must be conducted through subsidiaries
Real_act	Real Estate	Some investment and restrictions development apply
Act_restrict	Aggregate index	Total prohibition
Section II: Financial Conglomeration		
own_firm	Whether unrestricted are allowed to control non-financial firms	Financial Firms
firm_own_bank	Whether non-financial firms can own firms	Requires prior firms approval
non bankfin_own_bank	Whether other financial firms can own banks	Limits on ownership apply
overall_restrict	Aggregate index	Prohibited
Section III: Competition Regulation		
limit_foreign_bank	Degree of limits to entry of foreign institutions	0-4, increasing to restrictions
entr_bank_req	Legal requirements bank licensing	0-8, increasing to restrictions
frac_denied	Fraction of denied banking applications	Ratio
frac_dom_den	Fraction of domestic denials	Ratio
frac_for_den	Fraction of foreign denials	Ratio
Section IV: Required Capital		
ovr_cap_string	What risk elements are reflected in the ratio	0-7, increasing stringency
init_cap_strin	What classes of assets are allowed to be included in the required capital reserve	0-3, increasing stringency
cap_reg	Aggregate index	
Section V: Official Supervisory Action		
sup_power	What actions can the supervisory entity take	0-14, increasing powers

prmpt_corr_pwr	Whether there are legally required levels of solvency that demand automatic action	0-6, increasing promptness
restruc_pwr	Can regulators restructure failing institutions	0-6, increasing powers
insolv_pwr	Can regulators declare insolvency of troubled institutions	0-4, increasing powers
sup_forbear	Amount of supervisory discretion	0-4, increasing discretion
court_involve	Independence of regulators from the courts	0-3, decreasing discretion
loan_class_strin	Stringency for degradation of classification for overdue loans	Number of days
prov_strin	Provisioning is required when classification of a loan is degraded	Percentage
drivers_index	Amount of legally required asset diversification for banks and if they are allowed to borrow from abroad	0-2, increasing diversification
Section VI: Supervisory Structure		
sup_tenure	Tenure of supervisors	Years
sup_ind_political	Independence from political influence	Binary
sup_ind_fixed	Independence from the banking industry	
sup_ind_fixed	Existence of fixed-term mandates of at least 4 years	
sup_ind_overall	Aggregate measure of the former 3 variables	
multiple_supervisors	Multiple regulatory bodies for banks	
single_multiplesupervisors	Single supervisor for the entire financial sector	
Section VII: Private Monitoring		
Cert_audit	Requirements of external audits	Binary
IntRatedBanks_pct	Internationally Rated Banks	Percentage
DomRatedBanks_pct (*)	Domestically Rated Banks	
Nodepinsure	Existence of a formal deposit insurance system	Binary
BankAccounting	How informative banks`	0-4, increasing amount of

|	financial statements are.	information
PrivateMonitoring	Aggregate Index	
Section VIII: Deposit Insurance		
Depo_insur_pow	Institutions` power for taking action, or their directors	0-4, insurer increasing powers
Depo_insur_fund	Size of the insurance fund to total bank assets	Ratio
Funding_insured	Total deposits covered by deposit insurance	Percentage
MoralHazard	Measures taken to mitigate moral hazard	0-3, increasing mitigation
Section IX: Market Structure		
BankConcentration	Concentration of deposits	Percentage
BankConcentration_assets	Concentration of assets	
ForeignBanks	Foreign-owned Banks	
GovernmentBanks	Government-owned Banks	
Section X: External Governance		
ExAudit	Effectiveness of external audits	0-7, increasing efficacy
FS_Transparency	Transparency of financial statements of financial institutions	0-6, increasing transparency
AccPractices	Adoption of internationally validated accounting practices	Binary
ExRating_CreditMonitoring	Quality of external ratings	0-5, increasing efficiency
External_governance_index	Aggregate Measure	

TABLE VII: DATA VISUALIZATIONS

Histogram of secur_act for the crisis period

Histogram of insur_act for the crisis period

Histogram of real_act for the crisis period

Histogram of own_firm for the crisis period

**Histogram of firm_own_bank for the crisis period**

33
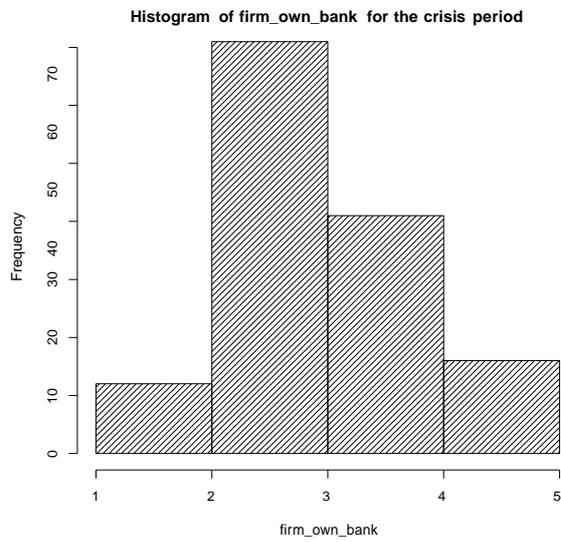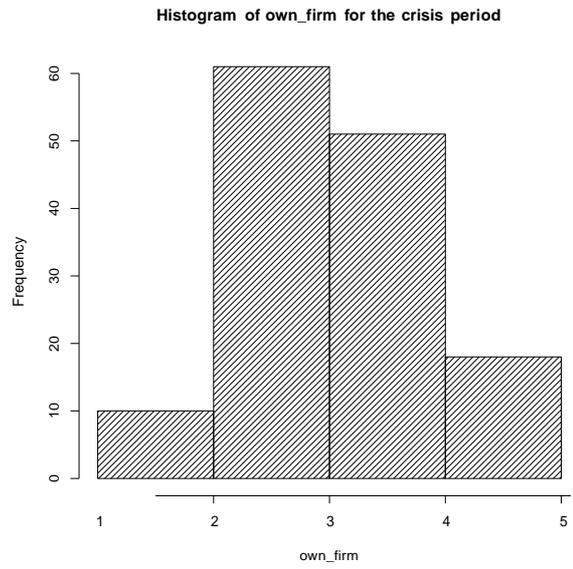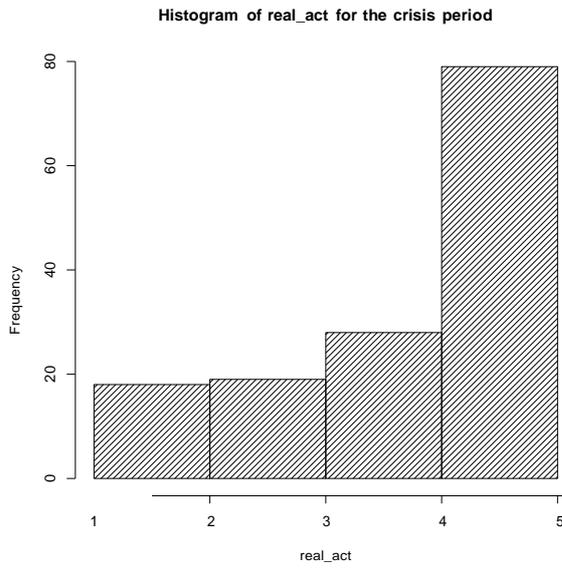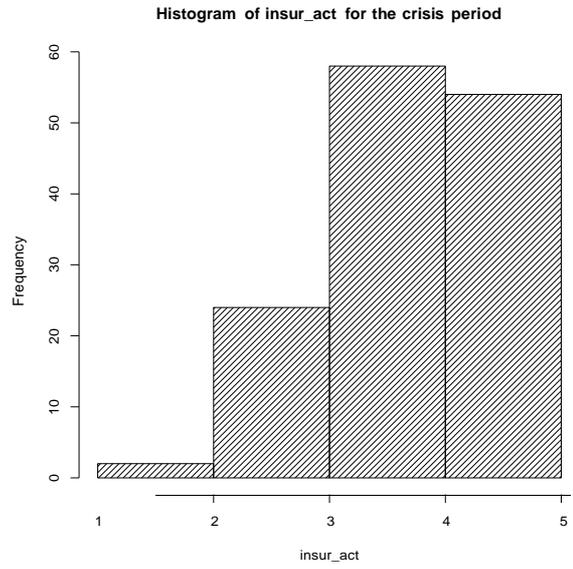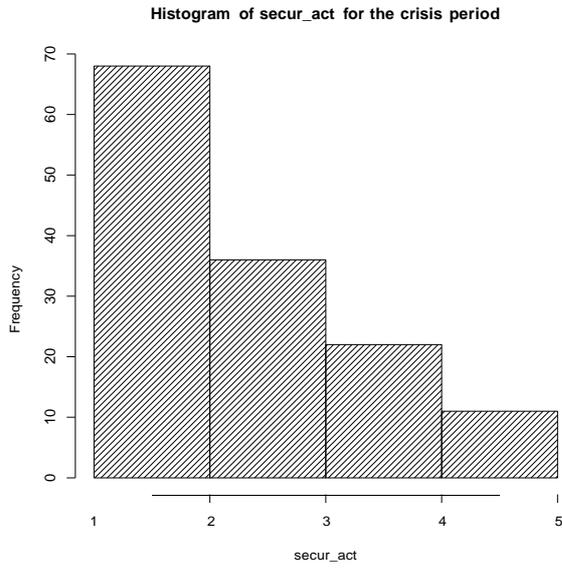
Histogram of nonbankfin_own_bank for the crisis period
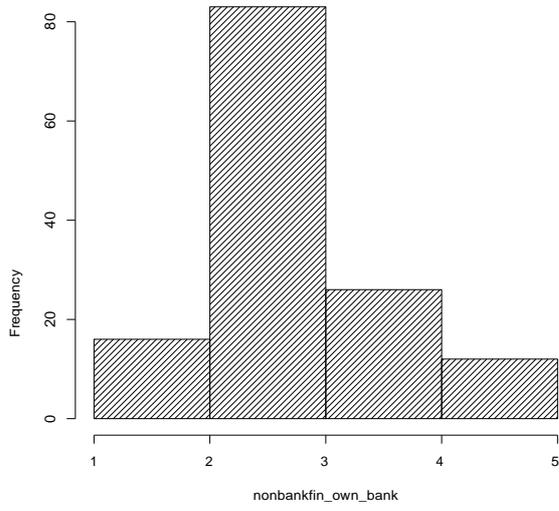
Histogram of ovr_cap_string for the crisis period
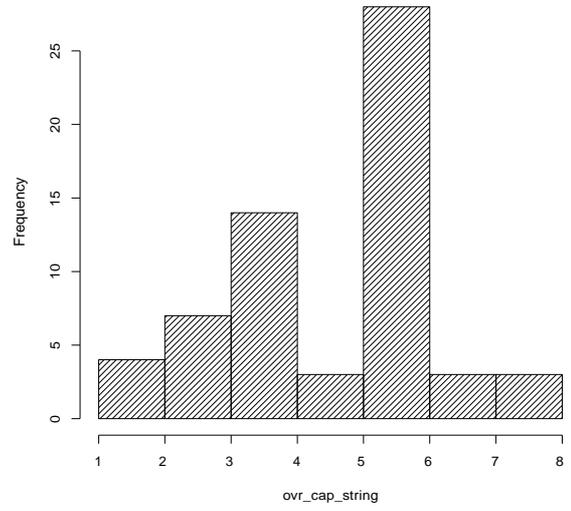
Histogram of init_cap_string for the crisis period
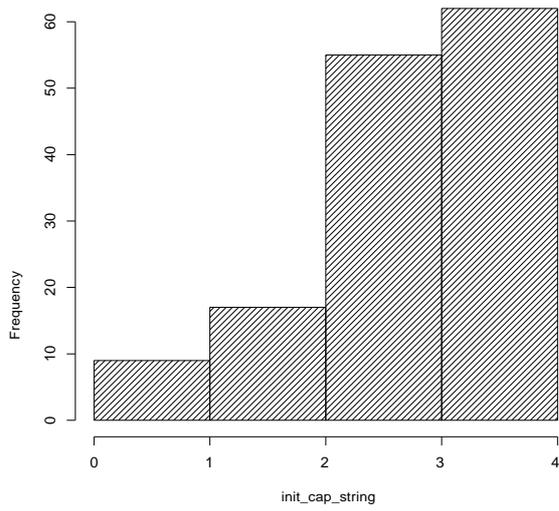
**Histogram of sup_power for the crisis period**
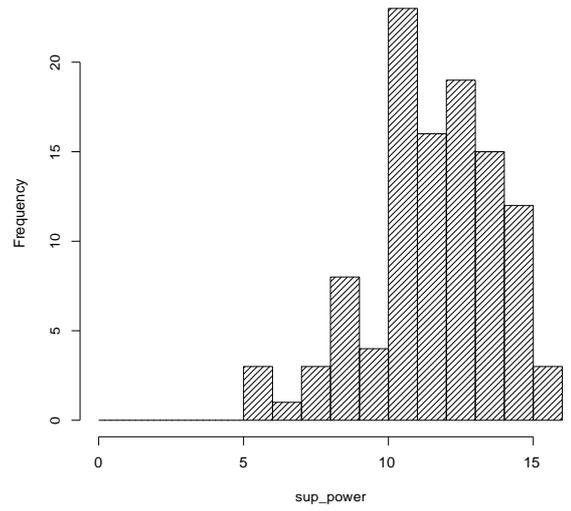
**Histogram of sup_forbear for the crisis period**

42
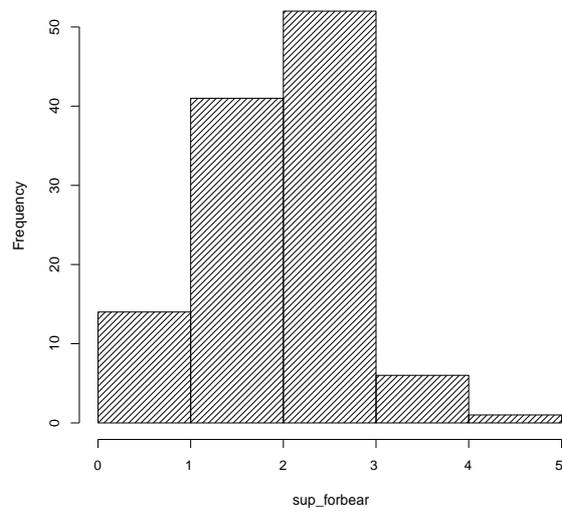
Histogram of court_involve for the crisis period
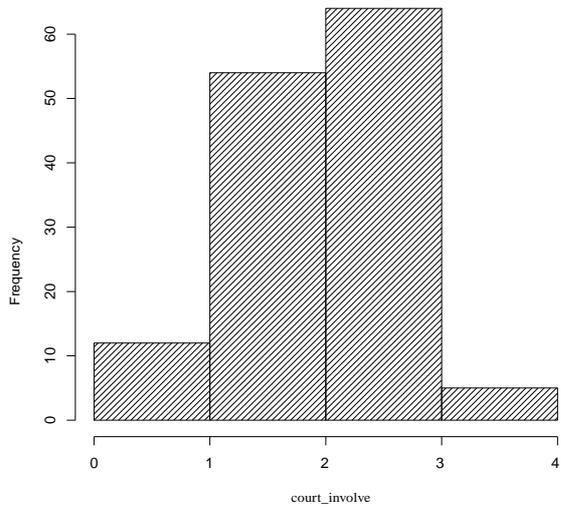
Histogram of average growth during the crisis
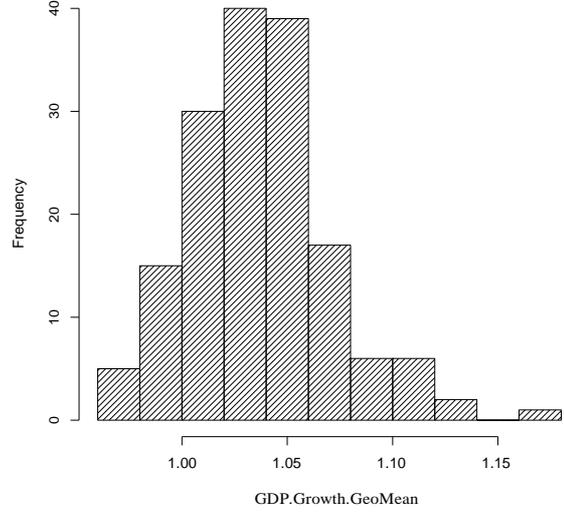
Histogram of fluctuation during the crisis

43
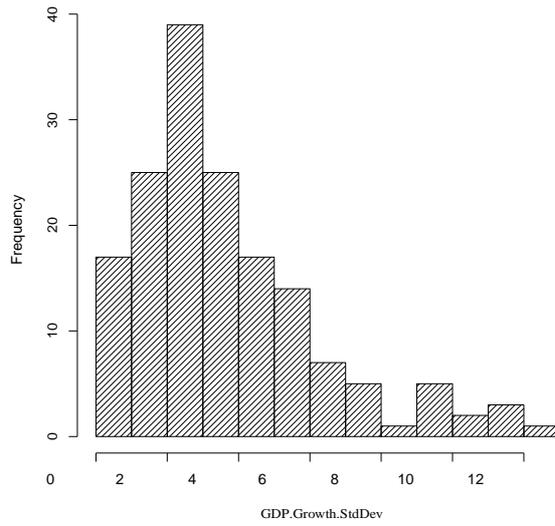
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