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Hryckiewicz, Aneta

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Originators, traders, neutrals, and traditioners – various banking business models across the globe. Does the business model matter for financial stability?

Dr Aneta Hryckiewicz*

Goethe University of Frankfurt and Kozminski University

Abstract:

Why were some banks heavily affected by mortgage crises, while others barely? Why were some banking sectors dominated by "originate and distribute" model, while others were trading? Why did some banks decide not to follow the others, and preferred to stay traditional banks? How the models chosen by banks translated into their risk-return profiles? And finally, which banking model makes the world safer? This article raises these issues. It shows that heterogeneity in the banking industry before the mortgage crisis was huge. We document that institutional factors were largely responsible for the development of individual banking models in single countries. We find that the most risky banking model is when banks specialize in trading and do not diversify. Therefore, the most "optimal" from risk-return profile seems to be the "balanced" model. The traditional model though appears as systemically the least risky, it does not allow banks to achieve sufficient return.

*Chair of International Banking and Finance, Johann Wolfgang Goethe University, House of Finance, Grueneburgplatz 1, 60323 Frankfurt am Main, Germany and Accounting Department, Kozminski University, Jagiellonska Street 57/59, 03-301 Warsaw, Poland, e-mail: ahryckiewicz@alk.edu.pl

1. Introduction

The mortgage crisis has revealed that the general knowledge about the activity undertaken by banks is limited. The banks have considerably increased in complexity and in size recently. In several countries banks' size exceeded country's size in terms of GDP as for example in Netherlands, Belgium or Switzerland. Banking business has also changed in nature. Banks started to be more tied to the capital market performance, interlinked with each other, and their products became more complex (Borio and Drehmann, 2009;Boot and Thakor, 2009; Song and Thakor, 2010). For example, the syndicated loan market solely in US rose from a mere $339 billion in 1988 to 2.2 trillion in 2007, the year a market has reached a peak. Similarly, the volume of loan trading in US increased from $8 billion in 1991 to $176 billion in 2005. The securitization of loans achieved $180 billion in 2007 in USA(Securities Industry and Financial Market Association).In Europe this growth trend was similar, however on a lower scale. The issuance volume of mortgage loans grew almost sixfold between 2000 and 2006 and reached 459 billion euro (Praet and Herzberg, 2008). At the same time, the repo market has doubled in size since 2002, with gross amounts outstanding at year-end 2007 of roughly $10 trillion in each of the US and euro repo markets, and another $1 trillion in the UK repo market (Hördahl and King, 2008). Despite this general trend in the global banking industry, banks profited from this development to a different extent. For example, at the end of 2006 the asset structure of Deutsche Bank, UBS, or ING consisted mainly of securities business, whereas such banks as Royal Bank of Scotland or HSBC werethe originators of these securities. Some banks also decided to follow more traditional model as banks in Spain, Italy, or some banks in France. Consequently, Gropp and Heider (2010)document that there wasa huge heterogeneity in the level of banks capital in various countries, which is not explained by the capital requirements, but rather by banks' specific features.

These recent changes in the global banking industry have caused huge problems for the global economies. First, the regulators did not have sufficient and reliable knowledge about banks' activities, which did not allow them properly to assess the banking sector risk, and timely react to the banking sectors' problems (Lo, 2009; McCarthy et al., 2010). Second and more important, banks themselves lost an overview of the level of the risk they possessed on, due to the complexity and size of their transactions. The Risk Management Officer of one of the largest banks admitted in one press conference that "*he was not aware of some practices used by a bank*" (December, 2010). As a result, we experienced mortgage crisis 2007-2009, whose consequences have been disruptive for the global economy. Consequently, the US government had to devote more than $20 trillion for rescuing the

banking sector in order to prevent it from a collapse (Bloomberg, 20. July, 2009). Not less had to spend Europe on rescuing its banking system.

The disruptive consequences of the mortgage crisis forced regulators to work on preventing from such financial vulnerabilities in the future. To this end, several new regulations have been proposed to. The most important are the US Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act"), reshaped Basel regulations, UK's Vickers Report or EU Liikannen Report. All these documents aim at reshaping the banking business imposing on banks huge restrictions with respect to the activities, level of capital, leverage, and off-balance sheet activities. Though this is a right step to make our world safer, previous experience shows that such actions might impair the profitability of the banking industry, increase the cost of banking services, restrict the access to banking products, and encourage banks to take on additional risk by avoiding the necessary regulations.[1] Thus, we should be very careful with how we regulate the banking business. The above concerns are even more justified, as the empirical results are very inconclusive. Some studies point toward separation of commercial and investment banking activities. The argumentation behind this step is that universal model tend to use the capital inefficiently to cross-subsidize marginal or loss-making projects, draining resources from healthy businesses (Berger and Ofek, 1995; Laeven and Levine, 2009). On the other hand, other studies defend a universal model. They argue that it allows banks to achieve diversification, and thus stabilize their income source. Also, a relatively low correlation among key financial businesses explains a positive stability-effect of a firm scope (Saunders and Walter, 1994; 2012; Baele et al., 2007). Moreover, there is no agreement in the literature, which activities should be allowed for the banking business.Trading, underwriting or securitization interrelate with each other but affect differently the banking sector risk.

With our study we raise a question, what business model the banking industry should follow that does not impair banking efficiency, while at the same time does not increase the systemic risk? More specifically, by reviewing a wide scope of banking models and their effect on risk-return profile of these banks, we aim to identify the banking model, which seems to be the most optimal from risk-return perspective. With this respect we contribute significantly to the timely debate on the shape of regulations in the banking industry. In our artide, we ask the following questions: *a) which banking strategies could we define before the mortgage crisis?, b) why did banks decide to follow these*

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[1] For example, Barth et al.(2004) document that regulations have a negative effect on banks' stability by: a) higher probability of suffering a major banking crisis, b) lower banking-sector efficiency

strategies?, c) how did the banking strategies translate into the risk-return profile of these banks?, and finally d) how systemically important were these strategies?

To this end, we investigate the characteristics and risk profile of around 360 banks coming from all OECD countries over the period of 1995-2011. In addition, we also test the contribution of these models to the global systemic risk. Our analyses make three important contributions to the existing literature. First, using factor model analysis we identify the main banking models, which were observable in the global banking industry before the mortgage crisis. Then, using the asset and income approach we classify our banks into these categories identified by the factor model. Our approach allows us to determine the characteristics of the specific banking models and their impact on banking risk avoiding the endogeneity problem prevalent in this type of existing studies. Moreover, this approach also allows usto address the non-linear nature of financial effects, a problem not sufficiently captured by the existing studies.For example, Boot and Ratnovski (2012)document that combining the relationship banking with trading may offer some benefits at a low scale of trading, but risks outweigh the benefits when trading becomes a greater share of activity. Second, to the best of our knowledge there are no empirical results how banks' specific profiles are determined by countries' institutional factors. We ask the question, why the "originate-and-distribute" model was more prevalent in the USA and UK, whereas in Germany, Switzerland, Belgium or Netherlands we could observe rather a trader model; on the other hand,in Spain or Italy banks preferred to follow more balanced model, without significant exposure to very risky investment products. Third, we extend the set of income and asset structure variables to explicitly control for a type of banks' activities. Finally, we test the systemic importance of individual banking models by using a broad set of recently developed systemic measures including the systemic indicators developed by the V-LAB of New York University.

Our results are promising, addingto the current debate on banking regulations. They also provide important contribution to the existing academic literature on the role of banking activities in promoting the risk effect. First, they show that we could observe four major banking groups based on banks' activities before the mortgage crisis: *originators,traders*, *neutrals*, and *traditioniers*. These banking groups represent the models, which significantly vary with respect to their activities, income sources, liquidity, funding strategies, profitability, and risk level. The result of the analysis suggests that the models, which appeared to be very profitable, and exhibited high capital ratios before the mortgage crisis performed the poorest during the financial crisis of 2007-2011 contributing

significantly to the systemic risk. Our results point toward *trader*and *originator* model as the most risky, despite their satisfactory performance before the crisis. Similarly, as Adrian and Shin (2010)we argue that this effect is a result of high correlation of these banks' performance with the capital market. As the market turns down, the situation of these banks gets much worse than the other banking groups.Moreover, our results show that the high capital ratio of *originators* did not reflect the true risk of these banks due to large scale of their transactions included in the off-balance sheet. Though our results suggest that *traditional* model exhibits lower capital ratio, it is the least risky from the systemic risk perspective. Our results seem to suggest that the situation of these banks is more sustained, as the market turns down. Despite this feature of this model, these banks exhibit lower efficiency. The estimationssuggest that the*neutral* modelseems to be the best choice to follow, despite its positive however low correlation with the systemic risk measures. This result confirms the theoretical model of Boot and Ratnovski (2012)documenting that combining the relationship banking with non-interest activities may offer some benefits at a low scale of trading, but risks outweigh the benefits when they become a greater share of activity, as the originator and trader models indicate.

The rest of the paper looks following. The next section discusses the banking models observed before the mortgage crisis. The third section discusses the literature related to these models. The fourth section discusses the data and the methodology, however the fifthdescribes the main characteristics of banks applying particular strategy as well as factors responsible for the development of these strategies. The sixth section discusses the income sources, asset structure, and funding sources of individual banking models. Finally, the seventhsection discusses the contribution of individual model to global systemic risk. And last section concludes.

2. Recent trends in the banking business models – Factor Model Analysis

The recent financial liberalization, globalization, and development of innovation have resulted in an increased size, complexity and interconnectedness of banking institutions. However despite this global trend, banks became more heterogeneous they have ever been. This refers to banks' activities, efficiency, performance and risk-taking behavior. In this section we use the factor model analysis to distinguish the most prevalent banking strategies, which we could observe on the global banking market before the mortgage crisis. Thus, our approach allows us to group banks exhibiting similar features into the same class. The differences in banks' characteristics will reflect the differences in the banking models.

More specifically, factor analysis allows latent variables, which cannot be observed directly – in our case the banking model – to be assessed by a set of measures which are observable: reflective indicators (see e.g. Diamantopoulos et al., 2008). In our case the factor model will use banks' financial characteristics to group them into one component (i.e. factor), depending on the relative explanatory power of these variables (i.e. grouping banks exhibiting similar characteristics). The differences in the factor models show the differences between banking strategies. Table 1 presents the results for factor analysis based on the full sample period 1995-2006, and two time sub-periods as 1999-2004, and 2004-2006. Additionally, Table 2 presents the analysis over the entire sample period, however categorizing banks by their size. This analysis allows us to notice the differences between the banks' characteristics depending on their size.

[Table 1]

[Table 2]

The analysis presents interesting results. It indicates that each factor is explained by distinct characteristics of banking groups, which reflect banks' individual strategies. The estimations confirm that banking sector constituted a very heterogeneous group before the mortgage crisis.

The first factor load is largely explained by banks' non-interest income, and capital ratio. These characteristics seem to reflect the strategies of such banks as UBS, ING, or Fortis bank, which mainly focused on trading activities, however higher capital ratio reflected an upward trend observed on the capital market recently. We label this model as a *"trader"*. On the other hand, the second factor load is mostly explained by interest income and loan activity. These characteristics seem to reflect the

traditional banking model, hereafter called *"traditionier"*. This strategy was mainly followed by banks in less matured economies, as Poland or Latin America, where strong credit growth was observed in recent years (Bakker and Gulde, 2010). Interestingly, we see that third factor mainly loads on the profitability ratio, however without specific biased toward any income source. This factor might reflect strategies of banks, whose models were diversified in terms of income, however very profitable. Due to their "balanced" nature we name these banks as *"neutrals"*. This might point toward Italian or Spanish banks. Finally, the factor four is mostly explained by the non-operating income. This factor might reflect the "*originate and distribute*" model, where banks following this model had significant share of off-balance sheet activities. We call these banks hereafter as *"originators"*.

Interestingly, the model estimations show that the importance of individual banks' characteristics varies between individual sub-periods. The data seem to suggest that the divergence between the banking activities especially occurred at the end of 90s. The banks' determinants explaining the individual factors show the highest explanatory power in the second sub-period for the years of 1999-2004. However we also find that the importance of banks' characteristics' for individual factor loads slightly declined at the eve of the mortgage crisis between 2004-2006. Moreover, the data also suggest that non-interest income was the main driver of banks' performance in the entire sample period (cumulative power of non-interest operating income is 0.62, and non-operating income is 0.76, as compared to the interest income at the level of 0.59).This points toward highrisk accumulation in the banking sector before the mortgage crisis. The movement of banking activities from traditional into investment business has been mentioned in the literature, as a main determinant of the mortgage crisis(Adrian and Shin, 2010). The importance of the interest income however slightly increased for all sample banks between 2004-2006.

Finally, the data also show that the larger the bank is, the more non-interest activities it has in its balance sheet. Also, consistent with many empirical studies, our data show that the size of a bank translates into a better profitability. In the 90 centile of banks' asset size, the profitability is the main factor explaining a banking business model. This supports the empirical evidence on the positive effects of economy of scale in the banking sector (Stiroh and Rumble, 2006; Hughes and Mester, 2013;Wheelock and Wilson, 2012).

3. Banking business models in the literature

For a very long time period, literature has considered three main banking models: traditional, investment, and conglomerate or universal model. These models have significantly varied among their asset and liability structure. However, the combination of the asset with specific type of liability made each model unique, and less vulnerable to the financial turbulence. Moreover, the dominance of each of the model under specific institutional environment caused that all elements of country's financial sectors fit to each other, making the entire financial system consistent, and thus less pronounced to the financial crises (Tyrell and Schmidt, 2006; Allen and Gale, 2004).

The recent two decades have brought a lot of changes in the banking industry. As mentioned, banks became larger in size, more interconnected, and more complex, often combining traditional activities with capital market products. These changes have led to a situation that the composition of banks' balance sheet started to exhibit a mixture of features stemming from various banking models discussed in the theoretical literature. Therefore, we are interested in how these changes in the banks' balance sheets have translated into the risk-return profile of these institutions.

The answer to this question is however incredible difficult to test due to the endogenous character of financial variables, non-linear financial effects, and lack of necessary data, especially on banks' particular activities. Therefore, the current literature rather examines how specific banking characteristics affect banks' risk or banks' return. Besides a few exceptions, it however does not capture the effect of all bank's features on this bank's risk-return profiletreating all bank's financial variables as exogenous.

DeYoung (1994)andRogers (1998)document that large amounts of fee-based activities improved banks' efficiency in the 80s and 90s. However Stiroh (2004) and Stiroh (2006), and Fraser et al. (2002)find that banks' activities that generate significant non-interest income are far riskier than interest income activities. Moreover, the authors show that the risk-adjusted returns are no better than the risk-adjusted returns from traditional banks that rely primarily on interest income. Similarly,Allen and Jagtiani (2000) document that diversification benefits are not sufficiently large to justify expanding bank powers into securities business.

Recently, Demirgüç-Kunt and Huizinga (2010)find that bank risk decreases up to the 25th percentile of non-interest income, and then increases. Foos et al. (2010)analyze the effect of loan growth on

bank's risk in 15 EU countries. The results indicate that banks with high rate of loan growth are more risky than more conservative banks. Recently, growth in financial innovation allows banks to improve their financial ratios. Banks could achieve higher profits, minimize their regulatory capital, and improve their liquidity (Ambrose et al., 2005; Jeffrey et al., 2006; Wu et al., 2011).Overall this literature shows that financial innovation, and in particular securitization has a positive effect on bank's overall market value (Duffie and Gârleanu, 2001). Paradoxically, Froot et al. (1993), and Cebenoyan and Strahan (2004)find that banks that use more financial innovation to manage their risk more efficiently operate with greater leverage, and riskier balance sheet. Purnanandam (2011) and Rosen (2011)show that banks, which were engaged in the securitization tended to lend to more risky borrower, due to wrong incentives induced by "originate-and-distribute" model. Recently, Shleifer and Vishny (2010)show that investor sentiment makes profits and balance sheet of banks involved in the securitization process more volatile. The authors also show that this risk increases with the bank's leverage. Acharya and Hasan (2001)studied the effect of specialization versus diversification of assets on the return and risk of Italian banks over the period 1993-1999. Their results are documenting that a diversification in bank assets does not produce superior performance and/or greater safety for banks. In contrast, several studies show that diversification can offer banks a superior risk-return profile (García-Herrero and Vázquez, 2013; Wheelock and Wilson, 2012).

Studies analyzing the role of banks' funding show that deposit-funded banks were less affected by the mortgage crisis, had better performance, and were less risky (Loutskina, 2011). This is because the retail deposits are typically insured by the government, and their withdrawals in most circumstances are usually predictable at the aggregate level and mostly linked to the depositors' liquidity needs (Song and Thakor, 2007). In contrary, banks, which relied on the wholesale funding, were more heavily hit by the mortgage crisis(Adrian amd Shin, 2010). This is because in the liquidity crisis the wholesale market immediately reacts to the bad signals on the market situation. Demirgüç-Kunt and Huizinga (2010)stress the role of bank's capitalization and find that better capitalized banks experienced smaller decline in their equity value during the mortgage crisis than less capitalized. To the best of our knowledge, there exist only two studies, which evaluate the return-risk profile of banks at the same time. Boot and Ratnovski (2012) in their theoretical modeldocument by their model that combining the relationship banking with trading may offer some benefits at a low scale of trading, but risks outweigh the benefits when trading becomes a greater share of activity. This study is however of a theoretical nature. However King et al. (2013) empirically test the model of Boot and

Ratnovski and show that trading activities are positively correlated with banks' risk, however are negatively linked with banks' profitability and stock returns.

Another drawback of the existing studies is that most of the research classifies banks according to banks' activity based on the income source measured by interest versus non-interest income. However banks' non-interest combines a lot of sub-categories of income, as trading, service, commission, stakeholding etc. These income sources do not contribute to the banks' risk to the same extent. For example, Brunnermeier et al. (2011)document that trading can lead to a persistent loss of bank's income following a negative shock, whereas underwriting while more volatile than traditional banking is not associated with persistent loss of profitability. Accordingly, the non-interest income does not show to which extent banks are involved in a given business. For example, trading activity can be zero or negative even though a bank is actively engaged in this business. Finally, the non-interest income does not control for banks' off-balance sheet activities, though some banks heavily profited from these transactions. Only a few studies consider a broader definition of banks' activities and evaluate the impact of these income sources on banks' characteristics. Brunnermeier et al. (2011)investigate this relationship by decomposing non-interest income into two components: trading and, the sum of investment banking and venture capital income, showing that it increases risk in the banking sector. De Jonghe (2010)separate the non-interest income into net interest income, net commission, and fee income, net trading income, and net other operating income. However DeYoung and Torna (2013)split the non-interest income into three categories: fee income from traditional banking activities, fee-for-service income from nontraditional activities like brokerage and insurance, and stakeholder income if a bank make principle investment on its own behalf. All these studies find that nontraditional activities make banks' profits more vulnerable and thus increase probability of banks' failure. However King et al. (2013) test the role of trading income on banks' return-risk profile by decomposing the bank's activities into traditional, trading, and off-balance sheet. Interestingly, the authors measure the share of these activities in the bank's total income, asset, and market share. The authors find that especially the trading activity increases banks' risk profile, without compensating bank's return. Finally, some studies also look at the impact of banks' activities on the systemic risk. These studies mostly find a positive correlation. De Jonghe (2010)document that the shift to non-traditional banking activities increases banks' tail betas and thus reduces banking system stability. Brunnermeier et al. (2011)document that higher non-interest income (noncore activities like investment banking, venture capital and trading activities) has a higher contribution to systemic risk than traditional banking (deposit taking and lending). However

King et al. (2013) find that in particular trading activities make the greatest contribution to the systemic risk. Relatedly, Cifuentes et al. (2005), and Brunnermeier and Sannikov (2011)show that when the market structure is complete and banks keep similar assets in their balance sheet, the contagion effect driven by the asset price changes increases, and thus the systemic risk in a banking sector.

4. Data and methodology

4.1. Data

The main interest of our article lies in how various bankingactivities translate into the risk-return profile of these banks, and what is the contribution of the individual models to the systemic risk. We used the factor model analysis to identify the banking strategies, whichused to exist before the mortgage crisis. Then using the asset and income approach we group our sample banks into identified banking groups. The former approach allows us to classify banks into the appropriate banking model based on banks' activities. We consider following types of activities: mortgage origination and sale, trading of securitized asset, balanced mix of investment and traditional activities, and solely traditional activities. Depending ona type ofbank's specialization, we classify banks as "*originators*", "*traders*", "*neutrals*", and "*traditioniers*", respectively. However the income approach allowsus toclassify banks based on the importance of the following income sources: *interest income*, *non-interest operating income*, and *other non-operating income*. The latter we use as a proxy for off-balance sheet activities. Thus, we classify a bank as a *traditionier* if interest income of a bank is above the mean, and other source of income is below the mean; *neutral* if both types of income, as interest and non-interest are closed to the mean; an *originator* if the interest and non-interest income are above the mean, and a *trader*, if the non-interest income is above the mean, however the interest income is below the mean.

Our analysis covers all banks coming from OECD countries over the period of 1995-2006. Moreover, for testing the importance of each banking model in the systemic risk we use the mortgage crisis period of 2007-2009. In total, we have collected information about 357 banking institutions from following countries: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Germany, Greece, Hungary, Ireland, Israel, France, Ireland, Italy, Luxembourg, the Netherlands, Mexico, Poland, Portugal, Slovakia, Spain, Switzerland, the United Kingdom, and United States, New Zealand. For our

purposes, we define banks as all institutions that are regulated and that perform the traditional bank roles of maturity and credit transformation. Thus, the banks discussed throughout our article refer to all commercial banks, bank holding companies (BHCs), thrifts and thrift holding companies, credit unions, and foreign banking organizations, including their domestic branches. Note that whether an institution is classified as a bank may vary over time. The information on banks' financials were retrieved from banks' financial statements provided by Bureau van Dijk/IFCA's. Additionally, for the purpose of classification of banks' strategies based on bank's asset structure, we have also used the additional notes to the financial statements to detect the scope of off-balance sheet activities. This information for most of the banks was publicly available.

4.2. Model

In order to investigate how various banking strategies translate into these banks' characteristics, and more specifically into banks' risk-return profile, we estimate the probability model according to the below specification:

Prob. ($R_{i,c}$) = β_0 + β_1*$X_{i,c,t}$ + error term

where (R_i,c,t) is a business model "*i*" a bank follows, defined as "*originator*", "*trader*", "*neutral*", or "*traditionier*" in a country "*c*" over the period of 1995-2006. $X_{i,c,t}$ is a set of banking control variables including bank's size, bank's capital, asset structure, efficiency, profitability, funding sources, income structure, and country's control variables as banking sector concentration, financial development, institutional development, and regulatory environment at time "*t*". We run regressions on a panel data over the period of 1995-2006, and sub-periods of 1999-2004 and 2004-2006. All regressions include the time-dummies.

Additionally, we analyze the effect of individual banking business models on global systemic risk. Thus, we estimate the standard OLS model according to the specification:

$S_{i,c,t}$ = β_0 + $\beta_1 Y_i$ + β_2*$X_{i,c,t}$+ error term

where **$S_{i,c,t}$** is a systemic risk measure defined as bailout dummy, global systemic risk indicator developed by the V-Lab of the New York University,and tier 1 ratio of a bank's "*i*" coming from

country "*c*" at time "*t*". Y_i is a variable of our main interest, namely, proxing a banking business model defined as "*originator*", "*trader*", "*neutral*", and "*traditionier*". Simiarly, $X_{i,c,t}$ is a vector of bank's and country's control variables, as in the previous specification. In these regressions all bank's variables appear as lagged variables. The period of analysis covers the mortgage crisis of 2007-2009, however most of our observations are concentrated over the years of 2007-2008 in order to capture the major consequences of the crisis. Again, all regressions include also the time-dummies.

4.3. Control variables

Following the empirical literature, in order to estimate the characteristics of the specific banking business models, as well as their effect on the systemic risk, we create four groups of regressors, which account for: **bank capital, asset structure, profitability, income structure, asset size, and funding strategies.** Consequently, we argue that banking business models vary with respect to these characteristics.

More specifically, we define a bank capital as a ratio of *equity to total asset*. The literature documents that the level of bank's capitalization is an important determinant of financial distress during a crisis. Following these studies, banks engaged in excessive expansion of their activities as well as lending activities will have lower capital ratio, however these banks which were more engaged in investment banking activities will experience higher capital ratio, due to a possibility of economizing on capital requirements (Wu et al., 2011). However we also expect that the latter group will be more distressed by the financial turbulence due to a cyclicality of its income linked to the capital market performance (Shleifer and Vishny, 2010; Damar et al., 2013).

We include the asset structure measured as proportion of *loan activity in the bank's assets*. Brunnermeier et al. (2011) and De Jonghe (2010) document that investment activities, as compared to the traditional ones, make the banks more exposed to the systemic risk accompanying the financial crisis. However Foos et al. (2010) show that if traditional banking is associated with the excessive credit growth and international expansion, the banks are more exposed to the systemic risk and are more likely to experience distress during financial crisis.

De Jonghe (2010), and DeYoung and Torna (2013) document that the shift of banks to non-traditional banking activities, which generate commission, trading, and other non-interest income increases

banks' tail betas and thus reduces banking system stability. Following this literature we include *income interest to average assets* as a control for the size of banking traditional activities, *other operating income to average asset*, and *non-operating income to average asset* as proxies for bank's involvement in a non-traditional activities. We expect that banks more diverged from a traditional banking will be more exposed to a systemic risk and financial distress. Especially, investment banking model may be more exposed to this risk, as their income is extremely sensitive to the capital market movements (Damar et al., 2013; Adrian and Shin, 2010a; Shleifer and Vishny, 2010).

We also include the profitability ratio measured as *return on asset* (ROA). We argue that banks' activities more linked to the capital markets offered higher margins, and thus increased banks' profitability (Wu et al., 2011). In addition, we also control for the bank's efficiency measured as *cost to income*. The existing research documents that less efficient banks are more willing to take on additional risk, and thus are more exposed to the distress risk during the market downturn (Kwan and Eisenbeis, 1997; Williams, 2004).

We also control for the asset size. Following the existing literature the asset size determines banks' efficiency, profitability, and risk-taking (Boyd and Runkle, 1993; Wheelock and Wilson, 2012). Thus, we expect that models specifically followed by the larger banks will be more profitable, but at the same time are systemically more risky.

Furthermore, in the later stage of the analysis, we also include the funding strategies of banks. The existing literature shows that source of funding determines the liquidity problems of banks, and thus the riskiness of banks(Shleifer and Vishny, 2010; Brunnermeier and Pedersen, 2007; Brunnermeier and Oehmke, 2013). Thus, we include *liquidity ratio* defined as liquid asset to deposit and short-term funding. We expect that banks with higher ratio of loans will exhibit less liquidity, however banks' engaged in investment activities will have better liquidity positions. Nevertheless, consistent with the existing literature, we also argue that the latter group may be affected by the financial crisis faster than the former, especially when the interbank market is affected (Acharya, Gale and Yourmulazer, 2009; Diamond and Raja, 2009). Moreover, we also look at the sources of the liquidity, including the *demand and savings deposit ratio to total liabilities* as well as a ratio of money market funding. Consistent with the existing literature the shorter maturity of debt, as well as greater reliance on the interbank market, as compared to the deposit funding, will result in a greater risk for banks.

In the later stage of the analysis, we are also interested in the institutional features, which have contributed to the development of specific banking models in individual countries. Therefore, we include country's variables proxing for the level of institutional development, as *pension industry size*, *mutual funds' size*, and *insurance industry size*. We expect that more developed institutional environment may determine the development of more complex financial products. We also argue that in countries more heavily relying on the capital markets, banks are more motivated to be linked to the capital markets, however in countries relying on banking, the traditional activities will be more prevalent. We also include the variables proxying for the regulatory environment of the countries as: *capital regulations*, *limitations on banks' activities*, and *the level of market discipline*. We expect that in countries where these regulations are stronger, banks will be less incentivized to engage in risky activities, and thus will be more stuck with the traditional business.

In addition, we also control for the concentration of the banking sector proxied by *concentration ratio* measured, as the ratio of the banking asset of three largest institutions to total banking asset in a sector consistent with the hypothesis supported by the recent evidence that more concentrated banking sectors are less affected by the financial crisis due to a possibility of more careful monitoring of banks' activities (Beck et al, 2006). In contrast, high competition on the banking markets might lead to more aggressive banks' behavior, especially in more developed countries (Beck et al., 2013).

The description of all variables can be found in **Table A1**, which we present in the **Appendix**.

5. Country's features and banking business models

The factor analysis has given us an indication about the differences between the banking strategies across the globe. Interestingly, the recent evidence points toward country's individual features opting for the development of specific banking models in individual countries (Demirgüç-Kunt and Huizinga, 2010). Below we present the list of countries with the associated banking business model, as selected by factor analysis. The classification has been made on the type of banks' specialization in a given country.

[Table 3]

As we can see, banks in countries with similar institutional and economic features tend to share similar activities. For example, we can notice that in Anglo-Saxon countries, banks tend to follow the

"*originator*" model, whereas banks in other economically strong, but geographically small regions tend to undertake a"*trader*"role.In contrast, banks in less developed countries exhibit more balanced structure of their activities with important role of traditional banking business.

5.1. Summary statistics

In this section we present the summary statistics showing the main differences between the country's banking models in terms of their risk-return profiles and theirincome sources. The size of the bubbles indicates the average size of banks representing individual banking models.

[Graphs 1 - Graphs 10]

As one can see banks significantly vary in terms of their income source, capital ratio, and consequently, return-risk profile.

The return seems to be the highest among the originator banks. All other banking models fall below this model. The traders had alsohigh return, however it was much below the originators.Interestingly, over the sample period the return of traders falls below the neutrals. For example, the average return on assetsof originator model amounted to 3 percent, whereas of the neutral and trader model had an average ratio of 1.1 percent and 0.77 percent, respectively. Surprisingly, we also find thattraders seem to have the lowest capital ratio, whereas the originators the highest over entire sample period.However the neutrals and traditioniersare placed in the middle of the profile. This result isconsistent with the theory showing that originators had high portion of off-balance sheet activities, which allowed them to keep high capital requirements. However the result on neutrals supports that income diversification allows banks to economize on their capital. Surprisingly, we find the low level of capitalization for traders. This might be a result of a long sample period, which includes the US crisis of 90s as well as prosperity years of 2004-2006. This result supports the studies, which show that trading activities are very risky since they are very sensitive to the capital market performance (King et al., 2013; Shleifer and Vishny, 2010).

The income sources reflect the nature of individual banking strategies, as identified by the factor model. We observe that traditioniers have the highest share of interest income in its asset, with the originators following them; the neutrals and traders seem to have the lowest proportion of this income source. On the other hand, a trader model solely relies on the non-interest income. Originators had also a high proportion of non-interest income in their asset, however their business

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model seems to be more profitable than the trader model. Surprisingly, we also observe a significant portion of non-interest income in the traditionier model.The neutrals seem to finalize this list with the lowest share of non-interest income in its assets.

Interesting is to see what types of income are captured by the non-interest variable. Graph 7 shows the distribution of non-interest income by individual banking models. We can see that this varies significantly between the banking groups. We find that the commission income is the most important for the originators and neutrals, whereas the trading income for traders and traditioniers. In generally, the results do not surprise. Since the originator model focused on loan origination and distribution, it mainly profited from the commission income. Surprising is the result for the traditioniers, which has significant portion of the trading income. It might indicate that the traditional banks started to trade their loan portfolio to increase their margin. The fee income was the most prevalent for the neutrals, and less for traders. This is probably a result of fees generated by loan servicing in the less developed countries.

Finally, the share of non-operating income seems to be the highest for*originators*. This finding is not surprising since this variable seems to reflect the extent of off-balance sheet activities. All other banking groups had negative results from this position, which might point toward their reduced practice of using the off-balance sheet transactions.

Regarding the riskiness of the particular income sources, we see a positive correlation between banks' exhibiting a high proportion of non-interest income and low capital ratio. This can be observed for banks especially following a trader model, however to lower extent for originators and neutrals. However, the capital ratio of traditioniers surpasses the capital ratio of neutrals and traders. These results seem to support the empirical literature indicating that non-interest income is positively correlated with a banking fragility (Stiroh, 2004; Stiroh and Rumble, 2006; Brunnermeier et al., 2011). The riskiness however seems to be related with a specific type of income.

Concluding this analysis, we can notice that the originator model seems to offer the highest return and the lowest risk expressed in the high capital ratio. However according to the theoretical literature this profile is mostly driven by the off-balance sheet activities, which allow these banks to achieve it. In contrast, the lowest return offers the traditionier model, though at very low risk. The

neutrals and traders are in the middle of the return profile, while the latter banks achieve it at high risk.

5.2. The characteristics of banking business models

In this section we estimate the characteristics of individual banking models based on the features of banks in a given country. Thus, we assign all banks in a given country a dummy of one, if banks in a given country follow an*originator* model, or a *trader* model, or a *neutral* model, or a *traditional* model, and zero otherwise. The grouping has been made on the main activities of banks in a given country: "originate and distribute" for *originator* model, trading of securitized asset for the *trader* model, balanced trading and commercial activities for the *neutral* model, and mainly commercial activities for the *traditionier* model. We regress then banking models on bank's and country's characteristics over the entire sample period of 1995-2006. We include the time-dummies in all regressions. Additionally, in order to compare how the characteristics of various banking models have changed across time, we also present the regression results for the sub-samples as 1999-2004, and 2004-2006. Table 4presents the results.

[Table 4]

The regression results present interesting implications. In general, we see that banks vary in terms of activities, return, and risk-profile. Moreover, the income sources seem to correctly reflect the nature of individual banking groups.

More specifically, the data show that the *traditioniers* tend to be smaller banks. This is not surprising since most of these banks are subsidiaries of foreign banks operating locally in less developed countries. Consistent with the summary statistics, the main interest of these banks has been in credit growth due to a still weak saturation of credit market in these countries (Bakker and Gulde, 2010). Thus, we observe a significant and positive coefficient of interest income variable, whereas negative coefficient of non-interest income, as compared to other banking models.Interestingly, while controlling for these banks' activities, we observe that these banks were less capitalized. It is not surprising since traditional banking model is the most capital intensive. The marginal importance of other activities causes that these banks cannot efficiently optimize their capital structure. Interestingly, we also find that traditional modelis more likely to exist in more concentrated banking structure. This is a consequence of the privatization processes, which took place in the banking

sectors in these countries. Many large state-owned banks have been taken over by foreign institutions(Bonin et al., 2005; Boubakri et al., 2005).

In turn, *neutrals* seem to be larger in size. This is because these institutions have grown excessively in size by expanding their activities internationally over recent decades, especially into the developing countries. Since we do not observe any significant importance of any income source, we can assume that this banking model was the most balanced among all others. However we find a statistical significant coefficient for the loan ratio, which might suggest that the lending was animportant business at these banks. This has been also confirmed by the conclusions of the summary statistics. Interestingly, we also find that this model was less efficient than other models. It may support the evidence by Buch et al. (2012)that larger in size institutions may become less efficient due to high cost of monitoring. However the evidence is in contradictory with other studies as by Wheelock and Wilson (2012),Feng and Serletis (2010), andHughes and Mester (2013)who show that larger in size banks generate efficiency benefits derived from technological advances and allows for better diversification of risk. Consistent with the observations from the summary statistics, we also find that this banking model exhibits higher capital ratio. It seems to support other evidence that diversification of activities allows for optimization of regulatory capital (Jiangli i Pritsker, 2008).

Different picture of banks' characteristics presents the *originator*model. Not surprising, we find a positive and statistical significant coefficient of non-operating income. This reflects the nature of this model, mainly dominated by the banks following "originate and distribute" strategy.Consistent with other studies, we find that this model allowed banks to economize on the regulatory capital to the greatest extent. This is why the capital ratio is highly statistical significant and has a positive sign. This is in line with studies, which show that capital optimization was one of the main determinants of "*originate and distribute*" model(Calomiris and Mason, 2004). We also find that the *originator* model seems to be more efficient than other credit origination models, as the neutral model.This is in line with studies, which document that innovation improves banks' efficiency, and profitability (Thakor, 2012). Interestingly, we also find that *originator* model tended to exist in countries with less concentrated structure. Probably, high concentration on the credit market and declining margins forced these banks to search for additional yields (Allen and Santomero, 2001; Rajan, 2006).

Moreover, this competition came from other institutional investors, especially insurance and investment funds (Lepetit et al., 2008). Accordingly, we find a concentration variable highly statistical significant and negative.

According to our expectation, we find that the activity of traders concentrated on the non-interest income. This is not surprising since traders were heavily involved in trading of securitized assets. This model seems to appear in the regression as highly specialized. The loan ratio appears as statistically significant but with a negative sign. This points toward unimportance of this type of business at these banks, as compared to other institutions. Similarly, as the originators, these banks seemed to be efficient. The result suggests that these banks could improve their efficiency through scale of their activity as well as technological rather than human intensive business allowing these banks to improve costefficiency. Accordingly, we also find that these banks were larger in size. Surprisingly, we do not see any effect of this banking model on the capital ratio. This is in line with the observation from the summary statistics and the studies, which show that capital ratio of these banks was sensitive to capital market movements (Adrian and Shin, 2010; Shleifer and Vishny, 2010). Two conflicting effects on capital ratio during our sample period might have caused that the effect of capital ratio statistically disappears (for example high-tech bubble and strong performance during 2004-2006).

Interestingly, we do not see any significant changes in the models characteristics over the sub-sample periods. However we see that the effects are the strongest over 1999-2004, which coincide with the period of financial deregulations, low interest rates, and strong capital market performance. The results seem to suggest that most of the models started to evolve during this period.

5.3. Do countries' characteristics matter for development of individual banking business models?

Our results, as suggested in the previous section seem to indicate that similar banking models tended to develop in countries sharing some features. For example, we saw that "originate and distribute" model was mostly prevalent in Anglo-Saxon countries, whereas the trader model was especially developed in the most advanced European countries. In contrast, in less developed countries we observe more traditional nature of banks, with some diversification structure.In this section we investigate whether and to which extent the institutional and regulatory infrastructure was responsible for development of individual banking models.

The existing literature is very scarce on this topic. In generally, this literature documents that in countries based on banking finance, the universal model with a strong bank-client relationships are more prevalent. In contrast, in countries with more capital-based financial sectors the investment banking model is more popular (Tyrell and Schmidt, 2006). In these countries, the universal model, if it exists, is more specialized than in countries with bank-based systems. Moreover, Henderson and Pearson (2011) argue that countries with well-developed institutional infrastructure are more likely to develop more structured, and complex financial products. However, Demirgüç-Kunt and Huizinga (2010)document that a stronger regulatory environment results in lower non-interest income position of banks in these countries. In contrast, Barth et al. (2013), Elul (2005), Calomiris and Mason (2004)document that greater capital regulations often result in bank's optimization of capital structure. Thus, these studies find that banks in these countries are more likely to engage in securitization, and other more risky activities.

To investigate the influence of countries' institutional features on development of individual banking models, we include into our previous regressions two group of the regressors. The first group includes country's institutional variables as: *banking sector* and *capital market size, pension fund asset, mutual fund asset, and insurance sector size*; the second group of the regressors includes the regulatory variables as: *capital requirements, restrictions on banks' activities*, and *level of market discipline*. The detailed description of these variables is presented in the **Appendix 1**, in table **AT1**.

We expect that countries having more developed institutional infrastructure, and especially the capital markets will bias their banking models toward more structured products, however stronger regulatory environment will motive banks to follow less risky models. The results of the regressions are presented in tables 5 and 6.

[Table 5]

[Table 6]

According to our expectation, the inclusion of the institutional country's variables improves the statistical significance of our coefficients, and thus the R-square for the regressions. This finding is consistent with the argument that specific institutional features have contributed to the development of specific bankingmodels. More specifically, our regression results show that banks, which decided to follow traditional model stemmed from institutionally less developed countries. Almost all coefficients proxying for the size of the institutional sector are statistically significant and

negative (Table 5). This is in line with our expectations that traditional model was interesting to follow for countries whose credit markets were less saturated. Similarly, the neutral model has evolved in countries, which were institutionally less developed (specification 2 and 3). The variables proxying for the size of the pension fund and insurance market appear as negative and statistically significant in the regressions. The results might also suggest that regulatory environment rather than institutional environment has played a significant role in evolution of this model. In contrast, our analysis shows that originators tended to develop in countries with a more important capital markets relative to the banking sector (specification 1). We also find that all other institutional variables as pension and mutual funds' size, and insurance sector's size appear in the regressions as statistically significant and positive for this model (specification 2, 3 and 4).This is consistent with the literature showing that banks in these countries faced competition from other institutions (Lepetit et al., 2008). Interesting results present the estimations on the trader model. They show that this model appears in countries with well-developed banking sectors (specification 1). Probably, it was a result of high saturation of the credit market and high competition between institutions in these countries, where the declining margins forced them to search for additional rents(Allen and Santomero, 2001; Rajan, 2006). Interestingly, the institutional variables proxing for the size of pension fund asset and insurance sector are statistically significant and positive, though capital market size appeared as non-significant for this model. The result indicates that the lack of well-developed capital markets prevented these banks from self-origination of structured products, probably because of high associated costs. However institutions in these countries have also faced competition from other institutional investors, which probably forced them to search for additional yields.

The regression results including the regulatory environment show that it has also played an important role in the origination of thespecific banking model (table 6). Interestingly, the regulatory stringency is positively correlated with the neutral model, and negatively linked with the originatormodel. This indicates that greater stringency of regulations discourage banks from non-traditional activities, which is consistent with the results of Demirgüç-Kunt and Huizinga (2010). Similarly, we also notice that greater activity restrictions prevented banks from non-traditional activities. The coefficients of this variable for the traditional, neutral, and originator model are positively and statistically significant. Both types of banking models were heavily engaged in the traditional banking business. Interestingly, in countries where the activity restrictions are low, banks were more engaged in non-traditional activities, as trading. The result confirmed the trader model. Finally, the result on private monitoring gives mixed conclusions. The variable is statistically

significant and positive for the neutral and trader model, however negative for the traditional and originator model. The results seem to suggest that it is difficult to find a general link between the depositors' behavior and banks' discipline.

6. Exploring differences in the banking business models by allowing for heterogeneity between the banks in a single country

So far, we have grouped all banks in a given country into one model. This is a natural way to explore the differences between the banking models across the countries, and to check the effect of country's institutional features on the development of specific models in these countries. Also, in many countries banks tend to share common features, as a result of country's institutional and regulatory infrastructure. However in many countries, we have observed a wide heterogeneity in the models followed by banks. In such countries as Luxemburg or France we saw that many banks decided to follow a balanced model, however there were also institutions representing the trader model or a traditional model. In order to better explore the differences in the banking strategies and allow for heterogeneity between the banks in a single country, we perform a similar type of the analysis as in the previous section, however we classify each individual bank, exploring this bank's characteristics, into one of the previous identified classes: *originator*, *trader*, *neutral*, and *traditionier* models based on income structure of this bank. We have already shown that the income structure reflects the nature of banking activities. Moreover, it is also more dynamic than the asset structure. Thus, we classify a bank as a *traditionier* if interest income of a bank is above the mean, and other source of income is below the mean; *neutral* if both types of income, as interest and non-interest are closed to the mean; an *originator* if the interest and non-interest income are above the mean, and a *trader*, if the non-interest income is above the mean, however the interest income is below the mean, as has been suggested by the previous analyses. Table 7 presents the regression results. Consistent with the existing studies arguing that the effect of the non-interest income on bank's profile might vary with respect to the type of the activities, we then split the non-interest income into the trading income, and fee and commission income. In addition, we also control for the asset structure of banks by including trading, investment securities as well as off-balance sheet activities. Alternatively, we also include mortgage loans and other loans, equity investment, and other investment asset. Table 8 presents the results.

[Table 7]

[Table 8]

In general, the regression results show that the coefficients of some bank's controls have changed the direction as well as their significance, as compared to our country's regressions from the section 5.2. The results seem to point toward heterogeneity among banks in individual countries.

More specifically, similarly as in the previous regressions, the *traditioniers* mainly concentrated on the lending activity. Thus, we see a positive sign of the interest income, however negative and statistically significant effect of other income sources (table 7). Similar conclusions presents table 8, specification (1). The commission and fee income as well as trading income are negatively and significantly linked with this model. Moreover, we also find that the credit activity variable is statistically significant with a positive sign (table 8, specification (1)). Similarly, the *traditionier* model is the only model when we find a positive correlation with the mortgage and other credit activity (specification (3)). These results point toward specialization of this model. Similarly, as in the previous regressions we find that that *traditionier* model shows lower capital ratio, as compared to other models (table 8, specification (1) and (2)). This is because the specialization model does not allow banks to economize on their capital structure, as compared to such models as originators or even neutrals. Interestingly, the coefficient of the cost to income variable has negative sign while explicitly controlling for trading and commission activities. This seems to suggest that to some extent non-traditional activities allow banks to increase their efficiency.

Regarding the neutral model, we observe similar characteristics, as in the regressions from the section 5.2. We do not observe any specific bias of this model toward any income source. Again, it seems to suggest that the neutral model exhibits the most diversified structure of its activities. This allows these banks to achieve sufficient efficiency at low level of trading (table 8, specification (2)). We observe that portfolio of trading securities is negatively correlated with this model, whereas the efficiency variable suggests about positive effect. Moreover, the estimations also show that capital ratio is positively linked with this model (table 8, specification (1)). This result supports our previous conclusions that non-interest activities allow banks to optimize their capital level and reduce their risk at low level of trading (Saunders and Walter, 1994; Pennacchi, 1988; Smith, et al.; 2003; Boot and Ratnovski, 2012).

Finally, the interesting results present the estimations on the *trading* model. In line with a strategy of these banks, trading is their main income source. Accordingly, we see in the regression the significant coefficient of the non-interest income (table 7), and more specifically of the trading income in table 8.

To a lesser extent we find these banks dependent on the commission and fee income (table 8, specification (1)). Also, the regression results from table 8 in thespecification (2) present that trading securities were the main investment of these banks. Other investment securities, though they appear in the regressions as statistically significant, they have negative a sign. This result points toward greater risk of this banking model.More importantly, we also see that while controlling for these banks' asset structure, this model exhibits higher capital ratio(table 8, specification (3)). The result is not surprising since the capital ratio mostly reflects the trend on capital market. Adrian and Shin (2010) and Shleifer and Vishny (2010)document that investment banks' capital is highly cyclical and move together with the assets' value. This feature is especially visible for the regressions on the tradermodel over the period 2004-2006(table 7, specification (3)). The capital ratio of traderbanks becomes highly statistically significant during this period - years of capital market prosperity(He et al., 2012). Interestingly, we also observe that atradermodel seems to be very profitable once we specifically control for the trading, and fee and commission income (table 8, specification (1)).

The results on the *originator* model are only presented in the table 7. Due to missing information for banks classified as *originators,* it was not possible the probit regressions for this model. The results are consistent with the existing literature. They show that banks following this model were more profitable. However surprisingly our estimations document that these banks exhibited also lower capital ratios.

5.2. Banking business models and funding strategies

The recent research has stressed the importance of banks' liquidity, as an instrument preventing a bank from a bankruptcy during financial turbulence (Diamond and Rajan, 2005). This research considers two aspects. First, the maturity and type of banks' funding sources, and second the correlation between the nature of bank'sasset and its source of funds. Demirgüç-Kunt and Huizinga (2010)document that banks, which fund their activities by non-deposit funds are more risky, however Allen et al. (2012), Brunnermeier and Oehmke (2013)indicate that especially banks, which used in their funding structure repo instruments suffered during the crisis at most. Also, the link between the nature of the asset and bank's liability source is important. Gorton and Pennacchi (1990)claim that the role of a banking system is to issue liquid shot-term debt claims against illiquid asset. Such a structure improves banks' liquidity management because deposits, mostly of retail nature, are unlikely to be withdrawn prematurely due to their public protection (Song and Thakor, 2007).

However Damar et al. (2013), Adrian and Shin (2010a) and Demirgüç-Kunt and Huizinga (2010)document that funding non-interest income by attracting non-deposit funding is the most risky strategy, as both tend to move into the same direction - as market drops, banks' assets go down, and thus funding is difficult to access to.

In this section we investigate the role of funding sources for individual banking models, and the effect of these funding sources on banks' risk-return profile. For this reason we add into our analysis the *liquidity ratio* defined as liquid asset to deposit and short-term funding as well as such sources of funds as: *demand deposits*, *savings deposits*, and *money market funding*. All these variables are scaled by bank's total liabilities. The other set of variables is the same, as in the previous sub-sections. Table 9 presents the results.

[Table 9]

The regressions on the funding strategies present interesting results. First, they show that individual banking models vary with respect to their liquidity (specification 1). Especially, we observe that banks having the traditional business among their activities(*neutrals*and o*riginators*) have lower liquidity ratio. The ratio of liquid asset to deposit funding is negatively correlated with these banking strategies. This result is not surprising because of long-term nature of banks' loans.Interestingly, we do not find any statistical significance of the liquidity ratio forthe trader and traditionier model.

Interestingly, we also find that banks significantly vary in their funding strategies (specifications 2-4). For example, we find that though the savings deposits are statistically significant in all banking models, they appear to be the most significant at the tradermodel. It seems to suggest that trading banks funded their activities to a larger extent by issuance of long-term deposit claims. This result might be surprising since many researchers have shown that non-deposit funding and related liquidity problems were the main cause of mortgage crisis (Brunnermeier and Pedersen, 2007). On the other hand,funding the investment activities by deposit-taking has made the mortgage crisis worsened because it has resulted in a dangerous bank runs, as the example of Northern Rock demonstrated. Also, the investment losses of many banks had to be taken over by the government to protect these banks against the potential bank runs, which generated significant costs for countries' governments. In contrast, in a traditional model we find a statistical significant effect of the demand deposits. This is in line with the banking literature arguing that traditional banking business relies on issuing short-term claims and converts them into long-term asset(Gorton and Pennacchi, 1990;

Kashyap et al., 2002). Also, the result on the different nature of banking deposits between the traditionier and trader model confirms the recent evidence. In the developing countries short-term deposits have funded most of banking activities, whereas in the developed countries this ratio is much lower(ECB, 2010). Surprisingly, we also find a positive effect of short-term money market funding on traditioniers, and no such effect on other banking models. This result might be because of these banks' dependence on foreign capital coming from the parent banks.

Overall, the results suggest that deposit funding was a significant source of funds for banks. This observation has also been made by Praet and Herzberg (2008).

7. Systemic Importance of Banking Models

The existing studies document that some banking strategies are more sensitive to financial turbulences, whereas others are less. For example, Brunnermeier and Pedersen (2007), Diamond and Rajan (2005), and Gorton and Metrick (2012)show that originate-and-distribute model was one of the determinants of mortgage crisis. Demirgüç-Kunt and Huizinga (2010)document that the most risky model is an investment banking model, where banks fund their non-interest income by short-term non-deposit funds. Most of the researchers agree that the least risky model seems to be a traditional one (De Jonghe, 2010). This model however has been shown to appear as one of the least profitable (Baele et al., 2007).In the existing literature there is no agreement, which model improves banks' efficiency, and the same time does not increase its risk. Therefore, in this section we investigate the contribution of individual banking models to the systemic risk, controlling for banks' profitability, efficiency, size, and risk-taking effect. For this reason we regress four systemic risk measures on the standard set of regressors, including the types of identified business models. We use following systemic risk measures: a) a *bailout dummy*, a variable equals to one if a bank has been intervened during financial crisis, and zero otherwise, b) a *nationalization dummy*, a variable equals to one if a bank has been nationalized during financial crisis, and zero otherwise, c) a *tier 1* ratio is a regulatory ratio as reported by the bank and shows whether a bank is sufficient to neutralize the risks, d) *systemic risk contribution*, thissystemic risk indicator developed by the V-LAB, the Volatility Institute of New York University and shows capital shortfall in the percent of bank's liabilities that a bank experiences when banking market drops by two percent. In the theoretical analysis of Acharya et al. (2010)document that such a capital shortage is damaging to the real economy, as the failure of a bank will have repercussions throughout the financial and real sectors. Thus, banks with a high

capital shortfall in a crisis are not only the biggest losers in a crisis, but create and extend the crisis. Our analysis covers the mortgage crisis period of 2007-2009, though most of our observations are concentrated in the center of financial crisis 2007-2008.

Before we come to the regression results we present the graphs 11-14, which show the differences between the systemic importance of individual countries, banks, and banking models, accordingly.

[Graphs 11-14]

The graphs present interesting implications for our analysis. First, we can see that country's banking sectors vary with respect to their contribution to a global systemic risk. The graph 11 documents that banks from such countries as France, Switzerland, United Kingdom, Netherlands, and Belgium have the greatest systemic influence. Most of these countries' banking sectors represent a trader model. However such countries as Portugal, Austria, and Spain, which tend to represent a neutral model appears at the bottom of the systemic importance. We however do not find any contribution to the global systemic risk bycountries relying on the traditional model. This observation confirms the evidence showing that the traditional model is the least risky among all banking models.

Interestingly, we also find that the contribution to a systemic risk of individual banks and the strategies they follow is very dispersed, depending how we define a systemic risk. For example, we find that the greatest systemic importance from a country's riskperspective had banks large in size, as compared to their country's size. The graph 12 documents that the largest impact on a country systemic risk has Danske Bank, ING Bank, DNB Nord, Erste Group Bank, and Banco Santander, whereas the lowest Citigroup, Royal Bank of Scotland, and BNP Paribas. In case of problems atthe former group, governments do not have sufficient capital to provide for these banks. These banks also come from smaller countries, however their size in many cases hasalready exceeded country's size. The latter group represents countries large in size, however the asset of these banking institutions, though considerable, is not as considerable in relation to a country's GDP, as in case of the first group. In contrast, graphs 14-15show that the most risky banks from the global perspective are Citigroup, Royal Bank of Scotland, Deutsche Bank, and BNP Paribas. These institutions have following features: a) they are institutions with most of their revenues generated abroad, and b) their asset is not only considerable from a country's perspective, but also from global risk. These results suggest that banks' importance varies with a definition of systemic risk. Banks which do not necessarilyconstitute a significant systemic risk from a country's perspective may become much

more important from a global perspective, as a result of their wide international presence, as compared to a first group of banks. We mostly concentrate on the global systemic risk.

To investigate how individual banking models influence the global systemic risk, we regress our systemic risk measures on the standard set of variables, used in the previous regressions. Table 10 shows the estimations where banking models are grouped by a country, as in the Section 5.2., whereas table 11 presents the regression results by grouping banks according to their individual strategies, as in the Section 6. In order to avoid multicollinearity between the financial variables and banking models characterized by these variables, we exclude in the second type ofregressions bank's control variables. The analysis covers the mortgage crisis period 2007-2009. All regressions include time-dummies.

[Table 10]

[Table 11]

The estimation results present very interesting implications. Consistent with our expectations and academic literature, we find that neutral, originator and trader are the most risky banking models. However, the results also suggest that the economic effect of these models on risk measures is diverse. The most risky seems to be a trader model, while the neutral model is the least risky among all three risky models (table 10). The traditional model is the least risky among all models, exhibiting even negative correlation with our systemic financial variables. These results support the existing studies. The regression results from table 11 provide similar conclusions though we do not observe any effect of the originator and neutral model on the risk measures. These results seem to support the recent regulatory initiatives for separation of commercial and trading activities. We also find that the larger the bank is, the more risky it is. This is also consistent with the existing studies, showing that banks tend to grow in size to become systemic important institutions, and thus being able to follow more risky strategies (Boyd and Runkle, 1993; De Nicolo and Kwast, 2002).

8. Summary

The main purpose of the article was to investigate the role of individual banking strategies on bank's risk-return profile. We consider such banks' characeteristics as bank's size, efficiency, profitability, risk-taking, asset structure, as well as funding strategies. Moreover, we also assess the role of country's institutional features and regulatory environment on the choice of individual banking strategy in a given country as well as the contribution of a banking model to a global systemic risk. Our approach allows us to solve the limitations of the existing studies. First, it allows to control for the endogneity problem stemming from the the character of financial variables. Second, it allows us to control for the non-linear effect. And third, it extends the existing studies by using a set of income and asset structure variables to control for banks' activities, not prevalent in the existing literature so far.

We apply factor model analysis to disitinguish banking models observable across the globe. Then using the asset approach, and income approach we categorize our sample banks into these models. Finally, by regressing banking models on bank's and country's controls, we assess the main characteristics of each banking model. We perform our analysis on a country as well as on individual bank level.

Our results present interesting conclusions. First, we show that there has been a wide heterogneity in banking activities across the globe before the mortgage crisis. In general, we can distinguish a *traditional*, *neutral*, *originator*, and *trader* model. Second, our results suggest that these models have varied with respect to their characteristics, and we show that controlling for all other factors, countries institutional features were mainly reponsible for the development of individual banking models. For example, we find that *traditional* model exhibits lower capital ratio and return, however is riskless from a systemic risk perspective. In contrast, the *originator* and *trader* models are more profitable and exhibit higher capitalization, however have significant influence on a systemic risk. This is becasue the performance of these banks is highly correlated with the performance of the capital markets (Adrian and Shin, 2010). Also, the risk is reduced due to high exposure of these banks to the off-balance sheet transactions. However the neutral model seems to be the most balanced in terms of its efficiency, activity, risk position as well as its contribution to the global risk. An interesting finding of our regression analysis is that institutional environment in many cases forced banks to search for additional yields, and thus switch into the investment business. In countries,

where the institutional investors were not so active, banks tended to follow more traditional business.

Our results provide important policy conclusions. The seperation of commercial and investment activities may impair banks' efficiency, and profitability, possibly encouraging banks to use financial innovation to a greater extent. The results seem to suggest that diversification in a banking business is a good thing assuming that banks follow a diversified instead of a specialized model.Especially, the specialization in the investment banking activities makes the banking business the most risky from the systemic perspective. Thus, consistent with the evidence of Boot and Ratnovski (2012)and DeYoung and Torna (2013) the non-interest interest can improve banks' risk-return profile until a certain threshold. Especially, this implies to the trading business. While this threshold has been achieved and banking model becomes more specialized, trading activities increase the risk of banks significanlty. Finally, our results seem to suggest that banking regulations and restrictions may prevent banks from becoming too systemically important, as our analysis on a neutral model documents.

Table 1: Factor model analysis

The factor estimations show the characteristics of banks grouped upon their common features. The analysis covers the period 1995-2006.

	(1) 1995-2006					(2) 1999-2006					(3) 2004-2006				
	factor 1	factor 2	factor 3	factor 4	Comm.	factor 1	factor 2	factor 3	factor 4	Comm.	factor 1	factor 2	factor 3	factor 4	Comm.
logasset	-0.425	-0.196	0.086	-0.151	0.751	-0.408	-0.199	0.095	-0.147	0.763	-0.446	-0.248	0.036	-0.031	0.737
net interest revenue	0.149	0.620	0.046	-0.023	0.591	0.160	0.605	0.057	-0.036	0.604	0.202	0.554	0.134	-0.087	0.627
other operating revenue	0.608	0.000	0.061	-0.088	0.619	0.568	0.024	0.045	-0.100	0.665	0.518	-0.014	0.057	-0.039	0.726
nonoperating revenue	-0.298	-0.239	0.085	0.299	0.757	-0.289	-0.273	0.114	0.297	0.740	-0.134	-0.060	0.225	0.553	0.623
cost to income	0.004	-0.074	-0.497	0.064	0.744	0.012	-0.100	-0.485	0.048	0.752	0.004	-0.071	-0.260	0.590	0.579
net loans	-0.159	0.497	0.040	-0.022	0.725	-0.154	0.484	0.061	0.004	0.738	-0.164	0.456	-0.005	-0.093	0.757
ROA	0.011	0.024	0.553	0.060	0.690	-0.007	0.027	0.540	0.057	0.704	-0.001	0.086	0.604	-0.044	0.626
equity to total assets	0.559	0.047	-0.034	0.006	0.684	0.535	0.045	-0.037	0.001	0.711	0.544	0.053	-0.045	-0.136	0.681

Table 2: Factor model analysis

The factor estimations show the characteristics of banks grouped upon their common features. The analysis covers the period 1995-2006.

	Centile 50					Centile 75					Centile 95				
	Factor 1	Factor 1	Factor 3	Factor 4	Comm.	Factor 1	Factor 2	Factor 3	Factor 4	Comm.	Factor 1	Factor 2	Factor 3	Factor 4	Comm.
logasset	-0.243	-0.050	0.101	0.024	0.912	-0.057	-0.206	-0.109	0.147	0.879	0.641	-0.105	0.053	-0.036	0.574
net interest revenue	0.134	0.702	-0.014	-0.096	0.478	0.728	0.195	-0.040	-0.193	0.389	-0.130	0.902	0.020	-0.145	0.149
other operating revenue	0.656	0.079	0.107	-0.123	0.534	0.425	0.464	0.109	-0.095	0.580	0.325	0.766	0.156	-0.051	0.279
nonoperating revenue	-0.144	-0.232	0.092	0.605	0.549	-0.301	0.044	0.127	0.782	0.279	-0.068	-0.189	0.129	0.752	0.376
cost to income	-0.056	-0.018	-0.262	0.605	0.560	0.029	-0.080	-0.211	0.766	0.361	0.034	-0.079	-0.238	0.749	0.375
net loans	-0.003	0.667	0.019	-0.081	0.547	0.652	0.097	0.023	-0.144	0.536	-0.232	0.665	0.082	-0.249	0.387
ROA	0.084	0.002	0.546	-0.122	0.680	-0.019	0.096	0.486	-0.109	0.742	0.092	0.267	0.539	-0.132	0.613
equity to total assets	0.582	0.094	-0.053	-0.059	0.643	0.342	0.549	0.040	0.042	0.578	-0.251	0.558	0.089	0.099	0.549

Table 3: Countries and their banking models

The table presents countries with their represented banking models. The grouping has been made on the major type of activities performed by banks in a given country. These activities include "originate and distribute" – banks assigned to a "originator" model, trading in the securitized asset – banks assigned to a "trader model", balanced investment and credit activities – banks assigned to a "neutral" model, and traditional activities – "traditional" model.

The analysis covers the period 1995-2006.

Country	Business Model
AUSTRIA	Neutral
BELGIUM	Trader
CANADA	Neutral
CHILE	Traditional
CZECH REPUBLIC	Traditional
DENMARK	Neutral
FRANCE	Neutral
GERMANY	Trader
HUNGARY	Traditional
IRELAND	Originator
ISRAEL	Traditional
ITALY	Neutral
JAPAN	Neutral
LUXEMBOURG	Trader
MEXICO	Traditional
NETHERLANDS	Trader
NEW ZEALAND	Neutral
NORWAY	Neutral
POLAND	Traditional
PORTUGAL	Neutral
SLOVAKIA	Traditional
SPAIN	Neutral
SWITZERLAND	Trader
UNITED KINGDOM	Originator
USA	Originator

Graph 1: Return-Risk Tradeoff

Graph 2: Interest income versus Performance

Graph 3: Non-interest operating income versus Performance

Graph 4: Non-operating income versus performance

Graph 5: Interest Income versus Risk

Graph 6: Non-interest income versus Risk

Graph 7: Distribution of income toward bank's assets

- Traders
- Orginators
- Neutrals
- Traditioniers

Graph 8: Non-operating income versus Risk

Table 4: Characteristics of country's banking business models using entire sample

Regression results present the probability of banks in a given country to be classified into one of the banking business models: *originator, trader, neutral or traditionier* given their characteristics. Classification was condition upon major type of the activities performed by the banks in a given country. These forms of the activity include: "originate and distribute" strategy, trading of securitized asset, balanced investment and commercial banking activities, and traditional business. The regressions cover all banks from OECD countries. The analysis period is 1995-2006. All regressions include the time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

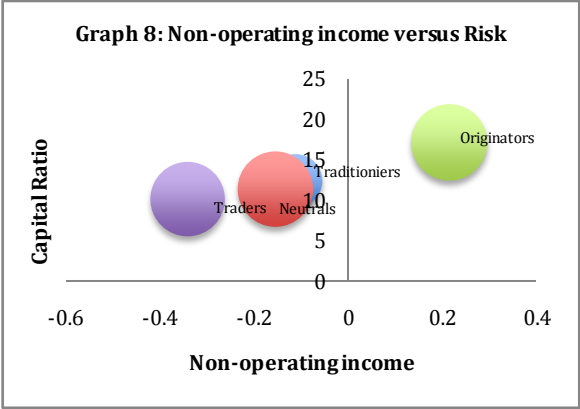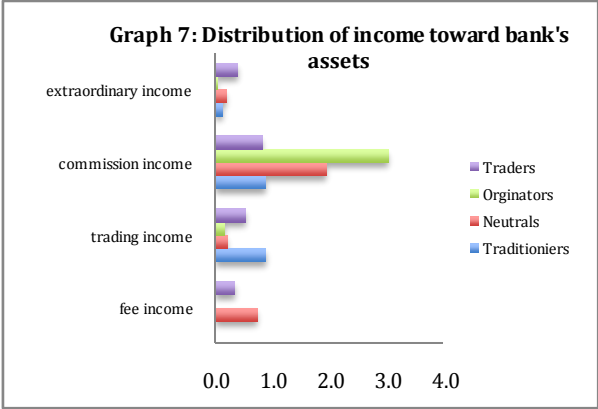| Variable	1995-2006 (1) Traditional Model	Neutral Model	Originator Model	Trader Model	1999-2004 (2) Traditional Model	Neutral Model	Originator Model	Trader Model	2004-2006 (3) Traditional Model	Neutral Model	Originator Model	Trader Model
Size	-0.398***	0.115***	0.028	0.092***	-0.416***	0.114***	0.031	0.093***	-0.362***	0.152***	-0.046	0.085***
	(0.045)	(0.033)	(0.042)	(0.029)	(0.052)	(0.036)	(0.039)	(0.030)	(0.048)	(0.039)	(0.048)	(0.033)
Interest Income	0.160**	-0.082*	0.103	-0.081	0.130	-0.114**	0.151*	-0.070	0.231**	-0.012	0.083	-0.117
	(0.068)	(0.047)	(0.083)	(0.061)	(0.087)	(0.051)	(0.090)	(0.062)	(0.092)	(0.047)	(0.081)	(0.090)
Other operating income	-0.050**	-0.050	0.011	0.066***	-0.054	-0.075**	0.046	0.076***	-0.057**	-0.023	0.026	0.051*
	(0.026)	(0.036)	(0.039)	(0.024)	(0.040)	(0.032)	(0.040)	(0.029)	(0.022)	(0.035)	(0.068)	(0.027)
Non-operating income	0.098	-0.015	0.188**	-0.034	0.080	-0.080*	0.308**	-0.014	0.137	-0.002	0.328***	-0.049
	(0.063)	(0.040)	(0.092)	(0.036)	(0.092)	(0.045)	(0.127)	(0.034)	(0.090)	(0.050)	(0.115)	(0.049)
Efficiency	-0.002	0.006***	-0.012**	-0.004***	-0.003	0.005***	-0.010*	-0.004**	0.000	0.006**	-0.021**	0.005*
	(0.002)	(0.002)	(0.006)	(0.002)	(0.002)	(0.002)	(0.006)	(0.002)	(0.003)	(0.002)	(0.008)	(0.003)
Activity	-0.006	0.011***	0.007	-0.013***	-0.008*	0.012***	0.004	-0.013***	-0.004	0.010**	0.005	-0.011***
	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)	(0.007)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)
Profitability	-0.054	0.012	-0.160*	0.003	-0.014	0.007	-0.102	0.001	-0.109	0.006	-0.302***	0.011
	(0.049)	(0.026)	(0.087)	(0.012)	(0.051)	(0.014)	(0.069)	(0.010)	(0.092)	(0.024)	(0.103)	(0.020)
Capital ratio	-0.036***	0.021**	0.023***	-0.011	-0.036***	0.020**	0.024***	-0.012	-0.046***	0.022**	0.007	-0.008
	(0.011)	(0.008)	(0.007)	(0.009)	(0.013)	(0.010)	(0.008)	(0.010)	(0.013)	(0.009)	(0.010)	(0.009)
Concentration	0.044***	0.000	-0.063***	0.005	0.048***	0.003	-0.064***	0.003	0.035***	-0.005	-0.062***	0.010**
	(0.005)	(0.004)	(0.010)	(0.004)	(0.006)	(0.004)	(0.012)	(0.004)	(0.006)	(0.004)	(0.010)	(0.005)
Constant	-0.378	-2.312***	1.656**	-0.351	-0.266	-2.607***	1.968**	-0.427	0.042	-2.630	3.391***	-0.712
	(0.412)	(0.493)	(0.652)	(0.442)	(0.484)	(0.563)	(0.769)	(0.469)	(0.492)	(0.600)	(0.902)	(0.541)
Number of obs.	1780	1780	1780	1780	1071	1071	1071	1071	617	617	617	617
R2	0.504	0.111	0.452	0.129	0.517	0.131	0.491	0.130	0.446	0.116	0.394	0.122

Table 5: Banking business models and institutional development
Regression results present the probability of banks in a given country to be classified into one of the banking business models: *originator, trader, neutral or traditioner* given their characteristics. Classification was condition upon major type of the activities performed by the banks in a given country. These forms of the activity include : "originate and distribute" strategy, trading of securitized asset, balanced investment and commercial banking activities, and traditional business. The regressions on a traditional model for the specification (2) and (3) are not available due to lack of institutional data. The regressions cover all banks from DECD countries. The analysis period is 1995-2006. All regressions include the time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

	(1) Traditional Model	Neutral Model	Originator Model	Trader Model	(2) Traditional Model	Neutral Model	Originator Model	Trader Model	(3) Neutral Model	Originator Model	Trader Model	(4) Neutral Model	Originator Model	Trader Model
Size	-0.707***	0.133**	-0.031	0.137***	-0.451***	0.140***	-0.025	0.111***	0.109***	-0.029	0.092***	0.111***	-0.077***	0.130***
	0.131	0.054	0.047	0.031	(0.028)	(0.016)	(0.028)	(0.013)	(0.013)	(0.026)	(0.019)	(0.013)	(0.026)	(0.014)
Income Interest	0.268**	-0.114*	-0.050	0.059**	0.086**	-0.074*	-0.145	-0.035	-0.112**	0.030	0.055**	-0.108***	0.000	-0.034
	0.114	0.063	0.061	0.028	(0.034)	(0.040)	(0.116)	(0.030)	(0.043)	(0.057)	(0.023)	(0.041)	(0.048)	(0.033)
Other Operating Income	0.002	-0.010	-0.128***	0.039***	0.015	-0.036*	-0.069	0.048***	-0.046**	0.035	0.056***	-0.089***	-0.012	0.072***
	0.104	0.020	0.038	0.014	(0.024)	(0.019)	(0.048)	(0.016)	(0.019)	(0.021)	(0.012)	(0.017)	(0.023)	(0.020)
Non-operating Income	0.082	-0.005	0.068**	0.001	0.080*	-0.005	0.218**	-0.032	-0.025	0.163**	0.012	-0.030	0.075	-0.016
	0.085	0.023	0.033	0.015	(0.046)	(0.040)	(0.095)	(0.029)	(0.033)	(0.079)	(0.026)	(0.037)	(0.047)	(0.032)
Efficiency	-0.002	0.003**	-0.022***	0.000	-0.004**	0.003***	-0.028***	-0.002**	0.003***	-0.014***	-0.002**	0.003***	-0.005**	-0.001*
	0.007	0.001	0.006	0.001	(0.001)	(0.001)	(0.006)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)
Activity	-0.032***	0.010**	-0.011***	-0.009***	0.000	0.013***	-0.012*	-0.014***	0.006***	0.007**	-0.009***	0.007***	0.004	-0.008***
	0.012	0.005	0.002	0.003	(0.003)	(0.003)	(0.007)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)
Profitability	0.013***	-0.002	-0.014***	-0.001	0.008	0.009	-0.224***	-0.008	0.011	-0.128**	-0.017*	0.018	-0.046	-0.008
	0.004	0.002	0.002	0.002	(0.023)	(0.013)	(0.098)	(0.008)	(0.012)	(0.065)	(0.009)	(0.018)	(0.037)	(0.009)
Capital	-0.041***	0.023***	-0.004	-0.020***	-0.029***	0.026***	-0.028**	-0.008**	0.017***	-0.005	-0.014***	0.017***	0.015**	0.001
	0.015	0.008	0.005	0.006	(0.006)	(0.004)	(0.012)	(0.004)	(0.004)	(0.007)	(0.004)	(0.004)	(0.006)	(0.004)
Concentration	0.065***	-0.003	-0.080***	0.013	0.050***	0.000	-0.120***	0.010***	-0.002	-0.103***	0.020***	-0.001	-0.072***	0.017***
	0.017	0.013	0.020	0.016	(0.005)	(0.002)	(0.011)	(0.002)	(0.002)	(0.014)	(0.002)	(0.002)	(0.009)	(0.002)
Banking Sector Size	-0.060***	-0.002	-0.020***	0.022**										
	0.013	0.002	0.006	0.010										
Capital Market Size	-0.055***	-0.006	0.024***	0.006										
	0.017	0.004	0.006	0.005										
Pension Fund Asset					-0.031***	-0.013***	0.070***	0.008***						
					(0.002)	(0.001)	(0.007)	(0.001)						
Insurance Asset									-0.003**	0.044***	0.039***			
									(0.002)	(0.008)	(0.002)			
Mutual Fund Asset												-0.001	0.030***	0.000
												(0.001)	(0.004)	(0.001)
Constant	6.786***	-1.482	4.224***	-5.374***	0.170	-2.338***	4.823***	-1.379	-1.455***	2.109***	-4.444***	-1.695***	1.607**	-2.464***
	1.749	1.061	0.859	1.339	(0.283)	(0.288)	(0.828)	(0.233)	(0.244)	(0.626)	(0.311)	(0.279)	(0.627)	(0.263)
Number of obs.	1642	1642	1642	1780	1188	1188	1188	1188	1349	1349	1349	1302	1251	1176
R2	0.916	0.190	0.711	0.523	0.598	0.178	0.821	0.159	0.105	0.575	0.413	0.116	0.674	0.146

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Table 5: Banking business models and regulatory environment

Regression results present the probability of banks in a given country to be classified into one of the banking business models: *originator, trader, neutral* or *traditionier* given their characteristics. Classification was condition upon major type of the activities performed by the banks in a given country. These forms of the activity include: "originate and distribute" strategy, trading of securitized asset, balanced investment and commercial banking activities, and traditional business. The regressions cover all banks from OECD countries. The analysis period is 1995-2006. All regressions include the time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

	(1) Traditional Model	Neutral Model	Originator Model	Trader Model	(2) Traditional Model	Neutral Model	Originator Model	Trader Model	(3) Traditional Model	Neutral Model	Originator Model	Trader Model
Size	-0.398***	0.113***	0.040**	0.093***	-0.382***	0.118***	0.040**	0.060***	-0.389***	0.115***	0.015	0.092***
	(0.021)	(0.013)	(0.019)	(0.011)	(0.024)	(0.013)	(0.016)	(0.012)	(0.022)	(0.013)	(0.017)	(0.011)
Income Interest	0.160***	-0.081**	0.107**	-0.080**	0.128***	-0.087**	0.081**	-0.037	0.174***	-0.082**	0.090**	-0.078***
	(0.041)	(0.035)	(0.042)	(0.032)	(0.037)	(0.035)	(0.038)	(0.029)	(0.041)	(0.033)	(0.044)	(0.030)
Other Operating Income	-0.050***	-0.050**	0.015	0.066***	-0.046***	-0.050**	-0.004	0.073***	-0.055***	-0.049**	0.008	0.069***
	(0.015)	(0.020)	(0.021)	(0.015)	(0.015)	(0.020)	(0.019)	(0.016)	(0.016)	(0.020)	(0.020)	(0.016)
Non-operating Income	0.098**	-0.014	0.192***	-0.034	0.061*	-0.019	0.165***	-0.025	0.096**	-0.016	0.182***	-0.028
	(0.042)	(0.042)	(0.063)	(0.029)	(0.034)	(0.040)	(0.056)	(0.028)	(0.043)	(0.040)	(0.061)	(0.030)
Efficiency	-0.002	0.005***	-0.012***	-0.004***	-0.002	0.006***	-0.013***	-0.005***	-0.002	0.006***	-0.014***	-0.004***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.001)	(0.003)	(0.001)
Activity	-0.006**	0.011***	0.007**	-0.013***	-0.009***	0.010***	0.004	-0.012***	-0.007***	0.011***	0.005*	-0.012***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Profitability	-0.055	0.011	-0.165***	0.003	-0.031	0.015	-0.144***	-0.004	-0.058	0.013	-0.153***	0.003
	(0.037)	(0.016)	(0.054)	(0.007)	(0.035)	(0.017)	(0.047)	(0.011)	(-0.035)	(0.017)	(0.053)	(0.007)
Capital	-0.036***	0.022***	0.023***	-0.011***	-0.035***	0.021***	0.017***	-0.012***	-0.036***	0.021***	0.023***	-0.010**
	(0.008)	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)	(0.008)	(0.004)	(0.005)	(0.004)
Concentration	0.043***	0.002	-0.067***	0.004***	0.046***	0.000	-0.055***	0.007***	0.045***	0.000	-0.062***	0.004***
	(0.003)	(0.002)	(0.006)	(0.002)	(0.003)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.005)	(0.002)
Capital Regulations	-0.019	0.088***	-0.182***	-0.009								
	(0.025)	(0.017)	(0.031)	(0.015)								
Bank Activity					0.350***	0.030*	0.183***	-0.429***				
					(0.031)	(0.018)	(0.029)	(0.022)				
Private Monitoring									-0.331***	0.095**	-0.311***	0.279***
									(0.064)	(0.041)	(0.047)	(0.040)
Constant	-0.293	-2.671***	2.168***	-0.318	-2.676***	-2.496***	0.341	2.120***	1.802***	-2.978***	4.041***	-2.358
	(0.269)	(0.234)	(0.430)	(0.200)	(0.326)	(0.246)	(0.404)	(0.259)	(0.503)	(0.380)	(0.602)	(0.348)
Number of obs.	1780	1780	1780	1780	1780	1780	1780	1780	1779	1779	1779	1779
R2	0.504	0.126	0.485	0.129	0.593	0.112	0.489	0.316	0.519	0.113	0.470	0.149

Table 7: Characteristics of banking business models based on bank-level estimations

Regression results present the probability of a bank in a given country to be classified into one of the banking business models: *originator, trader, neutral* or *traditionier* given its characteristics. Classification group was condition upon the mean of various incomes. Classification is condition upon the mean of various income sources: *traditioniers* if the interest income is above the mean, and other source of income is below the mean; *neutrals* if both types of income, as interest and non-interest are closed to the mean; *originators* if the interest and non-interest income are above the mean, and *traders*, if the non-interest income is above the mean, however the interest income is below the mean types of activities the major banks in a country exhibit. The regression on an "originator" model for the specification (2) is not available due to gaps in the data for banks representing this model. The regressions cover all OECD countries. The analysis period is 1995-2006. All regressions include time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

| | 1995-2006 | | | | 1999-2004 | | | 2004-2006 | | | |
| | (1) | | | | (2) | | | (3) | | | |
Variable	Traditional Model	Neutral Model	Originator Model	Trader Model	Traditional Model	Neutral Model	Trader Model	Traditional Model	Neutral Model	Originator Model	Trader Model
Size	-0.006	0.013	-0.506***	-0.006	0.001	0.014	-0.008	-0.043	0.023	-0.869**	0.032
	(0.032)	(0.031)	(0.113)	(0.038)	(0.034)	(0.034)	(0.038)	(0.031)	(0.024)	(0.344)	(0.041)
Interest Income	0.532***	-0.091	-0.340	-0.407***	0.494***	-0.069	-0.396***	0.609**	-0.128	-0.950*	-0.290
	(0.101)	(0.058)	(0.312)	(0.129)	(0.098)	(0.060)	(0.133)	(0.257)	(0.087)	(0.543)	(0.190)
Other operating income	-0.482***	-0.113**	0.021	0.460***	-0.475***	-0.104**	0.453***	-0.694**	-0.092*	-0.287*	0.512***
	(0.103)	(0.049)	(0.128)	(0.086)	(0.105)	(0.048)	(0.086)	(0.275)	(0.055)	(0.150)	(0.115)
Non-operating income	0.103	-0.091*	0.212***	0.049	0.036	-0.077	0.067*	0.105	-0.004	0.102	0.122
	(0.082)	(0.052)	(0.078)	(0.031)	(0.075)	(0.054)	(0.039)	(0.202)	(0.024)	(0.115)	(0.106)
Efficiency	-0.004	-0.002**	0.013***	0.002	-0.003	-0.002**	0.002*	-0.009	-0.002	0.042***	0.001
	(0.003)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.006)	(0.002)	(0.008)	(0.002)
Activity	0.012***	-0.003	0.016	-0.014***	0.013***	-0.004	-0.014**	0.007	0.001	0.009	-0.016**
	(0.004)	(0.003)	(0.016)	(0.006)	(0.005)	(0.004)	(0.007)	(0.005)	(0.004)	(0.010)	(0.007)
Profitability	-0.116	0.005	0.196***	-0.037*	-0.067	0.007	-0.042	-0.114	-0.004	0.041	-0.126
	(0.081)	(0.012)	(0.043)	(0.023)	(0.069)	(0.011)	(0.036)	(0.207)	(0.004)	(0.125)	(0.099)
Capital ratio	-0.015	-0.002	-0.287***	0.010	-0.016	-0.001	0.007	-0.019*	-0.006	-0.162***	0.021***
	(0.012)	(0.006)	(0.056)	(0.008)	(0.012)	(0.006)	(0.009)	(0.011)	(0.007)	(0.031)	(0.005)
Concentration	0.000	-0.002	-0.176***	0.011	0.001	-0.002	0.010	-0.002	-0.002	-0.218***	0.014
	(0.005)	(0.006)	(0.029)	(0.009)	(0.005)	(0.005)	(0.009)	(0.006)	(0.005)	(0.056)	(0.010)
Constant	-0.495	0.262	8.686***	-1.306	-0.648	0.146	-1.280	0.650	0.012	11.972***	-1.925**
	(0.603)	(0.485)	(1.486)	(0.810)	(0.626)	(0.536)	(0.881)	(0.874)	(0.501)	(4.585)	(0.953)
Number of obs.	1780	1780	1780	1780	1071	1071	1071	617	617	617	617
R	0.346	0.071	0.763	0.482	0.347	0.063	0.479	0.374	0.064	0.812	0.492

Table 8:Banking business models and their characteristics

Regression results present the probability of banks within a given country to be classified into one of the banking business models: *originator, trader, neutral* or *traditionier* given its characteristics. Classification is condition upon the mean of various incomes sources: *traditioniers* if the interest income is above the mean, and other source of income is below the mean; *neutrals* if both types of income, as interest and non-interest are closed to the mean; *originators* if the interest and non-interest income are above the mean, and *traders*, if the non-interest income is above the mean, however the interest income is below the mean types of activities the major banks in a country exhibit. The regressions on the *originator* model are not available for specification (2) and (3) due to gaps in the data for banks representing this model. The regressions cover all OECD countries. The analysis period is 1995-2006. All regressions include time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.
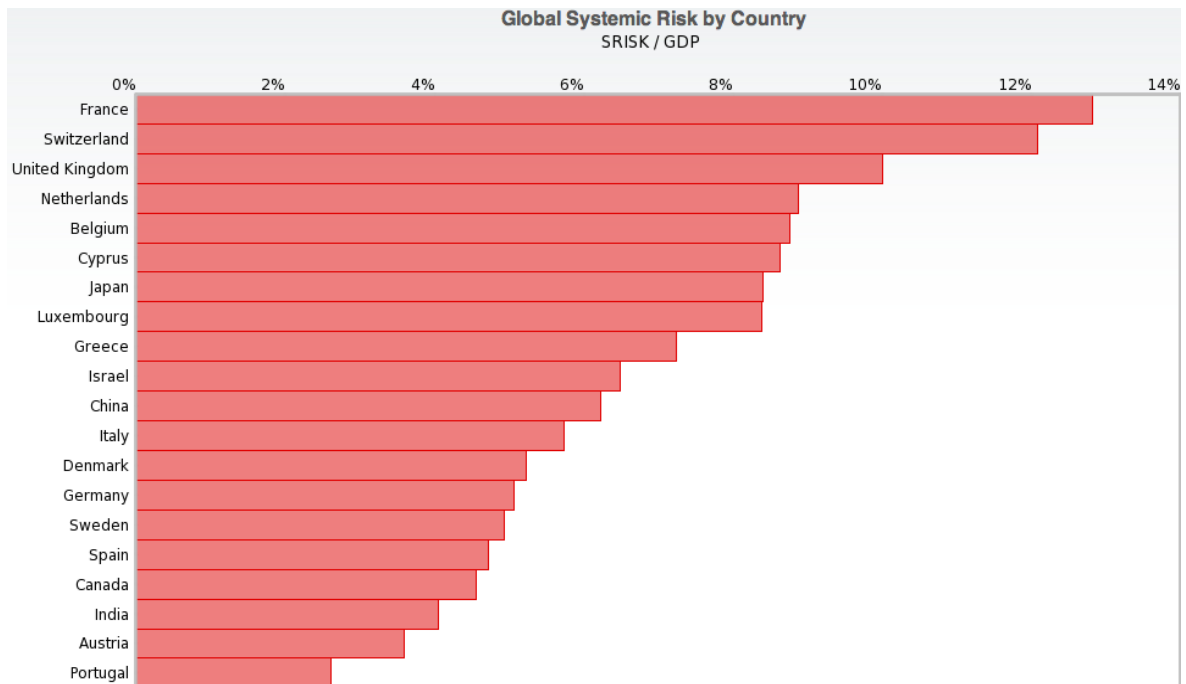
	(1)			(2)			(3)		
	Traditional Model	Neutral Model	Trader Model	Traditional Model	Neutral Model	Trader Model	Traditional Model	Neutral Model	Trader Model
Size	-0.224***	0.150**	0.144***	-0.081***	0.101***	0.008	-0.165	-0.042**	0.379***
	(0.020)	(0.070)	(0.040)	(0.015)	(0.021)	(0.053)	(0.116)	(0.019)	(0.10)
Income Interest	0.009***	-0.006***	-0.005						
	(0.001)	(0.002)	(0.003)						
Commission and Fee Income	-0.100***	-0.147	0.224***						
	(0.036)	(0.098)	(0.070)						
Trading Income	-0.464**	-0.329	0.939***						
	(0.205)	(0.229)	(0.223)						
Non-operating income	0.084	-0.288***	0.130						
	(0.076)	(0.033)	(0.115)						
Trading Securities				-0.008	-0.012**	0.025***			
				(0.009)	(0.005)	(0.004)			
Investment Securities				0.004	0.007	-0.022***			
				(0.003)	(0.006)	(0.004)			
Off-balance sheet activities				0.000***	0.001***	0.000***	-0.027***	-0.002	0.040***
				(0.000)	(0.000)	(0.000)	(0.008)	(0.005)	(0.014)
Mortgage Asset							0.008***	-0.010	-0.021
							(0.002)	(0.023)	(0.018)
Other loans							0.019***	-0.007	-0.041***
							(0.007)	(0.011)	(0.013)
Equity investment							-0.245*	-0.083*	-0.185
							(0.145)	(0.045)	(0.262)
Other investment							-0.728	0.872*	-2.883
							(0.469)	(0.494)	(5.193)
Efficiency	-0.008***	0.002	0.003*	-0.003	-0.008***	0.002	-0.006	-0.006	0.014
	(0.001)	(0.003)	(0.002)	(0.006)	(0.003)	(0.002)	(0.005)	(0.011)	(0.018)
Activity	0.026***	-0.010	-0.016***	0.021***	0.004***	-0.039***			
	(0.003)	(0.008)	(0.006)	(0.008)	(0.010)	(0.002)			
Profitability	-0.039	-0.037	0.148***	-0.071	-1.181	0.236	-0.012	-0.047	0.081
	(0.028)	(0.030)	(0.029)	(0.072)	(0.057)	(0.007)	(0.060)	(0.215)	(0.207)
Capital	-0.053***	0.034***	-0.005	-0.034**	0.001	0.019	-0.088	-0.156	0.262***
	(0.002)	(0.004)	(0.016)	(0.016)	(0.003)	(0.021)	(0.067)	(0.099)	(0.074)
Concentration	0.005	-0.011***	0.015***	-0.008	-0.008	0.040***	-0.002	-0.028**	0.090***
	(0.004)	(0.003)	(0.004)	(0.008)	(0.007)	(0.007)	(0.010)	(0.012)	(0.029)
Constant	1.401**	-0.737	-3.225***	0.542	-0.395	-2.304***	2.319	3.325***	-13.813***
	(0.716)	(1.176)	(0.464)	(1.173)	(0.864)	(0.705)	(2.556)	(0.691)	(3.523)
Number of obs.	460	460	460	690	690	690	166	166	166
R2	0.319	0.213	0.466	0.168	0.125	0.473	0.282	0.344	0.671

Table 9: Characteristics of banking business models and their funding strategies
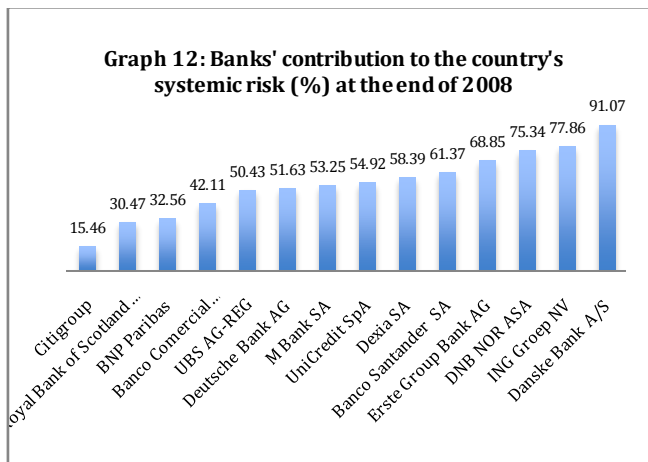
Regression results present the probability of banks within a given country to be classified into one of the banking business models: *originator*, *trader*, *neutral* or *traditionier* given its characteristics. Classification is condition upon the mean of various income sources: *traditioniers* if the interest income is above the mean, and other source of income is below the mean; *neutrals* if both types of income, as interest and non-interest are closed to the mean; *originators* if the interest and non-interest income are above the mean, and traders, if the non-interest income is above the mean, however the interest income is below the mean types of activities the major banks in a country exhibit. The regressions on an "originator" model in the specification (2) and (4) are not available due to gaps in the data for banks representing this model. The regressions cover all OECD countries. The analysis period is 1995-2006. All regressions include time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

	(1)				(2)			(3)				(4)		
	Traditional Model	Neutral Model	Originator Model	Trader Model	Traditional Model	Neutral Model	Trader Model	Traditional Model	Neutral Model	Originator Model	Trader Model	Traditional Model	Neutral Model	Trader Model
Size	-0.018	0.029	-0.645***	-0.018	-0.056	0.090***	-0.026	-0.016*	0.058**	-0.874***	-0.052	-0.120***	0.135***	0.017
	(0.019)	(0.022)	(0.156)	(0.042)	(0.039)	(0.030)	(0.057)	(0.010)	(0.030)	(0.253)	(0.036)	(0.026)	(0.038)	(0.071)
Liquidity Ratio	-0.003	-0.006***	-0.041***	0.007										
	(0.004)	(0.002)	(0.003)	(0.005)										
Demand Deposits								0.000***	0.000	-0.010	0.000			
								(0.000)	(0.000)	(0.009)	(0.001)			
Savings Deposits					0.000*	0.000*	0.000***							
					(0.000)	(0.000)	(0.000)							
Money Market												0.001**	0.000	-0.001
												(0.000)	(0.000)	(0.001)
Efficiency	-0.007***	-0.005**	0.020***	0.006***	-0.003	-0.005***	0.006***	-0.005	-0.005***	0.016***	0.005**	-0.009*	-0.001	0.002
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.001)	(0.002)	(0.004)	(0.002)	(0.005)	(0.002)	(0.005)	(0.001)	(0.002)
Activity	0.023***	-0.004***	-0.029**	-0.026***	0.021***	0.000	-0.028***	0.022***	-0.001	-0.024***	-0.027***	0.023***	0.002	-0.036***
	(0.004)	(0.001)	(0.012)	(0.001)	(0.004)	(0.003)	(0.006)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)
Profitability	-0.097	-0.165**	-0.445***	0.273***	-0.045	-0.041	0.060	-0.075**	-0.047	-0.009	0.078	-0.089**	0.031	0.029
	(0.090)	(0.066)	(0.153)	(0.087)	(0.040)	(0.040)	(0.060)	(0.037)	(0.050)	(0.054)	(0.067)	(0.040)	(0.048)	(0.046)
Capital	-0.010	0.001	-0.161**	-0.003	-0.013**	0.009*	0.004	-0.010	0.002	-0.270***	0.005	-0.034***	0.008	0.015
	(0.012)	(0.005)	(0.063)	(0.010)	(0.006)	(0.005)	(0.004)	(0.008)	(0.006)	(0.050)	(0.003)	(0.009)	(0.011)	(0.019)
Concentration	-0.005	-0.003	-0.213***	0.018**	0.003	-0.012*	0.017***	0.002	-0.006	-0.225***	0.011	-0.005	-0.004	0.020
	(0.005)	(0.008)	(0.050)	(0.008)	(0.004)	(0.007)	(0.005)	(0.005)	(0.008)	(0.049)	(0.009)	(0.009)	(0.006)	(0.016)
Constant	-0.0244	0.306	11.100	-1.381**	-0.566	-0.115	-0.998*	-0.780	-0.131	14.220***	-0.407	1.122	-1.629***	-0.977
	(0.478)	(0.728)	(2.747)	(0.569)	(0.502)	(0.726)	(0.556)	(0.637)	(0.776)	(3.646)	(0.663)	(0.806)	(0.521)	(1.320)
N	1574	1574	1456	1574	1224	1224	1224	1513	1513	1412	1513	807	807	807
R2	0.157	0.058	0.753	0.272	0.131	0.070	0.225	0.139	0.042	0.724	0.208	0.187	0.081	0.292

Graph 11: Global systemic risk to country's GDP

Global Systemic Risk by Country
SRISK / GDP

Source: V-LAB, NYU

Graph 12: Banks' contribution to the country's systemic risk (%) at the end of 2008

Source: V-LAB, NYU

Graph 13: Banks' contribution to the global systemic risk (%) at the end of 2008

Source: V-LAB, NYU

Graph 14: Banks' contribution to the global systemic risk (%) at the end of 2008
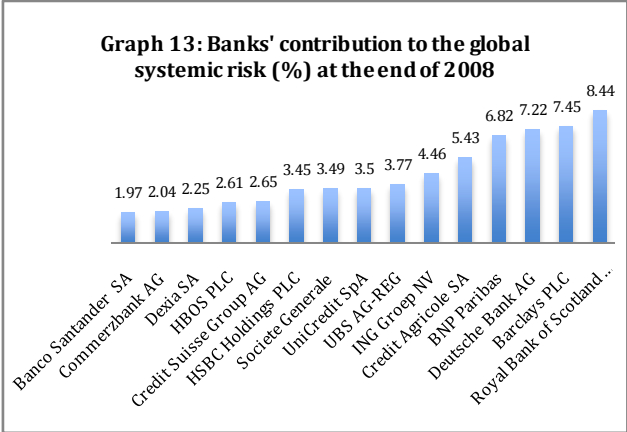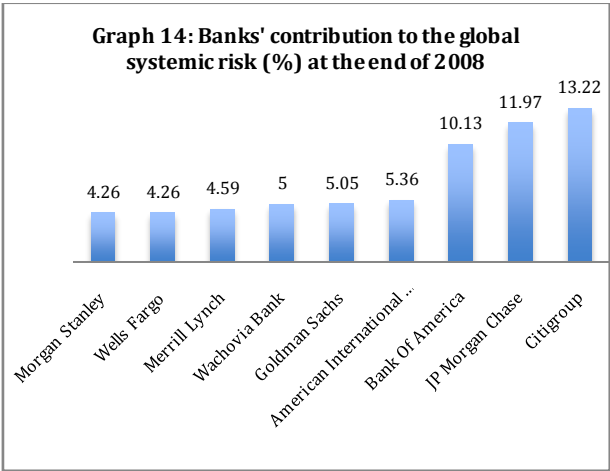
Source: V-LAB, NYU

Table 10: Banking Models, and Systemic Risk

The OLS estimations show the contribution of individual banking model to the systemic risk based on the country's models of banking sectors. The banking models include: *originator, trader, neutral,* and *traditionier.* Classification group was condition upon the types of activities the major banks in a country exhibit. The regressions cover all OECD countries. The analysis period is 2007-2009. All regressions include time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

Variables	Bailout dummy	Nationalization dummy	Tier 1 ratio
Size	0.935**	0.492**	-1.871***
	(0.377)	(0.213)	(0.633)
Income Interest (one-year lag)	0.284	0.190	-1.504
	(0.238)	(0.164)	(0.695)
Other Operating Income (one-year lag)	-0.717**	-0.710**	1.647
	(0.321)	(0.313)	(1.633)
Non-operating Income (one-year lag)	-0.051	0.070	-4.307
	(0.160)	(0.096)	(4.323)
Efficiency (one-year lag)	0.003	-0.002	-0.014
	(0.006)	(0.005)	(0.041)
Activity (one-year lag)	-0.006	0.007	-0.093
	(0.010)	(0.010)	(0.091)
Capital (one-year lag)	-0.022	-0.048	-0.130
	(0.055)	(0.049)	(0.299)
Concentration	-0.018*	-0.014	-0.057
	(0.106)	(0.013)	(0.072)
gdp per capita	-0.000**	-0.000**	-0.000*
	(0.000)	(0.000)	(0.000)
Neutral Model	2.686**	3.128**	8.386**
	(1.088)	(0.897)	(4.147)
Originator Model	3.113***	3.980***	12.622**
	(1.180)	(1.197)	(5.041)
Trader Model	4.843***	4.251***	10.171*
	(1.116)	(0.925)	(5.271)
Constant	-14.076	-9.095***	36.873***
	(5.277)	(3.343)	(12.733)
Number of obs.	0.725	0.486	0.483
R2	259	259	110

Table 11: Banking business models, and systemic risk

The OLS estimations show the contribution of individual banking model to the systemic risk. The banking models include: *originator*, *trader*, *neutral*, and *traditionier*. Classification is upon the mean of various income sources: *traditioniers* if the interest income is above the mean, and other source of income is below the mean; *neutrals* if both types of income, as interest and non-interest are closed to the mean; *originators* if the interest and non-interest income are above the mean, and *traders*, if the non-interest income is above the mean, however the interest income is below the mean types of activities the major banks in a country exhibit. The regressions cover all OECD countries. The analysis period is 2007-2009. All regressions include time-dummies. The ***, **, * indicate significance at 1%, 5%, and 10%, respectively.

Variables	Bailout dummy	Systemic Risk Measure	Tier 1 ratio
Size	0.039**	0.167***	-1.761***
	(0.015)	(0.057)	(0.579)
Concentration	-0.001	0.000	-0.121*
	(0.001)	(0.004)	(0.069)
gdp per capita	0.000	0.000*	0.000
	(0.000)	(0.000)	(0.000)
Neutral Model	0.007	-0.164	2.709
	(0.047)	(0.171)	(2.087)
Originator Model	0.081	0.660	-2.467
	(0.175)	(0.578)	(1.434)
Trader Model	0.069*	0.481**	-2.467***
	(0.037)	(0.231)	(1.434)
Constant	-0.220	-1.167**	34.853***
	(0.137)	(0.550)	(8.696)
N	0.178	0.124	0.346
R2	311	311	311

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Appendix:

Table A1

Variable	Description	Source
Profitability	Net income/Average Asset	Bankscope
Capital ratio	Book capital/total asset (%)	Bankscope
Size	Total assets (in mln USD) in logarithmic form	Bankscope
Activity	Net loans to total assets (%)	Bankscope
Efficiency	Non-interest expenses as share of operating income (%)	Bankscope
Interest Income	Income interest as a share of bank's average asset	Bankscope
Other Operating Income	Income from other bank's operating activities (trading, commission, fee, insurance income) except from the interest as a share of bank's average asset	Bankscope
Non-Operating Income	Income from other bank's non-operating activities as a share of average asset	Bankscope
Commission and Fee Income	Commission and Fee income as a share of bank's average asset	Bankscpe
Trading Income	Trading income as a share of bank's average asset	Bankscope
Trading Securities	Securities classified as held for trading, including government securities as a share of bank's average asset. They are reported at a fair value.	Bankscope
Investment Securities	Securities available for sale as a share of bank's average asset. They are reported at fair value.	Bankscope
Off-balance Sheet Activities	Asset that the bank does not have a control but where it may have some exposure to losses – for which it is most likely being paid a fee or is remunerated in some other way. Expressed as a ratio of a bank's average asset.	Bankscope
Mortgage Asset	Value of mortgage loans as a share of bank's average asset	Bankscope
Other Loans	Loans other than the mortgage loans as a share of bank's average asset	Bankscope
Equity Investment	Investment in associated companies as a share of a bank's average asset	Bankscope
Other Investment	Other type of the investment than financial investment as a share of bank's average asset	Bankscope
Demand Deposits	Demand deposits as a share of bank's average liabilities.	Bankscope
Savings Deposits	Savings deposits as a share of bank's average liabilities.	Bankscope
Money Market	Certificates of deposits, commercial papers, and other short-term money market instruments as a share of bank's average liabilities.	Bankscope
Liquidity Ratio	Liquid asset in relations to deposit and short-term funding	Bankscope
Banking Sector Size	Banking sector asset size in relation to country	World Bank

	GDP	
Capital Market Size	Stock market capitalization in relation to country GDP	World Bank
Pension Fund Asset	Pension fund sector size in relation to country GDP	World Bank
Insurance Asset	Insurance premium (life and non-life) in relation to country GDP	World Bank
Mutual Fund Asset	Mututal fund sector size in relation to country GDP	World Bank
Capital Regulations	Index of capital requirements that accounts for both overall and initial capital stringency. Overall capital stringency examines whether the capital requirement reflects certain risk elements and deducts certain market values from losses from capital before minimum capital adequacy is determined, whether initial capital stringency indicates whether certain funds may be used to initially capitalize a bank and whether they are officially verified. It is calculate on the basis of nince questions with higher values indicating greater capital stringency.	Barth et al. (2013)
Bank Activity Restrictions	Index of the degree of which banks may engage in real estate investment, insurance underwriting, and selling, underwriting, brokering and dealing with the securities, and all aspects of the mutual fund industry. Variable ranges from 0 to 4, with higher values indicating greater restrictiveness.	Barth et al. (2013)
Private Monitoring Index	Variable is calculated by adding 1 for each 'yes' and 0 for each 'no' to ten questions, which higher values indicating more informative bank accounts. Those questions indicate the degree of information that is released to officials, the public, credit audit requirements, and whether the credit ratings, either from domestic or international credit rating agencies are required.	Barth et al. (2013)
Concentration ratio	Assets of three largest banks as a share of the assets of all commercial banks	World Bank
GDP growth	Annual percentage growth rate of GDP at market prices based on constant local currency (annual) (%)	World Bank
Inflation	Annual percentage change in consumer price index (annual), in logarithms	World Bank