BANK REGULATION AND RISK-TAKING INCENTIVES: AN INTERNATIONAL COMPARISON OF BANK RISK.

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Abstract

This paper uses a panel database of 251 banks in 36 countries to analyze the impact of bank regulation on bank charter value and risk-taking. After controlling for deposit insurance and for the quality of a country's contracting environment, the results indicate that regulatory restrictions increase banks´ risk-taking incentives by reducing their charter value. Banks in countries with stricter regulation have a lower charter value, which increases their incentives to follow risky policies. These results corroborate a negative relation between regulatory restrictions and the stability of a banking system. Deposit insurance has a positive influence on bank charter value, mitigating the risk-shifting incentives it creates. This positive influence disappears when we control for the possible endogeneity of deposit insurance.

JEL classification: G32, G21, L22
Keywords: Banking, charter value, deposit insurance, regulation, risk.

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Abstract

This paper uses a panel database of 251 banks in 36 countries to analyze the impact of bank regulation on bank charter value and risk-taking. After controlling for deposit insurance and for the quality of a country's contracting environment, the results indicate that regulatory restrictions increase banks´ risk-taking incentives by reducing their charter value. Banks in countries with stricter regulation have a lower charter value, which increases their incentives to follow risky policies. These results corroborate a negative relation between regulatory restrictions and the stability of a banking system. Deposit insurance has a positive influence on bank charter value, mitigating the risk-shifting incentives it creates. This positive influence disappears when we control for the possible endogeneity of deposit insurance.

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1. Introduction

Bank regulation differs from country to country. A prime difference is in the freedom allowed to banks to pursue a range of different activities. There are in fact opposing arguments suggesting that a more lax regulatory regime may produce either a less stable or a more stable banking system. Relaxing restrictions on banking activities may encourage bank risk-taking by expanding a bank's range of activities. Yet relaxing restriction may also increase opportunities for bank diversification, and thereby reduce risk-taking. When these two contrary options are open, regulators will want to analyze bank risk-taking incentives because the ultimate consequence of expanding the range of activities allowed to banks will depend on these incentives.

The banking literature has pinpointed deposit insurance and bank charter value as the two main determinants of bank risk-taking incentives. We thus examine an international bank-level database to provide empirical evidence of the influence of these determinants on the relation between regulatory restrictions on banking activities and bank risk-taking.

We analyze both the effect of regulatory restrictions on bank risk-taking varies according to the charter value of banks and whether a country has deposit insurance, and also consider the potential endogeneity of bank charter value and its dependence on the regulations and institutions in a country. If the charter value of banks depends on the bank regulatory restrictions in the country, the influence of these restrictions on bank risk-taking would be two-fold. First, they would limit activities that banks could engage in, and, second, they would affect bank risk-taking incentives through their influence on charter value.

Barth et al. (2001, 2004) use a country-level database to analyze the influence of regulatory restrictions on the likelihood of a banking crisis and on the ratio of non-performing loans. Their results indicate that a banking crisis is more likely, the stricter the restrictions placed on securities investments, real estate investments, and bank ownership of non-financial firms. However, they do not analyze whether the influence of regulatory restrictions on bank risk-taking varies according to either bank charter value or the presence of deposit insurance in a country; nor do they consider the potential effect of regulatory restrictions on bank charter value.

To examine the potential two-fold influence of regulatory restrictions on bank risk-taking, we apply two-stage least squares analysis that includes the influence of regulatory restrictions on bank charter value in the first equation. Charter values

predicted by the first equation are then incorporated into a second equation to explain bank risk-taking, together with a variable that measures the level of restrictions in banking activity. In both equations, we control for a country's deposit insurance, quality of rule of law, and legal origin, and for bank balance sheet variables. We use an international database of 251 banks from 36 countries and information from 1995 through 1999. The availability of this bank-level panel data allows us to consider both cross-sectional and time series variability of regulatory restrictions and control for unobserved bank heterogeneity.

The rest of the paper is structured in the following way. Section 2 discusses the hypotheses regarding the influence of regulatory restrictions on bank risk-taking. Section 3 describes the characteristics of the database, whilst Section 4 describes both the methodology and empirical results. Finally, Section 5 presents some conclusions.

2. Hypotheses

There is no clear theoretical link between banking-related regulatory restrictions and the stability of the banking system without factoring in bank risk-taking incentives. Greater freedom for banks to pursue their activities might either increase the stability of the banking system, by increasing opportunities for diversification, or undermine it, by providing banks more opportunities to take on greater risk. [1]

When regulatory restrictions can either reduce or increase risk, depending on the use banks make of their greater latitude, the incentives banks have either to take on risk or to proceed cautiously need careful assessment. To analyze the role of these incentives, we focus on their two main determinants: the presence of deposit insurance in a country, and the charter value of the bank.

It has long been suggested that deposit insurance may make depositors less likely to enforce market discipline on banks and can encourage banks to take excessive risks (Merton, 1977; Bhattacharya and Thakor, 1993; Bhattacharya et al., 1998; Demirgüc-Kunt and Kane, 2002). There is empirical evidence to this effect, showing that deposit

[1]Eisenbeis and Wall (1984) and Kwan and Laderman (1999) argue that since profits from providing different financial services are not very highly correlated, there are diversification benefits from giving banks more latitude. Furthermore, broad or universal banks did not systematically abuse their powers in the pre-Glass-Steagall days and before the introduction of deposit insurance in the United States (Ang and Richardson, 1994; Kroszner and Rajan, 1994; Puri, 1996) or fail more frequently (White, 1986). Mishkin (1999) and others, however, point out that one lesson learned from the U.S. savings and loan crisis of the 1980s is that when financial institutions are allowed to enter new lines of business that present more opportunities for taking on risk, the moral hazard created by the government safety net can result in a substantial increase in risk-taking.

insurance increases the probability of banking crises (Demirgüc-Kunt and Huizinga, 2000, Demirgüc-Kunt and Detragiache, 2002). However, empirical evidence also shows that the detrimental impact of deposit insurance depends on the nature of the contracting environment and on the degree of freedom in banking activity. Kane (2000), Cull et al. (2001), Demirgüc-Kunt and Detragiache (2002), Demirgüc-Kunt and Kane (2002), and Laeven (2002) conclude that a sound legal system with proper enforcement of rules reduces the adverse effects of deposit insurance on bank risk-taking. Flannery (1998), Mishkin (1999), and Hovakimian and Kane (2000) note that restrictions on bank activities have been viewed by regulators and academics alike more as a useful tool for reducing bank risk than as a block on opportunities for diversification. Hovakimian et al. (2003) also show that loss-control features such as risk-sensitive deposit insurance premiums, coverage limits, and coinsurance temper the risk-shifting incentives exacerbated by the introduction of deposit insurance.

Given the claim that risk-shifting incentives are greater in countries with deposit insurance, we predict that regulatory restrictions will be more useful in reducing bank risk in these countries. Analysis must take into account both explicit and implicit deposit insurance that may impact depositors' expectations of public intervention in times of distress. Gropp and Vesala (2001) suggest that, in the absence of explicit deposit insurance, European banking systems have been characterized by strong implicit insurance. In this case, the introduction of an explicit system may imply a de facto reduction in the safety net. Their study confirms reduced bank risk in European countries after implementation of explicit insurance programs.

Even when there is deposit insurance, whether explicit or implicit, risk-taking incentives also depend on bank charter value, which has been defined as a bank's self-imposed risk discipline device (Buser et al., 1981; Marcus, 1984; Keeley, 1990). Keeley (1990) has shown that although the deposit insurance system appears to have worked well in the US throughout most of its fifty-year history, major problems began to arise in the early 1980s, when increased competition reduced the charter value of banks. Authors since then have provided further evidence that a high charter value reduces bank risk-taking incentives and, conversely, that a low charter value increases them. A bank with a high charter value has an incentive to avoid high-risk choices that may trigger a drop in its charter value. The potential loss of charter value for a low-charter value bank may no longer function as a risk-taking disincentive. In this case, implementing a higher-risk strategy (reducing capital relative to assets or increasing asset risk) may produce greater expected gain in the value of the bank's deposit insurance subsidy or in wealth expropriated from depositors than any loss in its charter value. [2]

[2] Consistent with this argument, empirical studies of the US banking industry indicate an inverse relationship between charter value and bank risk-taking. Keeley (1990) and Demsetz et al. (1996) present evidence for a sample of large US bank holding companies. Grossman (1992) finds that, in the 1930s, US

Regulatory restrictions should have a different effect on bank risk-taking, depending on bank charter value. Greater banking freedom should enable banks with low charter value to respond more to their high risk-taking incentives, while more freedom should allow broadened diversification opportunities for banks with high charter value and incentives to apply conservative investment policies. Therefore, we forecast that banks with a low charter value would have reduced incentives to behave prudently, and would likely take advantage of reduced restrictions in order to increase their risk. On the contrary, banks with a high charter value would take advantage of reduced restrictions in order to reduce their risk.

Regulatory restrictions may also have indirect effects on risk-taking through their potential influence on bank charter value. There can be two possible effects. First, if reduced regulatory restrictions have a positive effect on bank charter value, relaxing restrictions would enhance the stability of the banking system. Higher bank charter values associated with reduced regulation would provide incentives for banks to institute conservative investment policies and at the same time encourage increased diversification of their asset portfolio. In this case, there would be a positive relationship between the degree of regulatory restrictions and bank risk-taking.

Second, if reduced regulatory restrictions have a negative effect on bank charter value, relaxing restrictions would diminish the stability of the banking system. Lower bank charter values associated with reduced regulation would encourage greater risk-taking incentives. Banks would take advantage of greater freedom to increasing bank asset portfolio risk. In this case, there would be a negative relationship between the degree of regulatory restrictions and bank risk-taking.

This indirect influence of regulatory restrictions may operate in the case of other regulatory variables such as deposit insurance. This means deposit insurance may have an ambiguous influence on bank risk-taking incentives. On the one hand, risk-shifting incentives created by doing away with depositors' incentives to monitor bank managers might be exacerbated if deposit insurance also favored lower bank charter value. On the other hand, risk-shifting incentives created by implementing deposit insurance might be lessened if deposit insurance favored higher bank charter value.

Several empirical studies analyze the influence of freedom of bank activity and deposit insurance on the development of the banking system. Barth et al. (2004) show that

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thrifts operating in more competitive regulatory regimes (with lower charter value) were more prone to undertake risky lending activities than those operating in more restrictive regimes. Galloway et al. (1997), Cebenoyan et al. (1999), and Anderson and Fraser (2000) also confirm the negative influence of bank charter value on risk-taking behaviour in the United States in the 1980s and 1990s. A negative relationship between charter value and risk-taking is also found by Gropp and Vesala (2001) in a sample of EU banks over 1991-1998, and by Konishi and Yasuda (2004) for Japanese banks in the 1990s.

restriction of banking activity is negatively associated with bank development and efficiency.[3] Cull et al. (2001) in an examination of time series data for 58 countries find that deposit insurance favorably impacts the level of financial activity only in the presence of strong institutional development. The efficiency of the banking system is not the only determinant of bank charter value, however, as it considers only the total value created by banks without considering how this value is shared across banks, which will depend on the level of competition. In this respect, US studies reveal that periods of lower regulation are associated with lower bank charter value, because of the increase in competition (Keeley, 1990; Grossman, 1992; Galloway et al., 1997). This difference between efficiency levels and charter value means that neither the negative relationship between banking restrictions and the efficiency of the banking system, highlighted in Barth et al. (2004), nor the positive relationship between the presence of deposit insurance and the efficiency of the banking system, reported by Cull et al. (2001), can be extrapolated directly to the relationship between each of these two facets of regulation and bank charter value.

Although the potential influence of regulatory restrictions on bank charter value is an open question, it may be compatible with the influence of regulatory restrictions on bank risk-taking. For example, the positive relationship that Barth et al. (2001, 2004) find between the degree of regulation in a country and the probability of banking crisis could be explained if tighter regulatory restrictions favor lower charter value of banks and do not give the banks incentives to apply conservative investment policies. This is the key aspect we aim to clarify by making two contributions to work on the influence of regulatory restrictions on bank risk-taking. First, we analyze how the influence of regulation on risk-taking varies according to bank charter value and depending on the presence of deposit insurance in a country. Second, we also consider the potential indirect effect of regulation on bank risk-taking through its influence on charter value and therefore on risk-taking incentives.

3. Data

Our database comes from Worldscope, which provides financial data on stock exchange-listed banks. We use consolidated balance sheets and income statements. Since this database includes the market prices of banks stocks, we can calculate a

[3]Expanded banking powers are associated with a lower cost of capital and less stringent cash flow constraints (Delong, 1991; Berger and Udell, 1996). Vennet (1999) finds that unrestricted banks have higher levels of operational efficiency than banks with more restricted powers. Barth et al. (2001, 2004) find in a country level database that greater regulatory restrictions are associated with lower banking sector efficiency and do not find offsetting positive effects from restricting banking sector activities.

Tobin's Q for each bank in each year, and thus obtain a measure of bank charter value. Japanese banks are excluded from the analysis in order to avoid the potential bias caused by insolvency of the Japanese banking system since the late 1990s. The sample includes all the other banks in the Worldscope database for which the risk variables used in the empirical analysis are available (non-performing loans to total loans and bank stock price volatility) and for which it is possible to calculate Tobin's Q. Information was obtained from 251 banks in 36 countries over the 1995-1999 period. The panel is unbalanced, as year-by-year information on the variables used is not available for all the banks considered. All the estimations, including those for the 73 Japanese banks for which information is available in the Worldscope database, were nevertheless replicated, with no variation in the key results. The numbers of banks in each country in the sample are shown in Table 1.

(Insert Table 1)

Two different measures of bank risk are used: credit risk and overall bank risk. Credit risk is measured as the ratio of non-performing loans to total bank loans (NONPERF). As there are also other types of bank risk, such as market and operations risk, the standard deviation of daily bank stock returns for each year (PRICEVOL) is also applied as a measure of overall risk.

Bank charter value, measured as Tobin's Q, and the presence of deposit insurance in a country are both included as variables to measure banks' risk-taking incentives. To calculate Tobin's Q, we proxy the market value of assets by the book value of assets minus the book value of equity minus deferred taxes plus the market value of common stocks. The replacement value of assets is proxied by the book value of assets.

To control for deposit insurance we follow, among others, Cull et al. (2001) or Laeven (2002), and define a dummy variable (INS_{EXP}) with a value of 1 if the country has explicit deposit insurance and 0 otherwise. Only three countries –Hong Kong, Singapore, and South Africa– lacked explicit deposit insurance throughout the period analyzed; explicit deposit insurance was instituted in four other countries in the course of the period (Indonesia in 1998, Malaysia in 1998, Sweden in 1996, and Thailand in 1997). All the remaining countries in the study had adopted explicit deposit insurance before 1995. [4] Deposit insurance data come from Demirgüc-Kunt and Sobaci (2001).

[4] Results do not vary when the INS_{EXP} variable takes 1 as its value for each of the five years for the four countries that inaugurated explicit deposit insurance during the period. The rationale for applying 1 as the value for years preceding explicit deposit insurance was to incorporate the potential broad implicit insurance there may have been in these countries prior to explicit insurance.

To measure the level of regulatory restrictions on bank activities (REG), we use the banking and finance index published annually for each country by the Heritage Foundation. This index measures the relative openness of a country's banking and financial system by analyzing whether foreign banks and financial services firms are able to operate freely; how difficult it is to open domestic banks and other financial services firms; how heavily regulated the financial system is; and whether banks are free to provide customers with insurance and invest in securities. Values of REG range from 1 to 5; a higher value indicates a more restrictive banking system. The specific banking and finance grading scale is shown in Panel A of Table 2.

(Insert Table 2)

As none of the 36 countries included in the sample have a value of 5 in the banking and finance index, 1 and 4 are the limit values of REG in the sample. We also define a dummy variable, REG_{HIGH}, based on the index of freedom in the banking and finance activity, which is 0 if this index for the country is 1 or 2, and 1 if it is 3 or 4. We define just two country groups in order to reflect more clearly the differences in valuation and risk between banks in countries with low and high regulatory restrictions. To ensure robustness of the results, we also use separate dummy variables for each of the four values of REG in the sample ($REG1_{it,}$ $REG2_{it}$, $REG3_{it}$, and REG4it). $REG1_{it}$ equals 1 if the index of freedom in the banking activity for the country of bank *i* in year *t* is 1 and 0 otherwise; $REG2_{it}$ equals one if the index of freedom in the banking activity for the country *i* in year *t* is 2 and 0 otherwise, and so on. Results do not change using these alternative dummy variables and we thus do not present them.

As the REG index is available yearly from 1995, we can adopt a panel data methodology. This methodology differs from other studies in that it permits controlling for unobserved (time-invariant) bank effects. To show the difference between our index and the one in Barth et al. (2001, 2004) we analyze their correlation. [5] The correlation coefficients, which are shown in Panel B of Table 2, indicate that our index basically measures freedom for banks in each country to engage in three non-traditional activities (securities, insurance, and real estate). This differs from the Barth et al. (2001) measure of regulatory restrictiveness insofar as it excludes banks' ability to own and control non-financial firms.

[5] Barth et al. (2001) measure the degree to which national regulatory authorities allow commercial banks to engage in three non-traditional activities (SECURITIES, INSURANCE, and REAL ESTATE) and to own and control non-financial firms (BANKOWN). They average the values of these four indexes to calculate a summary index (RESTRICT) of the level of regulatory restrictions in the country. As the values given by Barth et al. (2001) are for 1997, we calculate the correlations using only the values of the index published by the Heritage Foundation in 1997.

To control for differences in the quality and enforcement of laws across countries, we use the law and order index (LAW & ORDER) of the International Country Risk Guide (ICRG). The index ranges from 1 to 6; a higher value indicates a better quality and enforcement of the legal system, although in our sample none of the countries scores 1.[6] As in the regulatory restrictions variable, we also define a dummy variable based on the law and order index (LAW_{HIGH}), which is 0 if the index for the country is 2, 3, or 4, and 1 if it is 5 or 6. As no alternative specifications of this dummy variable altered the results significantly, these results are not reported.

The origin of the national legal code (LEGAL ORIGIN) is also controlled for in the regressions. La Porta et al. (1998, 1999), Beck et al. (2001), and Beck and Levine (2002) confirm that historically determined differences in legal tradition help explain international differences in financial development today. Dummy variables for each country's legal origin (English common law, French civil law, German civil law, the Scandinavian civil code, and Socialist/Communist law) are therefore included, to explain both bank charter value and bank risk-taking. There are 16 countries of French legal origin in the sample, 11 of English, 4 of German, and 4 of Scandinavian origin, together with Poland, which is of Socialist legal origin. The Scandinavian law countries' dummy is excluded from the estimations. As it was not possible to obtain data on price volatility for the Polish banks, the SOCIALIST dummy variable is also omitted from the regressions that use price volatility of bank stocks as the dependent variable.

To control for specific bank characteristics, we include bank balance sheet variables that might explain differences in bank valuation and in bank risk. These variables are the natural logarithm of the book value of total bank assets (SIZE), the percentage of tangible assets (TANG), the percentage of investments in unconsolidated subsidiaries that the bank has a business relationship with or exercises control over (UCOIN), and the percentage of total debt (DEBT). All of these variables are divided by total bank assets at the end of each year to calculate their respective percentages.

The variables used in the empirical analysis are summarized in Table 3.

(Insert Table 3)

The descriptive statistics for bank-level variables are shown in Panel A of Table 4. Panel B shows the mean differences for each variable between groups of banks in

[6] This index is used for purposes similar to ours by Demirgüc-Kunt and Maksimovic (1998), Kane (2000), Cull et al. (2001), Demirgüc-Kunt and Detragiache (2002), and Laeven (2002).

countries with high and low regulatory restrictions on banking activities, between groups of banks with high and low law and order index values, and between groups of banks in countries with and without deposit insurance. Mean differences between banks in common law countries and banks in civil law countries are also shown in Panel B.

(Insert Table 4)

Analysis of the mean differences reveals that banks in countries with greater regulatory restrictions, with a lower quality legal system, without deposit insurance, and with a civil law code have higher credit risk or higher ratios of non-performing loans. Higher stock price volatility or higher overall risk is also observed for the same groups of banks, except in civil law countries and countries without deposit insurance.

Statistically significant higher bank charter values are observed in countries that have fewer regulatory restrictions on banking activities. We do not see statistically significant differences in bank charter values depending on the quality of the contracting environment, the presence of deposit insurance, and the legal origin of the country.

4. Regulatory restrictions, deposit insurance, charter value, and bank risk

While the analysis of mean differences suggests that stricter regulation increases bank risk and reduces bank charter value, we further apply multivariate analysis incorporating confounding effects that have so far been omitted. The regression analysis incorporates the effect of regulatory restrictions on both bank risk-taking and bank charter value, while also controlling for the presence of deposit insurance, the quality and enforcement of the legal system, the legal origin of the country, and bank-specific variables.

4.1. Endogenous bank charter value

We apply a two-stage least squares model to analyze the influence of regulatory restrictions on bank risk-taking, incorporating the effect of regulatory and institutional country variables on bank charter value. In the first stage, Tobin's Q-measured charter value is defined as a function of the regulatory and institutional characteristics of the country and of the specific bank variables. In the second stage, we incorporate the

Tobin's Q values predicted by the first stage as explanatory variables together with the regulatory and institutional variables of the country. This two-stage procedure explicitly considers the potential endogeneity of charter value. We apply it to avoid the bias arising from the correlation between bank charter value and the error term when we use the observed values of Tobin's Q to explain bank risk. [7]

The model estimated is:

$$Q_{TOBINit} = \alpha_0 + \alpha_1 REG_{HIGHit} + \alpha_2 LAW_{HIGHit} + \alpha_3 INS_{EXPit} + \alpha_4 \sum LEGALORIGIN_i + \alpha_5 X_{it} + \alpha_6 \sum_{t=95}^{99} TIME_t + \mu_i + \varepsilon_{it}$$

$$RISK_{it} = \beta_0 + \beta_1 REG_{HIGHit} + \beta_2 LAW_{HIGHit} + \beta_3 \hat{Q}_{TOBIN\,it} + \beta_4 \left(\hat{Q}_{TOBINit} \text{ x } REG_{HIGHit}\right) +$$
$$\beta_5 \left(\hat{Q}_{TOBINit} \text{ x } LAW_{HIGH}\right) + \beta_6 INS_{EXPit} + \beta_7 \left(INS_{EXP} \text{ x } REG_{HIGHit}\right) + \beta_8 \left(INS_{EXP} \text{ x } LAW_{HIGH}\right) +$$
$$\beta_9 \sum LEGALORIGIN_i + \beta_{10} Y_{it} + \beta_{11} \sum_{t=95}^{99} TIME_t + \eta_i + \omega_{it} \qquad [1]$$

The regulatory and institutional variables of the country (REG_{HIGH}, INS_{EXP}, LAW_{HIGH}, $\sum$LEGALORIGIN) and a set of bank-specific variables that might explain bank valuation (X_{it}) are incorporated in the first stage as explanatory variables of Tobin's Q. This specification assumes that two regulatory facets of each country are exogenous: level of regulatory restrictions (REG_{HIGH}) and deposit insurance (INS_{EXP}). In section 4.1.2. we move on to consider the possible endogeneity of these variables.

The bank-specific variables included in X_{it} are SIZE, TANG, and UCOIN. Their potential effect on bank charter value can be explained in different ways. For instance, the presence of scale economies or the greater market power inherent in larger size might lead to a positive relation between size and Tobin's Q. The percentage of tangible assets to total bank assets (TANG) is included as an additional control variable to account for possible differences that might vary depending on the tangible assets of the bank, including differences in efficiency, branching policy, or size of country.

Finally, in some European and Asian countries, banks take equity of industrial firms and maintain close lending relationships with them. The Worldscope data do not allow us to differentiate bank equity investments from loans granted to firms in which banks have

[7] Keeley (1990) uses a similar procedure in a first-stage analysis of how the degree of liberalization in the U.S. banking sector for the 1970-1986 period affects Tobin's Q, and in a second stage, of how Tobin's Q affects bank risk-taking. Gropp and Vesala (2001) also propose a similar two-stage procedure to analyze the influence of explicit deposit insurance on bank risk-taking in the EU.

taken equity. Since Worldscope provides only the sum total of investments in unconsolidated subsidiaries (UCOIN), we include this variable as a proxy in an effort to capture bank risk concentration and the influence of lending relationships and equity investments on bank charter value.

The second stage incorporates the predicted values of Tobin's Q from stage one ($\hat{Q}_{TOBIN}$) with the regulatory and institutional country variables. We expect a negative coefficient for $\hat{Q}_{TOBIN}$ in the risk equation because a bank with higher charter value has more incentives to behave prudently, as the expected loss would be greater if the bank went bankrupt as a result of risky strategies. The INS_{EXP} dummy variable is also included as an explanatory variable in the risk equation, as bank risk-taking incentives may be affected by the presence of deposit insurance. If there are more risk-taking incentives in countries with deposit insurance, we should obtain a positive coefficient for INS_{EXP} in this second-stage equation. The influence on risk-taking of regulatory restrictions and the quality of the legal contracting system in the country are also considered by inclusion of REG_{HIGH} and LAW_{HIGH} dummy variables.

Because risk-shifting incentives created by a low bank charter value or by deposit insurance can be offset, depending on restrictions on banking activity or on quality of the contracting environment, we incorporate interaction terms. First, we interact $\hat{Q}_{TOBIN}$ with REG_{HIGH} and LAW_{HIGH} to capture the potentially different influence of charter value on banks in countries with strict and lax regulatory restrictions and on banks in countries with good and poor quality and enforcement of the legal system. Stricter regulation will reduce a bank's ability to take on more or less risk, depending on bank incentives, we predict a positive coefficient for $\hat{Q}_{TOBIN}$ x REG_{HIGH}.

Second, we interact INS_{EXP} with both REG_{HIGH} and LAW_{HIGH} in order to know how risk-shifting problems caused by deposit insurance vary with the degree of regulation and a bank's institutional environment. If regulatory restrictions on banking activities are useful to counteract bank incentives to exploit deposit insurance, we should obtain a negative coefficient for the interaction term of INS_{EXP} x REG_{HIGH}. Furthermore, if the risk-shifting incentives of deposit insurance are higher in countries with weak institutional environments and weak enforceability of private contracts, as indicated by Kane (2000), Demirgüc-Kunt and Detragiache (2002), or Laeven (2002), we should obtain a negative coefficient for the interaction term of INS_{EXP} x LAW_{HIGH}.

The natural logarithm of total bank assets (SIZE), the ratio of bank investments in unconsolidated subsidiaries (UCOIN), and the ratio of total debt (DEBT) are all specific bank variables that might explain differences in bank risk-taking, included in Y_{it} as control variables. We cannot forecast a clear effect of SIZE on bank risk-taking. On the one hand, under a "too-big-to-fail" policy, larger banks may have greater incentives to

take risk than smaller banks, since they invariably enjoy a comprehensive safety net. On the other hand, larger banks have a greater potential to diversify and reduce their risk-taking.

The ratio of investments in unconsolidated subsidiaries (UCOIN) might also have an ambiguous effect on bank risk-taking. Higher investment in unconsolidated subsidiaries can represent a loss of diversification opportunities and be responsible for higher bank risk. Yet more bank investments in unconsolidated subsidiaries can also improve bank opportunities to acquire better information about investment quality, and reduce bank credit risk.

Finally, debt ratio (DEBT) is included as an additional explanatory variable of bank risk because a higher total debt-to-total bank assets ratio will imply more credit risk if the quality of loans declines and banks select higher-quality loans in the first place. A higher debt ratio also increases financial leverage and may cause greater stock price volatility.

A set of dummy time variables ($\sum_{t=95}^{99} TIME_t$) for each year considered in the analysis are included in both equations. The 1999 dummy is omitted from the regressions. These dummies capture any unobserved bank-invariant time effects not included in the regression, but their coefficients are not reported for reasons of space. Finally, u_i and η_i are bank-specific effects, and ε_{it} and ω_{it} are white-noise error terms.

The availability of a data panel enables us to apply a random-effects model to both stages, and therefore to correct for unobserved bank-specific and time-specific effects. The natural alternative specification of fixed effects is not feasible in our framework, given that there is no within-variation in the legal origin variables. [8] The random effects specification is supported by the Breusch and Pagan (1980) Lagrange multiplier test, (LM test), which rejects the null hypothesis that errors are independent within banks, i.e., individual effects are not irrelevant. For this reason, we do not present OLS estimations.

As the number of observations varies widely across countries, we also use weighted least squares (WLS) to estimate the regression models, taking the inverse of the number of country observations for each country as the weight for each bank in the country. The results are presented with White's (1980) heteroskedasticity-corrected standard errors.

[8] La Porta et al. (2000, 2002) use a random effects specification with the same type of database and legal origin variables.

4.1.1. Results

The results of random effects and WLS estimations of [1] are shown in Table 5. The results are basically similar in both types of estimations and for both measures of bank risk.

(Insert Table 5)

After controlling for the legal origin of the country, for bank balance sheet variables, and for bank-invariant time effects, the first-stage results indicate that regulatory restrictions on bank activities have a negative influence on bank charter value, and the presence of deposit insurance in the country has a positive influence. The quality and enforcement of the country's legal system does not appear to have a significant effect on bank charter value. In fact, the results of the random effects regressions indicate that, other things equal, the charter value of banks with low regulatory restrictions is 0.15 basis points higher than for banks in countries with high regulatory restrictions. Similarly, the charter value of banks in countries with deposit insurance is 0.24 basis points higher than for banks in countries without deposit insurance.

The higher charter value of banks in countries with less regulation may augment the incentives for these banks to behave prudently and therefore cause more lax regulation to be associated with greater stability of the banking system. And the positive influence of deposit insurance on bank charter value also reduces the benefits to be gained from high-risk policies for bank shareholders, as the expected gain in the value of the deposit insurance subsidy may be offset by the potential loss of charter value if the bank goes bankrupt.

These interpretations are corroborated by the results of the second-stage risk equations. The negative coefficient of the forecasted values of Tobin's Q from stage one ($\hat{Q}_{TOBIN}$) confirms the mitigating effect of charter value on bank risk-taking incentives in countries with weaker regulation and a weak contracting environment. The statistically significant positive coefficients of the interaction terms indicate that regulatory restrictions and a strong contracting environment reduce the influence of charter value on bank risk-taking, although regulation reduces the influence of bank charter value more than the quality and enforcement of the legal system in the country.

These results are also of economic importance. For instance, according to the random effects results, a 1 percent increase in Tobin's Q reduces non-performing loans by around 18 percent and stock price volatility by 13 percent in countries with a weak

contracting environment and fewer regulatory restrictions. When we sum the coefficients of $\hat{Q}_{TOBIN}$ and $\hat{Q}_{TOBIN}$ x LAW_{HIGH} to obtain the influence of charter value on bank risk-taking in banks with weaker regulation but high-quality legal system and enforcement, the influence on non-performing loans falls to 11.3 percent. In countries with strict regulation, however, regardless of the quality of the contracting environment, bank charter value does not have a significant influence on bank risk-taking. We do not obtain statistically significant coefficients for either measure of bank risk when we add the coefficients of $\hat{Q}_{TOBIN}$ and $\hat{Q}_{TOBIN}$ x REG_{HIGH} to estimate the influence of charter value of banks in countries with low-quality contracting environments but strict regulation. Nor do we obtain statistically significant coefficients when we add the $\hat{Q}_{TOBIN}$, $\hat{Q}_{TOBIN}$ x REG_{HIGH}, and $\hat{Q}_{TOBIN}$ x LAW_{HIGH} coefficients to estimate the influence of bank charter value in countries with strict regulation and good-quality contracting environments.

Thus the results of both stages of the analysis indicate that banks in countries with fewer regulatory restrictions have higher charter value, which provides incentives for banks to act prudently. Banks in countries with more regulatory restrictions have lower charter value, which fails to provide incentives to reduce risk-taking. In countries with a strong contracting environment, we also observe a diminishing effect of charter value on bank risk-taking, provided that banks are in low regulation countries, although this effect is weaker than in weak contracting environments.

That charter value does not influence bank risk-taking in countries with a high level of regulation suggests that banking stability in such countries depends on how well regulators limit banks´ opportunities to take excessive risk rather than on charter values providing private incentives for the banks themselves to act cautiously. And while more lax regulation increases banks´ opportunities to take risk, it also provides them with incentives to act cautiously by engendering higher bank charter values. The incentive to behave prudently provided by bank charter value in countries with fewer restrictions might explain the lower risk level of the banking system in these countries, described by Barth et al. (2001, 2004).

When bank charter value is not considered, the REG_{HIGH} variable is statistically significantly negative. That is, when we isolate the effect of regulatory restrictions on bank charter value and the charter value effect on risk-taking, we find that stricter banking regulation is efficient in limiting opportunities for risk-taking.

The positive coefficients of the INS_{EXP} dummy variable in the risk equation indicate that bank risk (in terms of non-performing loan ratio and bank stock price volatility) is significantly higher in countries with deposit insurance. The negative coefficients of the interaction terms INS_{EXP} x REG_{HIGH} and INS_{EXP} x LAW_{HIGH} indicate, respectively, that

the presence of higher regulatory restrictions on bank activities and the presence of a legal system with good quality and enforcement reduce the adverse effects of deposit insurance on bank risk-taking incentives. This latter result is consistent with the empirical evidence in Kane (2000), Cull et al. (2001), Demirgüc-Kunt and Detragiache (2002), or Laeven (2002), that shows deposit insurance adds to banking system fragility in countries with poor institutional environments.

To understand the overall effect of deposit insurance on risk-taking, one must remember that deposit insurance also increases charter value, which in turn reduces risk-taking incentives. When we consider both effects together, risk-taking incentives brought about by deposit insurance are dampened. According to the random effects results, deposit insurance leads to an increase of 4.42 basis points [0.242 (-18.303) + 7.643] in the non-performing loan ratio in countries with weaker regulation and a poor contracting environment. Strict regulation of banking activities in a country does not significantly reduce the risk-shifting incentives created by deposit insurance. Thus, deposit insurance in countries with a poor contracting environment and stricter regulation still causes an increase in the average ratio of non-performing loans of 5.89 basis points [4.42 + (0.242 x 13.923) - 1.899]. When we factor in the positive effect of deposit insurance on charter value together with the possibility of counteracting risk-shifting incentives through a good legal system and good enforceability of contracts, the risk increase attributable to deposit insurance is no longer statistically significant [4.42 + (0.242 x 7.044) - 7.458].

Similar results occur in the WLS estimates or when bank risk is measured by the daily standard deviation of bank stock returns. In the WLS estimations, deposit insurance in countries with good quality contracting environments even reduces bank risk in terms of the non-performing loan ratio. Results therefore suggest that an increase in charter value derived from deposit insurance, coupled with a legal system with proper rule enforcement in a country, offsets the direct detrimental impact of deposit insurance on bank risk-taking incentives.

Banks in countries of English legal origin have higher charter value than banks in countries of Scandinavian legal origin, and banks in countries of French, German, and Socialist legal origin have a higher charter value than banks in Scandinavian countries only by the WLS analysis.

Banks with a higher percentage of tangible assets have lower market values, given that TANG has a statistically significant negative coefficient in Tobin's Q equations. Bank size (SIZE) and investment in unconsolidated subsidiaries in which the bank has a business relationship (UCOIN) do not have statistically significant coefficients to explain differences in charter value. In the second stage of the analysis, the statistically

significant positive coefficients of SIZE to explain bank risk-taking are consistent with the "too-big-to-fail effect" argument that larger banks have more incentives to undertake risky investments because they always enjoy a comprehensive safety net. The percentage of bank investments in unconsolidated subsidiaries to total bank assets does not have a clear effect on bank risk-taking. In the case of WLS, it has a negative coefficient in the credit risk equation and a positive one in the overall risk equation, and the coefficients are not statistically significant in the random effects estimations. Bank debt ratio has statistically significant positive coefficients in three of the four estimations, which is consistent with the declining marginal quality of loans.

4.1.2. Controlling for simultaneity bias

The results we have described may be affected by a simultaneity bias if the regulatory variables (restrictions on banking activities and the decision to adopt deposit insurance) are endogenous to country characteristics and might be the consequence of instability in a country's banking system. To assess the extent of this problem, we apply instrumental variables to determine whether controlling for potential simultaneity bias alters the results shown in Table 5.

As the regulatory variables (REG_{HIGH} and INS_{EXP}) are dummy variables with a value of either 1 or 0, it seems counterintuitive to use lagged variables as instruments, so we estimate a probit for each variable using the instruments proposed by Barth et al. (2004) for the degree of regulation in a country as explanatory variables: religious composition dummy variables, latitudinal distance from the equator, and legal origin dummy variables. Religious composition is measured as the percentage of population in each country that is Roman Catholic, Protestant, Muslim, or "other". The Catholic dummy variable is omitted from the regressions. [9]

(Insert Table 6)

The new results obtained in the two-stage analysis using the values forecasted by the probit for the two regulatory variables ($\hat{REG}_{HIGH}$, $\hat{INS}_{EXP}$) are shown in Table 6. Polish banks were dropped from this estimation, as Poland had an unchanged regulatory

[9] Beck and Levine (2002) also use legal origin and the religious composition of countries as instrumental variables for the level and structures of financial sector development.

dummy variable of 1 throughout the 1995-1999 period, which was perfectly predicted by the SOCIALIST dummy variable.

The negative effect of regulatory restrictions on bank charter value is confirmed by the statistically significant negative coefficients of $\hat{R}EG_{HIGH}$ in Tobin's Q equations. In the second stage, we continue to observe that higher bank charter value reduces risk-taking incentives in countries with fewer regulations. Interaction term coefficients also suggest that the risk-reducing effect of charter value is lessened as regulation is strengthened and as the quality of the contracting environment in a country improves. For instance, according to the random effects analysis, a 1 percent increase in Tobin's Q leads to a 14 percent reduction in the ratio of non-performing loans and an 11 percent reduction in stock price volatility in countries with lax regulation and weak enforceability of contracts. The ratio of non-performing loans falls to 7.3 percent for banks in countries with lax regulation but high quality legal systems and enforceability of contracts.

When the $\hat{Q}_{TOBIN}$ and $\hat{Q}_{TOBIN} \times \hat{R}EG_{HIGH}$ coefficients are summed, however, we do not obtain statistically significant coefficients for either of the two measures of bank risk-taking. As in Table 5, this lack of significance indicates that the lower bank charter value suggested by the first stage in countries with strict regulation is not useful in motivating banks in these countries to behave prudently. After controlling for the effect of each variable on bank charter value, the negative coefficients of LAW_{HIGH} and $\hat{R}EG_{HIGH}$ confirm the Table 5 findings that a stronger institutional environment and a more restrictive banking industry play the useful role of reducing bank risk-taking.

The influence of deposit insurance on bank valuation and bank risk-taking when we consider the potential endogeneity of deposit insurance is different from the results shown in Table 5. In Table 6, the positive effect of $\hat{I}NS_{EXP}$ on Tobin's Q is not statistically significant. Despite no positive influence on Tobin's Q, the second stage also fails to indicate a marked increase in risk-taking associated with the presence of deposit insurance in a country. In the random effects estimations, $\hat{I}NS_{EXP}$ does not have statistically significant coefficients in the non-performing loans and stock price volatility equations. In the WLS estimations, the higher risk-taking incentives found in Table 5 for countries with deposit insurance are confirmed only by the standard deviation of daily bank stock returns, but not by the ratio of non-performing loans.

The results in both equations for the influence of country legal origin and bank balance sheet variables are basically the same as those observed in Table 5. The only difference in the influence of bank balance sheet variables is the positive coefficient of SIZE in the first stage, which indicates that larger banks also have a higher charter value.

4.2. Exogenous bank charter value

This section analyzes the potential bias caused when bank charter value is considered as an exogenous variable to explain bank risk-taking. Thus, rather than apply a two-stage procedure, only the risk equations are estimated using the observed values of Tobin's Q. In other words, bank charter value is assumed to be an exogenous variable, independent of the regulatory and institutional characteristics of the country, and results are compared with those obtained in the two-stage estimation. [10]

The model estimated is:

$$RISK_{it} = \lambda_0 + \lambda_1 \text{REG}_{\text{HIGH}it} + \lambda_2 LAW_{HIGHit} + \lambda_3 \text{Q}_{\text{TOBIN}\,it} + \lambda_4 \left(\text{Q}_{\text{TOBIN}it} \text{ x REG}_{\text{HIGH}it}\right) + \lambda_5 \left(\text{Q}_{\text{TOBIN}it} \text{ x} LAW_{HIGH}\right) + \lambda_6 \text{INS}_{\text{EXP}it} + \lambda_7 \left(\text{INS}_{\text{EXP}} \text{ x REG}_{\text{HIGH}it}\right) + \lambda_8 \left(\text{INS}_{\text{EXP}} \text{ x} LAW_{HIGH}\right) + \lambda_9 \sum \text{LEGALORIGIN}i + \lambda_{10} \text{Y}_{it} + \lambda_{11} \sum_{t=95}^{99} \text{TIME}t + \eta_i + \omega_{it} \quad [2]$$

Model [2] is estimated incorporating the potential endogeneity of the regulatory variables of the country (the degree of regulation and the presence of deposit insurance). Thus, Panel B of Table 7 shows the results obtained using the values forecasted by the probit estimations for the dummy variables of regulatory restrictions and deposit insurance in each country ($\hat{REG}_{HIGH}$, $\hat{INS}_{EXP}$). These are similar to the results in Panel A using the observed values of REG_{HIGH} and INS_{EXP}.

(Insert Table 7)

The results are clearly different from those obtained when we consider bank charter value to be endogenous. A risk-reducing effect of bank charter value is observed only for countries with lax regulation and a weaker contracting environment when the risk variable is the non-performing loan ratio according to the random effects analysis. And, at no time do we observe a risk-reducing effect of bank charter value when the risk variable is the standard deviation of daily bank stock returns or according to weighted least squares.

[10] In previous empirical evidence, both types of specification have been used independently, without any comparison of results. Galloway et al. (1997), Cebenoyan et al. (1999), and Anderson and Fraser (2000), introduce Tobin's Q as an explanatory variable of bank risk in one-stage analysis. Keeley (1990) and Gropp and Vesala (2001) consider the potential endogeneity of Tobin's Q and apply a two-stage procedure to analyze its potential influence on bank risk-taking.

The statistically significant positive coefficients of the dummy variable of high regulatory restrictions in six of the eight estimations suggest that the intensity of regulatory restrictions increases banks' risk-taking, whatever its influence on their incentives. This result also differs from the negative effect found for REG_{HIGH} or $\hat{REG}_{HIGH}$ in the two-stage procedure.

Although the results are less significant than those in Table 5, Panel A of Table 7 suggests higher bank risk in countries that have deposit insurance, as the INS_{EXP} has positive coefficients in all the estimations. The negative coefficients of the interaction terms (INS_{EXP} x REG_{HIGH}, INS_{EXP} x LAW_{HIGH}) also support the usefulness of greater regulatory restrictions and a strong contracting environment in counteracting risk-shifting incentives created by deposit insurance in a country. When we consider the potential endogeneity of deposit insurance in Panel B, its exacerbating effect on risk is less clear-cut, as the results vary according to the risk measurement applied.

These different results for the influence of Tobin's Q on bank risk-taking and for the dummy variable of regulatory restrictions indicate that the coefficients are biased when bank charter value is considered an exogenous variable that does not depend on the regulatory restrictions of the country. This should show the wisdom of applying a two-stage procedure to analyze the effect of regulatory restrictions on charter value and bank risk-taking.

4.3. Sample and regulation measure bias

Barth et al. (2001, 2004) indicate that a banking crisis is more likely in countries with stricter regulation and conclude that the relaxation of regulatory restrictions has a positive influence on the stability of a banking system. Our results are an extension that suggests a stable banking system in countries with fewer regulatory restrictions is attributable to higher bank charter values in these countries, which give banks incentives to behave prudently. Although these results are compatible, the Barth et al. (2001, 2004) results are not directly comparable to ours, as we use a bank-level database that is different from their cross-sectional country database. Furthermore, we use a different annual measure of regulatory restrictions on banking activity.

To check the robustness of our results and to ascertain the influence of these differences, we test whether we can replicate the positive relationship between regulatory restrictions and risk level described by Barth et al. (2001, 2004) using our database and our regulation measure. We estimate the relation between bank risk and regulatory restrictions without considering the charter value of banks. In these

estimations we control for bank size (SIZE), percentage of debt (DEBT), and ratio of investments in unconsolidated subsidiaries (UCOIN).

The exact estimated model is as follows:

$$RISK_{it} = \theta_0 + \theta_1 \mathrm{REG}_{\mathrm{HIGH}it} + \theta_2 \sum \mathrm{LEGALORIGIN}_i + \theta_3 \mathrm{Y}_{it} + \theta_4 \sum_{t=95}^{99} \mathrm{TIME}_t + \upsilon_i + \varsigma_t \qquad [3]$$

The results of the random effects and WLS estimations are reported in Table 8.

(Insert Table 8)

The statistically significant positive coefficients of $\mathrm{REG}_{\mathrm{HIGH}}$ in all estimations are consistent with the conclusion that regulatory restrictions have negative influence on banking system stability and coincide with the results of Barth et al. (2001, 2004). This result suggests that differences in database or in measures of regulatory restrictions are not sufficient to explain our novel results. Rather, the different effect we observe of regulatory restrictions on bank risk depends on charter value and the negative influence of regulatory restrictions on it.

The coefficients of the bank balance sheet variables in Table 8 are basically the same as those obtained in the other specifications. Larger banks and banks with higher debt ratios have higher risk. The positive influence of SIZE confirms the "too-big-to-fail" effect and the positive influence of debt ratio on bank risk-taking is consistent with the declining marginal quality of loans available to banks.

5. Conclusions

We have analyzed how regulatory restrictions affect bank charter value and risk-taking, controlling for deposit insurance, the quality of the contracting environment, and the legal origin of the country, as well as for specific bank balance sheet variables.

Tests on a sample of 251 banks in 36 countries provide evidence that weaker regulatory restrictions in a country favor higher bank charter value. Moreover, higher charter values of banks in countries with fewer regulatory restrictions are found to provide incentives for banks to reduce risk, although this effect is weakened when the country

has good-quality legal system and enforceable private contracts. The contrary result is that banks in countries with stricter regulatory restrictions have lower charter values that do not provide risk-reducing incentives.

These results are consistent with a higher probability of banking crisis that Barth et al. (2001, 2004) note in countries with more regulation. Our work extends their results, however, by suggesting that the greater banking stability in countries with less regulation has its origin in higher bank charter values, which increases the incentives for banks to behave prudently. Unlike Barth et al. (2001, 2004), we find that fewer regulatory restrictions are associated with greater bank risk-taking after isolating the effect of regulatory restrictions on bank charter value and the influence of bank charter value on risk-taking. These results point to the endogeneity of bank charter value and its dependence on regulatory characteristics, and they warn against the bias of estimations that consider bank charter value as an exogenous variable to explain bank risk-taking.

Our results also corroborate empirical findings that deposit insurance encourages banks to engage in risk-shifting, and that the quality of the contracting environment in a country reduces risk-shifting incentives created by deposit insurance. We go further to show that risk-shifting incentives arising from deposit insurance are not so high if we consider the positive effect of deposit insurance on bank charter value. In countries with less regulation and good-quality contracting environments, the risk incentives arising from deposit insurance are shown to be totally offset by the quality of the legal environment and by increases in bank charter value when we assume that regulatory restrictions and the presence of deposit insurance are exogenous to country characteristics. When we control for the possible endogeneity of the regulatory characteristics of a country, we observe neither a positive effect of deposit insurance on bank charter values nor a marked increase in risk-taking linked to deposit insurance in the country.

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Table 1
Composition of sample

This Table shows the number of banks from each country making up the sample. The total number of banks is 251 spread over 36 countries.

Argentina	4	Hong Kong	12	Portugal	2
Australia	10	India	1	Singapore	5
Austria	5	Indonesia	7	South Africa	3
Belgium	4	Ireland	3	Spain	14
Brazil	7	Italy	23	Sweden	5
Canada	8	Luxembourg	2	Switzerland	12
Chile	2	Malaysia	7	Taiwan	3
Colombia	7	Netherlands	3	Thailand	8
Denmark	4	Norway	3	Turkey	4
Finland	1	Peru	4	United States of America	47
France	4	Philippines	7	United Kingdom	9
Germany	7	Poland	2	Venezuela	2

Table 2

Index of Banking and Finance

Panel A describes the five categories of the Banking and Finance Index established by the Heritage Foundation since 1995. The scale runs from 1 to 5: A score of 1 signifies a less restrictive banking industry, while a score of 5 signifies more government intervention in banking activity. Panel B shows the correlations of the 1997 Banking and Finance Index with the indexes used by Barth et al. (2001) to measure national restriction levels in three non-traditional banking activities (SECURITIES, INSURANCE, REAL ESTATE) and the bank's ability to own and control non-financial firms (BANKOWN). RESTRICT is the average index of these four indexes used by Barth et al. (2001).

Panel A: Grading scale (Source: 2002 Index of Economic Freedom. Heritage Foundation)

Score	Restrictions on banks	Criteria
1	Very low	Government involvement in the financial sector negligible; very few restrictions on foreign financial institutions; banks may engage in all types of financial services.
2	Low	Government in the financial sector minimal; few limits on foreign banks; country may maintain some limits on financial services; domestic bank formation may face some barriers.
3	Moderate	Substantial government influence on banks; government owns or operates some banks; government control of credit; domestic bank formation may face significant barriers.
4	High	Heavy government involvement in the financial sector; banking system in transition; banks tightly controlled by government, possible corruption; domestic bank formation virtually non-existent.
5	Very high	Financial institutions in chaos; banks operate on primitive basis; most credit controlled by government and goes only to state-owned enterprises; corruption rampant.

Panel B: Correlations

	SECURITIES	INSURANCE	REAL ESTATE	BANKOWN	RESTRICT
Index of Banking and Finance (REG)	0.216***	0.402***	0.431***	-0.004	0.282***

*** Significant at 1 % level.

Table 3

Variables

This table describes the variables collected for the 36 countries included in our analysis. We present the description and the sources from which each variable is collected.

Variable	*Description*
NONPERF	Ratio of non-performing loans to total bank loans. Source: Worldscope (2001).
PRICEVOL	Standard deviation of daily bank stock returns. Source: Worldscope (2001).
TOBIN'S Q	The ratio of the market value of assets to their replacement value at the end of the most recent fiscal year. The market value of assets is proxied by the book value of assets minus the book value of equity minus deferred taxes plus the market value of common stock. The replacement value of assets is proxied by the book value of assets. Source: Worldscope (2001).
INS_{EXPL}	Dummy variable that takes a value of 1 if the country has a deposit insurance scheme and 0 otherwise. Source: Demirgüc-Kunt and Sobaci (2000).
REG	Annual Index of freedom in the banking and finance activity that ranges from 1 to 5 with a higher value indicating a more restrictive banking system. This index is available for each country since 1995. Source: Heritage Foundation (2002).
REG_{HIGH}	Dummy variable defined from the index of freedom in the banking and finance activity of each country. It takes 0 if the index of freedom in the banking activity is 1 or 2, and 1 if the index of freedom in banking activity is 3 or 4. In the sample no country has a value of 5 in the index of banking and finance. Source: Heritage Foundation (2002).
LAW & ORDER	Annual index of law and order of the International Country Risk Guide (ICRG). This ranges from 0 to 6 with a higher figure indicating a better quality and enforcement of the legal system. Source: ICRG published by the Political Risk Service Group.
LAW_{HIGH}	Dummy variable defined from the annual index of law and order in each country. It takes 0 if the index of law and order is 2, 3 or 4, and takes 1 if the index of freedom in the banking activity is 5 or 6. Source: ICRG published by the Political Risk Service Group.
LEGAL ORIGIN	Identifies the legal origin of the commercial code of each country. There are five possible origins: (1) English common law; (2) French commercial code; (3) German commercial code; (4) Scandinavian commercial code; and (5) Socialist/Communist laws. A dummy variable for each legal origin is considered. Source: La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998).
SIZE	Natural logarithm of book value of bank total assets at the end of each year. Source: Worldscope (2001)
TANG	Ratio of book value of tangible assets to total bank assets at the end of the each year. Tangibility of assets is measured as the ratio of net property, plant, and equipment to total assets. Source: Worldscope (2001).
UCOIN	Ratio of investments in unconsolidated subsidiaries to total bank assets. It represents the long-term investments and advances in unconsolidated subsidiaries and affiliates in which the bank has a business relationship or exercises control. Source: Worldscope (2001).
DEBT	Ratio of total debt to total bank assets. Source: Worldscope (2001).
YEAR DUMMY VARIABLES	A variable dummy for each year from 1995 to 1999 that controls for macroeconomic variables that affect all banks identically in a given year but that vary from year to year.

Table 4

Data

Panel A shows descriptive statistics of bank-level variables used in the empirical analysis. Panel B shows mean differences for each variable between groups of banks in countries with high and low regulatory restrictions on banking activities; between groups of banks with high and low law and order index values; between groups of banks with and without deposit insurance in the country; and between banks in civil law countries and banks in common law countries. T-statistics of mean differences are shown in parentheses.

	NONPERF	PRICEVOL	TOBIN'S Q	SIZE	TANG	UCOIN	DEBT
Panel A: Descriptive statistics							
Mean	2.342	24.377	1.920	17.880	0.020	0.010	59.641
Median	0.960	22.230	1.599	17.555	0.016	0.001	62.220
Min	0	5.340	0.083	12.560	0	0	0.07
Max	39.02	67.290	7.01	27.119	0.149	0.990	96.18
Std. Dev.	4.513	9.638	3.586	2.316	0.016	0.070	18.400
# of observations	713	838	1246	1254	1240	1155	1213
Panel B: Mean differences							
High versus low regulatory restrictions (High-Low)	3.518*** (6.19)	6.747*** (7.45)	-0.580*** (-2.38)	1.106*** (7.60)	0.008*** (7.64)	-0.006** (-2.25)	1.029 (0.81)
High versus low Law & Order index (High-Low)	-1.804*** (-4.15)	-11.950*** (-9.38)	-0.410 (-0.81)	-1.354*** (-7.29)	-0.015*** (-10.53)	-0.002 (-0.41)	-2.302* (-1.77)
Deposit versus no deposit insurance (Deposit- No deposit)	-1.999*** (-3.30)	-0.186 (-0.19)	0.359 (1.19)	-0.819*** (-4.75)	-0.002* (-1.67)	0.009*** (3.47)	-13.261*** (-11.47)
Civil vs. Common law (Civil-Common)	1.370*** (3.88)	0.973 (1.34)	-0.207 (-0.91)	0.341*** (2.57)	0.007*** (8.17)	0.013*** (3.09)	-13.744 (-13.86)

*** Significant at 1 % level. ** Significant at 5 % level. *Significant at 10% level.

Table 5. Bank regulation, charter value, and bank risk. Two-stage analysis

Results of random- effects and WLS regressions of two-stage analysis. The dependent variable of the first equation is Tobin's Q (Q_{TOBIN}), and the measures of bank risk used as dependent variables in the second equation are the ratio of non-performing loans to total loans (NONPERF) and the standard deviation of daily bank stock returns (PRICEVOL). As independent variables we include a dummy variable that takes 0 if the index of freedom in the banking activity published by the Heritage Foundation (2002) is 1 or 2, and 1 if the index of freedom in the banking activity is 3 or 4 (REG_{HIGH}); a dummy variable that takes the value of 0 if the index of law and order is 2, 3, or 4, and 1 if the index of freedom in the banking activity is 5 or 6 (LAW_{HIGH}); a dummy variable that takes the value of 1 if the country has explicit deposit insurance and 0 otherwise (INS_{EXP}); a set of four dummy variables that identify the legal origin of the commercial code of each country (ENGLISH, FRENCH, GERMAN, SOCIALIST). We omit from the analysis the dummy corresponding to Scandinavian countries. As bank variables explaining bank valuation and bank risk we include the natural logarithm of assets (SIZE), the ratio of tangible bank assets (TANG), the percentage of investments in unconsolidated subsidiaries (UCOIN), and the bank debt ratio (DEBT). As an additional explanatory variable of bank risk in the second equation we include the values of Tobin's Q forecasted by the first equation ($\hat{Q}_{TOBIN}$). Year dummy variables were included for all estimations but are not reported.

	RANDOM EFFECTS			WLS		
	First Stage	Second Stage		First Stage	Second Stage	
	TOBIN	NONPERF	PRICEVOL	TOBIN	NONPERF	PRICEVOL
INTERCEPT	0.746	14.528**	-7.853	0.715**	27.564***	19.473**
	(1.40)	(2.30)	(-1.08)	(2.05)	(5.01)	(-2.17)
REG_{HIGH}	-0.152*	-19.196***	-8.977**	-0.119*	-18.643***	-5.578
	(-1.70)	(-6.01)	(-2.49)	(-1.64)	(-5.53)	(-0.89)
LAW_{HIGH}	0.047	-3.306	2.949	-0.022	-17.699***	19.564**
	(0.41)	(-0.67)	(0.63)	(-0.24)	(-3.36)	(2.29)
$\hat{Q}_{TOBIN}$		-18.303***	-12.997***		-20.471***	-12.338**
		(-4.28)	(-2.89)		(-5.18)	(-2.36)
$\hat{Q}_{TOBIN}$ x REG_{HIGH}		13.923***	5.569***		14.905***	7.834**
		(7.96)	(2.95)		(7.64)	(2.22)
$\hat{Q}_{TOBIN}$ x LAW_{HIGH}		7.044***	0.186		15.384***	-6.208
		(2.88)	(0.08)		(5.00)	(-1.29)
INS_{EXPL}	0.242**	7.643***	8.309**	0.185*	3.047	22.975***
	(2.06)	(2.72)	(2.55)	(1.86)	(1.49)	(8.42)
INS_{EXPL} x REG_{HIGH}		-1.899	-0.649		-1.651	-5.674***
		(-1.29)	(-0.31)		(-1.08)	(-2.87)
INS_{EXPL} x LAW_{HIGH}		-7.458***	-3.292		-5.515***	-16.232***
		(-3.11)	(-1.38)		(-3.27)	(-6.68)
ENGLISH	0.807***	8.384**	15.338***	0.798***	2.480	17.259***
	(4.01)	(2.35)	(3.95)	(7.10)	(0.71)	(4.53)
FRENCH	0.301	3.757***	9.793***	0.485***	3.219	10.564***
	(1.44)	(2.59)	(4.43)	(4.64)	(1.63)	(4.51)
GERMAN	0.079	1.719	0.417	0.442***	1.295	4.524*
	(0.31)	(0.74)	(-0.16)	(3.31)	(0.47)	(1.89)
SOCIALIST	0.912	3.625		1.316***	-4.714	
	(1.26)	(0.84)		(4.21)	(-0.96)	
SIZE	0.020	0.279*	1.886***	0.18	-0.036	1.676***
	(0.86)	(1.76)	(8.48)	(1.24)	(-0.25)	(11.26)
TANG	-5.404**			-6.154***		
	(-1.77)			(-2.71)		
UCOIN	0.071	-27.908	18.148	0.046	-94.710***	25.437**
	(0.10)	(-0.80)	(1.62)	(0.13)	(-3.12)	(2.00)
DEBT		0.008	0.061***		0.031*	0.099***
		(0.49)	(4.20)		(1.81)	(5.73)
TIME DUMMIES	YES	YES	YES	YES	YES	YES
Adjusted R^2				5.67%	21.84%	48.72%
F				5.75***	10.19***	39.54***
R^2 overall	10.71%	31.27%	37.45%			
Wald χ^2	60.63***	143.51***	430.06			
LM χ^2	335.71***	58.19***	662.23***			
# observations	1107	626	731	1107	626	731
# individuals	251	163	197			

*** Significant at 1 % level. ** Significant at 5 % level. *Significant at 10% level.

Table 6. Endogenous bank regulation, charter value, and bank risk. Two-stage analysis

Results of random- effects and WLS regressions of two-stage analysis. The dependent variable of the first equation is Tobin's Q (Q_{TOBIN}), and the measures of bank risk used as dependent variables in the second equation are the ratio of non-performing loans to total loans (NONPERF) and the standard deviation of daily bank stock returns (PRICEVOL). As independent variables we include the forecasted values of a probit for the dummy of regulatory restrictions ($\hat{REG}_{HIGH}$) and for the dummy of the presence of deposit insurance ($\hat{INS}_{EXP}$) in the country. As explanatory variables of the probit we use religious composition dummy variables, latitudinal distance from the equator, and legal origin dummy variables. As other explanatory variables of Tobin's Q and bank risk-taking we use a dummy variable that takes the value of 0 if the index of law and order is 2, 3, or 4, and 1 if the index of freedom in the banking activity is 5 or 6 (LAW_{HIGH}), and a set of four dummy variables that identify the legal origin of the commercial code of each country (ENGLISH, FRENCH, GERMAN, SOCIALIST). We omit in the analysis the dummy corresponding to Scandinavian countries. As bank variables explaining bank valuation and bank risk we include the natural logarithm of assets (SIZE), the ratio of tangible bank assets (TANG), the percentage of investments in unconsolidated subsidiaries (UCOIN) and the bank debt ratio (DEBT). As additional explanatory variables of bank risk in the second equation we include the values of Tobin's Q forecasted by the first equation ($\hat{Q}_{TOBIN}$). Year dummy variables were included for all estimations but are not reported.

	RANDOM EFFECTS			WLS		
	First Stage	Second Stage		First Stage	Second Stage	
	TOBIN	NONPERF	PRICEVOL	TOBIN	NONPERF	PRICEVOL
INTERCEPT	0.499	20.919**	7.350	0.637*	44.546***	23.644*
	(0.93)	(2.09)	(0.83)	(1.82)	(4.26)	(1.81)
$\hat{REG}_{HIGH}$	-1.168***	-25.080*	-2.595	-0.563***	-47.566***	-59.043***
	(-3.25)	(-1.66)	(-0.22)	(-2.63)	(-3.03)	(-3.82)
LAW_{HIGH}	-0.050	-13.837*	-4.377	-0.077	-34.224***	-7.530
	(-0.41)	(-1.80)	(-0.74)	(-0.83)	(-4.22)	(-0.74)
$\hat{Q}_{TOBIN}$		-13.855*	-11.542*		-21.513***	-28.422***
		(-1.75)	(-1.67)		(-3.01)	(-3.87)
$\hat{Q}_{TOBIN}$ x $\hat{REG}_{HIGH}$		19.995***	13.226***		37.870***	36.665***
		(3.08)	(3.18)		(4.34)	(4.15)
$\hat{Q}_{TOBIN}$ x LAW_{HIGH}		6.555*	1.280		17.283***	0.809
		(1.92)	(0.50)		(4.18)	(0.16)
$\hat{INS}_{EXP}$	0.088	-3.287	1.932	0.097	-8.428***	6.118***
	(0.69)	(-1.25)	(0.47)	(0.92)	(-4.78)	(2.57)
$\hat{INS}_{EXP}$ x $\hat{REG}_{HIGH}$		3.679	3.748		2.221	15.797***
		(0.70)	(0.85)		(0.55)	(4.78)
$\hat{INS}_{EXP}$ x LAW_{HIGH}		3.932	2.681		9.540***	2.510
		(1.43)	(0.90)		(5.36)	(1.05)
ENGLISH	0.732***	6.471	14.792***	0.765***	1.646	25.177***
	(3.62)	(1.28)	(3.10)	(6.76)	(0.42)	(6.59)
FRENCH	0.517**	1.009	3.697	0.584***	-0.629	10.586***
	(2.35)	(0.29)	(1.04)	(5.30)	(-0.22)	(3.75)
GERMAN	0.066	3.341	-0.823	0.474***	1.789	8.476***
	(0.26)	(1.39)	(-0.36)	(3.55)	(0.59)	(3.29)
SIZE	0.057**	0.080	1.132***	0.033**	-0.303	1.381***
	(2.17)	(0.20)	(2.69)	(2.05)	(-1.43)	(6.90)
TANG	-3.430			-5.133**		
	(-1.09)			(-2.18)		
UCOIN	0.107	-32.873	14.317	0.063	-91.061***	14.901
	(0.16)	(-0.91)	(1.36)	(0.18)	(-2.99)	(1.27)
DEBT		0.009	0.036***		0.022	0.036**
		(0.54)	(2.57)		(1.31)	(2.13)
TIME DUMMIES	YES	YES	YES	YES	YES	YES
Adjusted R^2				5.91%	24.28%	56.53%
F				6.33***	12.06***	53.74***
R^2 overall	11.65%	29.92%	49.74%			
Wald χ^2	68.69***	133.93***	621.20***			
LM χ^2	334.95***	73.60***	612.25***			
# observations	1104	622	731	1104	622	731
# individuals	249	162	197			

*** Significant at 1 % level. ** Significant at 5 % level. *Significant at 10% level.

Table 7. Bank regulation, charter value, and credit risk. Regression analysis

Results of random effects and WLS regressions assuming that bank charter value is an exogenous variable not dependent on country regulatory restrictions. The measures of bank risk used as dependent variables in the second equation are the ratio of non-performing loans to total loans (NONPERF) and the standard deviation of daily bank stock returns (PRICEVOL). In panel A we assume that regulatory characteristics and the presence of deposit insurance in the countries are exogenous and use as explanatory variables the observed values of REG_{HIGH} and INS_{EXP}. In panel B we consider the potential endogeneity of these variables and substitute the observed values for the forecasted values from a probit model in which the independent variables are: religious composition dummy variables, latitudinal distance from the equator, and legal origin dummy variables. As other explanatory variables of bank risk we include the observed values of Tobin's Q (Q_{TOBIN}), the four dummy variables indicating the origin of the legal code of the country (ENGLISH, FRENCH, GERMAN, SOCIALIST), natural logarithm of total assets (SIZE), bank investments in unconsolidated subsidiaries (UCOIN), and bank debt ratio (DEBT). Year dummy variables were included for all estimations but are not reported.

	Panel A Exogenous bank regulation				Panel B Endogenous bank regulation			
	Random	Random	WLS	WLS	Random	Random	WLS	WLS
	NONPERF	PRICEVOL	NONPERF	PRICEVOL	NONPERF	PRICEVOL	NONPERF	PRICEVOL
INTERCEPT	-6.431	-19.075***	-3.455	-23.043***	-0.367	-3.716	1.181	-8.073**
	(-1.32)	(-3.36)	(-0.86)	(-5.80)	(-0.09)	(-0.60)	(0.33)	(-2.26)
REG_{HIGH}	2.554	0.392	3.802**	13.396***	9.927**	27.763***	12.247***	16.445***
	(1.59)	(0.19)	(2.32)	(6.93)	(2.06)	(5.53)	(3.33)	(4.93)
LAW_{HIGH}	2.188	3.028	5.060**	10.156***	0.167	0.532	1.545	1.708
	(0.74)	(1.25)	(2.04)	(4.14)	(0.06)	(0.18)	(0.70)	(0.88)
Q_{TOBIN}	-1.466**	0.039	-0.278	1.855***	-0.437	0.577	0.697	2.554***
	(-2.18)	(0.15)	(-0.36)	(4.13)	(-0.60)	(1.34)	(0.86)	(3.39)
Q_{TOBIN} x REG_{HIGH}	0.779**	-0.106	0.222	-2.242***	1.732**	-0.422	0.865	-1.594
	(2.39)	(-0.40)	(0.52)	(-5.04)	(2.56)	(-0.73)	(1.00)	(-1.59)
Q_{TOBIN} x LAW_{HIGH}	1.254*	-0.289	-0.049	-1.021**	0.111	-0.679*	-1.010	-2.226***
	(1.88)	(-0.98)	(-0.06)	(-2.04)	(0.17)	(-1.95)	(-1.37)	(-4.25)
INS_{EXPL}	3.000	4.716	1.642	17.999***	-2.842	1.720	-5.683***	4.067**
	(1.03)	(1.55)	(0.77)	(7.17)	(-1.22)	(0.41)	(-3.62)	(2.09)
INS_{EXPL} x REG_{HIGH}	-1.489	0.624	-1.357	-5.521***	7.242	4.004	8.068*	14.807***
	(-0.93)	(0.31)	(-0.83)	(-2.86)	(1.36)	(0.88)	(1.95)	(4.41)
INS_{EXPL} x LAW_{HIGH}	-4.445*	-2.742	-3.927**	-15.464***	1.891	1.854	5.565***	0.639
	(-1.68)	(-1.15)	(-2.08)	(-6.59)	(0.78)	(0.62)	(3.40)	(0.34)
ENGLISH	0.667	5.853***	0.573	2.298**	3.126***	8.300***	3.472***	7.972***
	(0.57)	(2.91)	(0.68)	(2.27)	(2.82)	(4.62)	(4.06)	(7.76)
FRENCH	2.024*	7.139***	3.244***	1.626*	-1.168	0.001	0.627	-0.292
	(1.77)	(3.57)	(4.09)	(1.73)	(-1.04)	(0.00)	(0.76)	(-0.33)
GERMAN	0.888	-1.611	1.083	-4.193***	4.055*	-2.469	4.545**	-2.341**
	(0.35)	(-0.62)	(0.49)	(-3.83)	(1.69)	(-1.06)	(2.15)	(-2.27)
SOCIALIST	0.718		0.818					
	(0.18)		(0.47)					
SIZE	0.252	1.683***	-0.003	1.289***	-0.130	0.643***	-0.349**	0.709***
	(1.57)	(7.93)	(-0.03)	(9.94)	(-0.83)	(2.98)	(-2.54)	(5.28)
UCOIN	-16.724	18.268	-95.301***	34.242***	-37.462	14.887	-94.322***	20.498*
	(-0.44)	(1.62)	(-2.98)	(2.75)	(-1.03)	(1.41)	(-3.08)	(1.73)
DEBT	0.046***	0.074***	0.045**	0.119***	0.020	0.039***	0.023	0.047***
	(2.59)	(5.23)	(2.85)	(7.36)	(1.19)	(2.88)	(1.51)	(2.83)
TIME DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2			13.29%	49.77%			22.29%	54.92%
F			6.01***	41.19***			10.86***	50.40***
R^2 overall	18.62%	31.94%			27.47%	49.03%		
Wald χ^2	65.61***	411.17***			129.13***	592.07***		
LM χ^2	83.06***	629.65***			89.43***	622.17***		
# observations	622	731	622	731	620	731	620	731
# individuals	164	197			163	197		

*** Significant at 1 % level . ** Significant at 5 % level. *Significant at 10% level.

Table 8. Regulation and bank risk

Results of random effects and WLS regressions. The dependent variable is bank risk, measured as the ratio of non-performing loans to total loans (NONPERF) and as the standard deviation of daily bank stock returns (PRICEVOL). In panel A we assume that regulatory characteristics in the countries are exogenous and use as explanatory variable the observed values of REG_{HIGH} . In panel B we consider the potential endogeneity of this variable and substitute the observed values of this variable for the forecasted values by a probit model in which the independent variables are: religious composition dummy variables, latitudinal distance from the equator, and legal origin dummy variables. Other explanatory variables of bank risk are four dummy variables indicating the origin of the legal code of the country (ENGLISH, FRENCH, GERMAN, SOCIALIST), natural logarithm of total assets (SIZE), percentage of bank investments in unconsolidated subsidiaries (UCOIN), and bank debt ratio (DEBT). Year dummy variables were included for all estimations but are not reported.

	Panel A				Panel B			
	Exogenous bank regulation				Endogenous bank regulation			
	Random	Random	WLS	WLS	Random	Random	WLS	WLS
	NONPERF	PRICEVOL	NONPERF	PRICEVOL	NONPERF	PRICEVOL	NONPERF	PRICEVOL
INTERCEPT	-5.202	-13.613***	1.001	-13.036***	-2.271	-0.771	2.345	-6.727**
	(-1.52)	(-2.97)	(0.36)	(-4.41)	(-0.71)	(-0.17)	(0.88)	(-2.27)
REG_{HIGH}	2.320***	0.808**	2.400***	5.154***	15.434***	25.870***	11.494***	17.545***
	(4.89)	(2.29)	(5.03)	(8.06)	(9.02)	(9.17)	(8.80)	(11.19)
ENGLISH	0.672	5.217***	0.821	1.338	2.270**	6.715***	1.551**	3.744***
	(0.59)	(2.57)	(1.19)	(1.31)	(2.13)	(3.50)	(2.32)	(3.75)
FRENCH	1.807	7.180***	2.554***	3.087***	-0.908	0.800	0.576	2.158**
	(1.60)	(3.50)	(3.73)	(3.13)	(-0.83)	(0.39)	(0.81)	(2.25)
GERMAN	0.621	-1.454	1.028	-2.996**	3.591	-2.409	3.229	-1.667
	(0.24)	(-0.54)	(0.46)	(-2.54)	(1.48)	(-0.95)	(1.50)	(-1.48)
SOCIALIST	2.062	1.992*						
	(0.57)	(1.65)						
SIZE	0.223	1.647***	-0.096	1.450***	-0.047	0.747***	-0.251*	1.089***
	(1.38)	(7.65)	(-0.72)	(10.56)	(-0.31)	(3.29)	(-1.94)	(7.76)
UCOIN	-9.228	16.036	-79.431***	35.808***	-49.363	11.724	-90.177***	26.387**
	(-0.25)	(1.42)	(-2.57)	(2.64)	(-1.39)	(1.09)	(-3.02)	(2.01)
DEBT	0.040**	0.072***	0.036**	0.155***	0.018	0.043***	0.024*	0.082***
	(2.33)	(5.21)	(2.44)	(9.43)	(1.10)	(3.20)	(1.67)	(4.65)
TIME DUMMIES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2			11.08%	39.84%			17.23%	44.12%
F			7.60***	45.06***			12.94***	53.54***
R^2 overall	16.34%	30.83%			25.47%	43.01%		
Wald χ^2	43.94***	43.94***			104.59***	502.59***		
LM χ^2	98.34***	609.19***			105.04***	746.17***		
# observations	636	733	636	733	632	733	632	733
# individuals	164	197			163	197		

*** Significant at 1 % level. ** Significant at 5 % level. *Significant at 10% level.