How Country and Safety-Net Characteristics Affect Bank Risk-Shifting*

Armen Hovakimian

Baruch College

Edward J. Kane

Boston College

Luc Laeven

World Bank

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Abstract: Risk-shifting occurs when creditors or guarantors are exposed to loss without receiving adequate compensation. This paper seeks to measure and compare how well authorities in 56 countries controlled bank risk shifting during the 1990s. Although significant risk shifting occurs on average, substantial variation exists in the effectiveness of risk control across countries. We find that the tendency for explicit deposit insurance to exacerbate risk shifting is tempered by incorporating loss-control features such as risk-sensitive premiums, coverage limits, and coinsurance. Introducing explicit deposit insurance has had adverse effects in environments that are low in political and economic freedom and high in corruption.

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* Correspondence to Professor Edward J. Kane, Boston College, Finance Department, Fulton Hall 330A, Chestnut Hill, MA 02467. Phone: (617) 552-3986; Fax: (617) 552-0431. E-mail: edward.kane@bc.edu.
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Even when its long-run effects are adverse, instituting deposit insurance can benefit short-horizoned policymakers and politicians. As long as its guarantees remain credible, explicit insurance promises to eliminate the threat of depositor runs and to protect depositors from harm with only a smidgen of its true economic cost actually registering on the official government budget.

Part of the long-run cost of deposit insurance is that it reduces incentives for depositors to monitor their banks and for banks to bond their ability to repay their depositors. In countries that have not introduced deposit insurance explicitly, insurance still exists in an implicit form. The costs and benefits society experiences from either type of guarantees depend on how effectively government regulators can control bank risk-shifting (Buser, Chen, and Kane, 1981; Brickley and James, 1988; Calomiris, 1992; Kane, 1995; Honohan and Klingebiel, 2002).

Risk-shifting occurs whenever a contractual counterparty is exposed to loss from fraud, leverage or earnings volatility without receiving adequate compensation for the risk entailed. Other things equal, a bank can shift risk onto its deposit insurer in two principal ways: by increasing its leverage and by increasing the volatility of its return on assets. Risk-shifting is subsidized whenever the value of the explicit and implicit deposit guarantees a country's banks enjoy exceeds the implicit and explicit premiums the insurer imposes on them. To avoid subsidizing bank risk taking, a deposit insurer must monitor increases in volatility and leverage and police them appropriately.

The empirical literature on bank risk-shifting begins with Marcus and Shaked (1984). Employing U.S. data and a single-equation framework, these authors use a one-year put option model to estimate a risk-adjusted "fair" value for a bank's deposit insurance premium. These authors and subsequent research by Ronn and Verma (1986) find that on average FDIC insurance was overpriced, but that the distribution of fair premiums was strongly skewed to the right. Pennacchi (1987a and b) shows that this skewness gains importance when deposit insurance is analyzed in a multiperiod context inasmuch as evidence of average underpricing emerges in long-maturity models.

Improving on these single-equation models, Duan, Moreau and Sealey (1992) separate the effects of leverage and return volatility in testing for risk shifting during 1976-1986. Using a sample of thirty large U.S. banks, they found that twenty percent showed risk-shifting behavior. Adopting this triangular two-equation framework and fitting both single-period and infinite-maturity option models of deposit-insurance value, Hovakimian and Kane (2000) examine risk-shifting in 1985-1994 for a sample of 123 U.S. banks. They find that on average capital regulation did not prevent sample banks from shifting risk. Risk-shifting proved particularly strong for poorly capitalized banks and for banks with high ratios of insured deposits to insured debt.

Laeven (2002a) fits the single-equation option model to a sample of banks in several countries. He interprets estimates of the fair (i.e., properly priced) deposit insurance premium (IPP) as a proxy for bank risk and shows that this proxy helps to forecast bank distress in different countries. Laeven (2002b) investigates how country-specific and bank-specific features contribute to the value of insurance services. The opportunity-cost value of deposit insurance services proves higher in countries with explicit deposit insurance, but its contribution to bank stock prices disappears in countries with high-quality and well-enforced legal systems.

Kane (2000) argues that the value of a country's financial safety net should respond to country-specific variation in risk control: differences in informational environments and in the enforceability of private contracts in particular. Demirgüç-Kunt and Kane (2002) contend that explicit deposit insurance generates costly subsidies in countries whose institutional environment is weak. Demirgüç-Kunt and Detragiache (2002) find cross-country evidence that, in countries with weak institutional environments, explicit deposit insurance increases the probability of banking crises.

Using Hovakimian and Kane's (2000) adaptation of the two-equation regression model introduced by Duan, Moreau, and Sealey (1992), this paper focuses on how well authorities in 56 countries controlled risk-shifting incentives in recent years. Although we find significant risk shifting on average, our method allows us to model how the effectiveness of risk control differs across countries. As hypothesized in Kane (2000), differences in the value of IPP across countries are explained by differences in deposit-insurance design features and in environmental measures of political repression, economic freedom, and government corruption. Specifically, we find that introducing explicit deposit insurance may exacerbate risk shifting, but that this effect is tempered when loss-control features such as risk-sensitive deposit insurance premiums, coverage limits, and coinsurance are incorporated into the deposit-insurance system. We also find that introducing explicit deposit insurance expands risk-shifting opportunities in environments that are low in political and economic freedom and high in corruption.

Regression results confirm that recent adopters of explicit insurance have done a particularly poor job of managing the value of their deposit guarantees.

The paper proceeds as follows. Section I details the methods used to model bank risk-shifting incentives. Section II describes the sources of our data and our sampling procedures. Section III presents and interprets estimates of risk-shifting incentives. In this section and in Section IV, the analysis focuses on how risk-shifting incentives differ when countries manage their deposit insurance system in different ways and in different contracting environments. Section V summarizes our findings.

I. Role of Alternative Deposit-Insurance Models

This section describes procedures for estimating risk-shifting opportunities at individual banks. Merton (1977, 1978) shows that, other things equal, the fair insurance premium (expressed as a percentage of deposits) increases with a bank's leverage and with the volatility of its returns. Our tests employ a linear approximation to this relation:

$$IPP = \gamma_0 + \gamma_1\sigma_V + \gamma_2(B/V) + \varepsilon_1 \quad (1)$$

In this equation, B is the face value of deposits and other debt, V is the market value of a bank's assets, σ_V is the standard deviation of asset returns, and IPP is the "fair" deposit insurance premium per dollar of deposits.

From (1), Duan, Moreau, and Sealey (1992) assess bank-risk shifting incentives by breaking out the following pair of equations:

$$B/V = \alpha_0 + \alpha_1\sigma_V + \varepsilon_2, \quad (2)$$

$$IPP = \beta_0 + \beta_1\sigma_V + \varepsilon_3. \quad (3)$$

The intuition is that of a rational-expectations game: a bank sets its leverage and asset risk, σ_V, with a clear understanding that creditors and regulators will monitor and discipline their choices. Similarly, creditors and regulators expect banks to react to the discipline they provide. Equation (2) expresses the idea that regulators and creditors constrain banks to a limited set of leverage and volatility pairs. The slope coefficients in equations (2) and (3) have the following interpretations:

$$\alpha_1 \equiv \frac{d(B/V)}{d\sigma_V}, \tag{4}$$

$$\beta_1 \equiv \frac{\partial IPP}{\partial \sigma_V} + \frac{\partial IPP}{\partial (B/V)}\alpha_1 = \gamma_1 + \gamma_2 \alpha_1. \tag{5}$$

The Merton model (1) treats the insurer's guarantee as a simple put option written on bank assets. This formulation implies that, other things equal, the value of deposit insurance increases in both σ_V and *B/V*. By themselves, the positive partial derivatives $\gamma_1 = \partial IPP/\partial \sigma_V$ and $\gamma_2 = \partial IPP/\partial (B/V)$ in the linearized model (1) tell us how much value bank stockholders might extract from the insurer by unconstrained portfolio adjustments. However, in practice, the deposit-insurance contract incorporates loss-control powers with the put that permit the insurer to monitor and constrain risk taking by insured banks.

Our tests focus on the signs rather than the magnitudes of α_1 and β_1. If effective, risk-sensitive capital requirements modify the benefits of risk-taking by introducing penalties that would create in (2) a negative relationship between *B/V* and σ_V. The first issue is whether regulatory and market discipline forces a bank to strengthen its capital position as its asset volatility increases and to cut back its volatility when its leverage increases. A negative α_1 would imply that risk-sensitive capital regulation and complementary market discipline constrain realizable deposit-insurance benefits.

Given the external discipline a bank faces, the sign of β_1 in Equation (3) indicates whether, in a particular contracting environment, increases in asset volatility can increase the value of the implicit and explicit government guarantees that are imbedded in the bank's stock price. To fully neutralize risk-shifting incentives at the margin, disciplinary penalties that induce a decline in *B/V* must be large enough to fully offset whatever increase in *IPP* would otherwise be generated by a higher σ_V. Empirically, only if the total derivative β_1 is nonpositive are risk-shifting incentives fully neutralized.

Thus, for market and regulatory pressure to consistently discipline and potentially neutralize incremental risk-shifting incentives, two conditions must be met:

Capital increases with volatility: $\alpha_1 < 0$,

Guarantee value does not rise with volatility: $\beta_1 \leq 0$.

None of the variables featured in our three equations is directly observable. However, Marcus and Shaked (1984) show how to use option-based models of deposit insurance to track these variables synthetically. Because unobservable expectations play a central role in term-structure and asset-pricing theories, running regressions on synthetic data sets is a common practice in finance. Our two-step econometric models test substantive hypotheses about asset valuation jointly with the subsidiary hypothesis that the synthetic observations are unbiased estimates of the true variables. In our experiments, one cannot rule out the possibility that measurement error and simultaneous-equation bias distort test results. Murphy and Topel (1985) show that standard errors of substantive parameters are often underestimated in two-step tests.

These considerations suggest that we should interpret t-values conservatively and subject our results to a variety of robustness tests.

The first step in the Marcus-Shaked procedure is to obtain tracking values for V and σ_V by numerical methods. These values are then used to estimate IPP as the value of a put option on bank assets. The procedure begins by solving the call-option formula for equity, E. The last step uses Îto's lemma to link σ_V to E, V and σ_E (the instantaneous standard deviation of equity returns) by means of equation (6):

$$\sigma_V = \sigma_E(E/V)/(\partial E/\partial V). \tag{6}$$

To establish whether inferences are robust to differences in how forbearance is modeled, we conducted regressions using proxies for V, σ_V, and IPP derived from three different models of deposit-insurance option value.[1]

The first model follows Merton (1977) in portraying deposit insurance as a single-period European put option on the bank's assets. This model treats bank equity as the sum of a dividend-unprotected European call option and the present value of the dividends distributed before the option's expiration date. The bank's debt is assumed to mature in one year, which is also the assumed exercise date for the insurer. The model expresses the value of a bank's equity, *E*, and the value of the fair deposit insurance premium, *IPP*, as:

$$E = V[1-(1- \delta)^T] + V(1- \delta)^T N(x_1) - BN(x_2), \tag{7}$$

$$IPP = N(-x_2) - (1- \delta)^T N(-x_1)V/B. \tag{8}$$

In (7) and (8), δ is the fraction of bank assets distributed at each interim dividend date to stockholders, T is the number of interim dividend payments, $N(x_i)$ states the probability that the variate value x is $\leq x_i$, given that x is distributed with zero mean and unit variance.[2]

Ronn and Verma (1986) adapt Merton's model to account for market conjectures that the FDIC may forbear from exercising its implicit call on the put when its claim is only slightly in the money. The RV model scales down the effective exercise price of the put by a factor of $\rho = 0.97$. Our second model employs an adaptation of the RV model devised by Hovakimian and Kane (2000):

$$E = V[1-(1-\delta)^T] + V(1-\delta)^T N(x_3) - \rho B N(x_4), \quad (9)$$

$$IPP = N(-x_4) - (1-\delta)^T N(-x_3) V/B. \quad (10)$$

The third model also appears in Hovakimian and Kane (2000). It assigns stockholder benefits from forbearance only to banks that actually experience a capital shortfall. This model suppresses the forbearance benefit $(1-\rho)BN(x_2)$ for solvent banks. The value of a bank's equity becomes:

$$E = V[1-(1-\delta)^T] + V(1-\delta)^T N(x_3) - \rho B N(x_4) - (1-\rho) B N(x_2), \quad (11)$$

$$IPP = N(-x_4) - (1-\delta)^T N(-x_3) V/B - (1-\rho) N(x_2). \quad (12)$$

These models fix ρ at either 1.0 or 0.97 for every country at every date. Although one might usefully experiment with other specifications, the policy implications of our regression tests prove relatively insensitive to this parameter.

Pennacchi (1987a and b) shows that, by counterfactually presuming prompt and complete insolvency resolution, single-period models of IPP tend to understate the economic value that government guarantees convey to bank stockholders. In exploring

[1] Hovakimian and Kane (2000) provide a detailed discussion of these models.

risk-shifting opportunities and authorities' ability to constrain them, this bias promises to increase the power of regression tests based on Merton's minimal-forbearance model.

II. Sample Selection and Data

The paper uses annual data from 1991 through 1999. Bank-level data come from two sources. Monthly stock prices and annual market values of equity are obtained from Datastream. Balance-sheet data come from Bankscope.[3] Data on incentive-modifying deposit insurance features employed in different countries come from the World Bank Survey of Prudential Regulations and Supervision of Commercial Banks and from the Demirgüç-Kunt and Sobaci (2001) database studied by Demirgüç-Kunt and Kane (2002).

Country characteristics are measured on three dimensions. Repression of political rights and civil liberties is measured by the Freedom House, which constructs a categorical repression indicator.[4] This indicator recognizes three categories: free, partly free, and not free. The second index is a measure of economic freedom compiled by the Heritage Foundation.[5] The third index reports the perceived corruption of national governments (CP) as assessed by Transparency International.[6] This index ranks countries on a scale of 1 (very corrupt) to 10 (not corrupt). The CP is based on surveys of

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[2] $x_1 = [\ln((1-\delta)^T V/B)+\sigma_V^2 T/2]/(\sigma_V\sqrt{T})$, $x_2 = x_1 - \sigma_V\sqrt{T}$, $x_3 = [\ln((1-\delta)^T V/\rho B)+\sigma_V^2 T/2]/(\sigma_V\sqrt{T})$, $x_4 = x_3 - \sigma_V\sqrt{T}$.

[3] To scale down the number of listed banks in Japan and the US, we include only long-term credit, city and trust banks in Japan and in the U.S. only multinational and superregional banks as these are defined by Goldman Sachs in its Global Banks Fact Sheet (July 2000).

[4] These data are explained at the following website: http://www.freedomhouse.org.

[5] The economic freedom index tracks the following factors: Corruption in the judiciary, customs service, and government bureaucracy; Non-tariff barriers to trade, such as import bans and quotas as well as strict labeling and licensing requirements; The fiscal burden of government, which encompasses income tax rates, corporate tax rates, and government expenditures as a percent of output; The rule of law, efficiency within the judiciary, and the ability to enforce contracts; Regulatory burdens on business, including health, safety, and environmental regulation; Restrictions on banks regarding financial services, such as selling securities and insurance; Labor market regulations, such as established work weeks and mandatory

business people, academics, and risk analysts. Because the three indices measure related aspects of a country's institutional infrastructure, pairwise correlations among the indices range between 0.54 and 0.67. Panel A of Table I summarizes the distribution of each index and selected deposit-insurance features across sample countries.

Individual-bank data were screened in two ways. First, to be included into our sample, the datasets must record at least three years of data on the input variables needed to calculate B/V, σ_V, and IPP. Second, to guard against reporting errors in the Datastream source, observations generating extreme values for these variables (specifically those below the first or above the ninety-ninth percentiles) are trimmed away. These screening criteria are satisfied for a total of 2,255 bank-year observations. The political freedom indicator is available for 2,192 observations. The economic freedom index is available for 1,533 observations. The CP is available for 1,401 observations.

Panel B in Table I summarizes sample coverage by country, year, and deposit insurance status. Our sample covers 390 banks representing 56 countries. The number of observations per country varies from four (one bank) for Russia to 309 (42 banks) for Denmark. Ten countries (299 observations) limit themselves to implicit deposit insurance during our observation period. Eight more countries (351 observations) introduce explicit deposit insurance (EI) during the period. The remaining thirty-eight countries (1605 observations) offer explicit insurance throughout the observation period.

For four salient subsamples, Table II reports the mean leverage ratio, the standard deviation of returns on assets, and the mean insurance premium per dollar of deposits

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separation pay; and Black market activities, including smuggling, piracy of intellectual property rights, and the underground provision of labor and other services.

[6] Additional details may be found at http://www.transparency.org.

calculated from the three alternative models of deposit insurance summarized in Section I. The first column reports values for observations recorded under an implicit insurance (II) regime. These estimates pool observations from countries that never introduced explicit guarantees with pre-adoption observations for countries that introduced EI during our 1991-99 observation period. Column (2) pools all observations in years spent under an EI regime.

Standard t-tests indicate that the EI subsample is characterized by significantly higher leverage but significantly lower return volatility. Although mean IPP proves lower in the EI subsample, the differences in leverage and volatility broadly offset each other, so that the difference in premiums is not statistically significant. For each subsample, the mean values of leverage and return volatility vary only slightly across the three models. However, the economic significance of the observed difference in leverage emerges clearly if the fraction reported is inverted. How forbearance is modelled proves important in that the mean IPP varies directly with the degree of forbearance assumed.

Demirgüç-Kunt and Kane (2002) argue that many of the countries that adopted deposit insurance in the 1990s lacked an appropriate institutional infrastructure and are finding it difficult to compensate for imperfections in their contracting environments. For the subset of countries that introduced EI during the observation period, columns (3) and (4) in Table II compare results experienced under implicit and explicit regimes. The explicit-regime subsample shows a significantly higher leverage ratio (9.2 vs. 8.3) and an insignificantly higher return volatility. However, fair deposit insurance premiums are significantly higher under the EI regimes than under the preceding implicit regimes. For countries introducing EI during the 1990s, not only does the leverage ratio increase from

8.6 to 11.6, but banks show an increase rather than a decrease in return volatility and a substantially (and significantly) higher mean IPP. This indicates that regulatory discipline did a poor job of replacing the bank bonding activities and depositor discipline that EI displaced.

Table III reports the mean value of the fair explicit premium for banks in each sample country under each of the models summarized in Section I. For each country, the value of government guarantees increases with the degree of forbearance assumed. Values range from less than 0.001 percent for Australia, Austria, Germany, and Luxembourg using Merton's minimal-forbearance model to a high of 2.943 percent for Russia using RV's maximal-forbearance formulation. Particularly large values are reported for countries known to have experienced a financial crisis during the observation period.

III. The Effects of Deposit Insurance on Risk-Shifting Behavior

A. Benchmark Runs

In this section, we examine the effectiveness of risk-shifting controls by expanding models (1) through (3) to include bank-specific fixed effects and particular deposit-insurance design features. Likelihood-ratio and Hausman tests support the fixed-effects specification over either a random-effects specification or a specification that dispenses with bank-specific effects. Because the Merton and Hovakimian-Kane models achieve much the same results, we report benchmark estimates for the Merton and Ronn-Verma specifications only.

Tables IV and V let us compare results for four versions of regressions (1) through (3). In each table, results for a fixed-effects benchmark model appear in the first column of Panels A, B, and C. Each panel explores a different question:

A. How valuable are unconstrained increases in leverage and volatility?

B. How strongly do capital requirements discipline volatility?

C. Do officials generate enough supervisory and regulatory pressure to offset the private bonding and depositor discipline that government guarantees displace?

Column (1) in Panel A summarizes the benefits of unconstrained risk-shifting. The significantly negative estimates for α_1 in column (1) of Panel B confirm that, on balance across the sample, regulatory capital requirements and private market pressure did generate risk-restraining discipline. Unfortunately, the significantly positive β_1 value in the first column of Panel C tells a sadder story. It implies that on average outside restraints on bank risk-taking did not fully neutralize risk-shifting incentives.

Column (2) minimally expands the fixed-effects regressions. It introduces a zero-one dummy variable to recognize the presence of explicit insurance: the "EI Dummy." In both tables, the EI dummy receives a negative sign in the Panel A regressions, indicating that on average explicit insurance did not increase risk-shifting opportunities. However, the significantly positive values found for EI as a slope-shift parameter in the Panel B (B/V) regressions imply that net external discipline weakens. We interpret this as evidence that explicit deposit insurance displaces more private policing than authorities manage to supply. In the Panel C (restrained IPP) regressions, the effect of explicit deposit insurance on risk shifting is insignificant in both Tables IV and V. Still, it is only in the minimal-forbearance Merton model (Table IV) that the coefficient on the EI dummy in the IPP regression even receives the hoped-for negative sign.

Columns (3) and (4) further expand the regressions to test the hypothesis that risk-mitigating features of deposit-insurance design also influence model coefficients. The first experiment interacts a dummy variable that is set to one if explicit premiums are risk-sensitive, and is zero otherwise. The regression experiments reported in column (4) look at two additional interactions. These experiments introduce dummy variables for the existence of coinsurance and limits on the size of insured balances.

In both the leverage and the constrained IPP regressions, coefficient estimates for the explicit insurance dummy are significantly positive, but coefficient estimates for all three interacted risk-control features prove significantly negative. This indicates that contractual controls designed to reduce bank risk-shifting incentives are at least partially successful. In Panel C, the strength of risk-shifting incentives may be calculated as the sum of the regression coefficients of included variables. The differences observed are economically significant. For example, column (4) of Panel C of Table IV indicates that a percentage-point increase in asset volatility σ_V generates a 16 basis-point increase in IPP in countries without EI and a 23 basis-point increase in countries that adopt EI but refrain from introducing any risk-mitigating design features. On average, increases in σ_V slightly <u>reduce</u> IPP in countries that adopt all three risk-mitigating features.

B. How does risk-shifting change when a country adopts explicit insurance?

The insignificance of the interacted EI Dummy in column (2) of the IPP regressions in Tables IV and V may reflect differences in economic and political maturity between countries that adopted EI years ago and those that adopted it only recently. In this subsection, we focus on the subsample of 351 observations drawn from countries that installed explicit insurance during 1991-99. The analysis seeks to assess the quality of risk control in these countries in terms of shifts in α_1 and β_1 observed in the post-adoption era.

Comparing Panel A of Table VI with the same panel of Table IV shows that unconstrained risk-shifting offers larger returns in adopting countries, while the last column shows that explicit insurance reduced IPP only in countries that set coverage limits. In the Panel B and C regressions, significantly positive coefficients emerge for the interacted variable (EI Dummy × σ_V). This result confirms that regulators in other adopting countries either deliberately sought to use EI as a way of subsidizing weak banks or found it difficult to compensate adequately for the private monitoring that EI displaced. The favorable effect of the Risk-Sensitive Premium Dummy in containing risk-shifting incentives fails to achieve significance in Table VI. However, the slope-shift estimated for the Coverage Limits Dummy remains significantly negative in all regressions.[7]

IV. How risk-shifting is affected by specific country characteristics

A. Differences in Risk-Shifting Across Environments

In countries where political and economic freedoms are low and government corruption is high, households and firms should be reluctant to entrust their deposits to opaque banks. In these circumstances, would-be depositors are apt to insist on information flows, bonding activity, and deterrent rights sufficient to price the risk exposure banks pass through to them. Kane (2000) argues that, in low freedom/high corruption countries, introducing explicit deposit insurance is apt to displace more private discipline than government regulators may reasonably be expected to generate in its stead.

Tables VII through IX test this hypothesis with data derived from the Merton model.[8] The tests investigate the extent to which coefficients of our three equations differ across subsamples of countries whose institutional environments differ in specified ways. In each table, observations have been ranked and grouped into subsamples according to the strength of a particular measure of the character of a country's financial contracting environment. Each experiment is limited to countries for which the particular measure is available. In every panel, we benchmark background risk-shifting opportunities that exist in the absence of explicit insurance, and use the EI dummy to estimate the adjustment in opportunities occurring in countries that have adopted EI.

Table VII investigates the effect of differences in political freedom using a three-way partition developed by Freedom House. Because this index is widely available, this experiment includes almost every observation studied in Tables IV and V. Panel A shows that, as freedom declines, risk-shifting opportunities increase. The leverage regressions in Panel B indicate that, as freedom declines, private discipline tends to increase and so does the extent to which this discipline is mitigated by EI. The Panel C regressions indicate that risk-shifting opportunities exist even without EI, except in the economies that show the least amount of political freedom. Again, the discipline-mitigating effect of introducing EI grows as freedom declines.

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[7] The Coinsurance Dummy could not be incorporated into these runs because no country in the recent-

Table VIII partitions the 1533 observations for which the Economic Freedom index exists. The "free" subsample includes all countries whose score on the index equaled or exceeded the median value of 2.3. Results differ sharply between the two environments. In strong (i.e., "free") contracting environments, explicit insurance strengthens rather than undermines private risk-shifting discipline. However, and as we found in Table VII, in poor contracting environments, EI expands banks' opportunities to shift risk.

Table IX examines the 1401 observations covered by the Corruption index. Kane (2000) shows that in countries for which accounting standards have been indexed, the CP correlates strongly with the informativeness of accounting records. CP may also correlate positively with a government's capacity to collect the taxes needed to make its guarantees credible. Countries are divided according to whether CP falls short of or exceeds 5, the midpoint of the index range. In both regressions, benchmark discipline is greater in more-corrupt and less-transparent environments, and explicit insurance expands risk-shifting opportunities in high-corruption environments. In low-corruption countries, while EI exerts no significant effect on leverage discipline, its presence does serve to limit the size of the fair insurance premium.

That explicit insurance arrangements control risk-shifting only in strong contracting environments accords with empirical evidence on how explicit insurance affects the probability of financial crisis as summarized in Demirgüç-Kunt and Kane (2002). Tables VII to IX support these authors' contention that governments should repair weaknesses in their contracting environments before trying to establish an explicit

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adopter subsample requires coinsurance.

deposit insurance system. The differences we observe continue to be economically significant. For example, in Panel C of Table IX, a percentage-point increase in asset volatility σ_V generates a net 16 basis-point increase in corrupt countries, but only a 10 basis-point increase in IPP in countries that are less corrupt.

B. Robustness Tests Focusing on Equations (2) and (3)

Our final experiments expand in sometimes-complicated ways the regressions reported in the previous six tables. Both to save space and to focus the robustness testing on policy implications, Table X through XIII omit parallel results for adapted versions of Equation (1).

Table X investigates whether we can incorporate deposit-insurance design features and potentially collinear country characteristics into summary regressions. In both the leverage and IPP equations, results confirm the patterns found for individual deposit-insurance features in Tables IV to VI. However, the disruptions we observe in coefficient magnitudes from specification to specification support the hypothesis that unfavorable country characteristics adversely influence deposit-insurance design.

Because the coverage of individual indices must overlap, the final catchall regressions must be run over a particularly small subsample. The catchall IPP regression implies that when we control for levels of political repression, corruption, and restrictions on economic freedom at the same time, EI strongly expands risk-shifting and coinsurance and coverage limits significantly reduce it. While economic freedom drops out of the catchall fair-premium regression, political repression promotes benchmark risk-shifting and integrity in government curtails it.

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[8] The results (not reported) are qualitatively similar when the other two models are used.

Two-step regression model with self-selection. It seems likely that the coefficient estimates found for deposit insurance design features in Tables IV and V are subject to sample-selection bias. Countries that adopt features to restrain risk-shifting behavior might have experienced less risk-shifting in any case, precisely because the overall contracting environment in these countries restrains risk shifting. As a robustness check, we re-estimate the coefficients for design features using Heckman's (1976, 1978) two-step approach to incorporate control-system self-selection. The endogenous variable in the first-stage probit model is a dummy variable that indicates whether the design feature is selected or not. We investigate three features: risk-sensitive premiums, coinsurance, and coverage limits. The results of the second-stage model are presented in Table XI. Because Heckman's method reduces the useable sample, we also report OLS estimates for the original model using the parallel subsample.[9] The coefficient for Heckman's lambda (also known as the inverse Mill's ratio) measures the covariance of the error terms from the substantive regression and the selection equation. A significant coefficient on Heckman's lambda indicates the presence of a sample-selection bias.

The results support the hypothesis of sample-selection bias, since the coefficient on Heckman's lambda is significant in all but one specification. However, taking account of selection affects only one policy implication: risk-sensitive premiums lose statistical significance in the IPP regression. However, the sample size in these runs is less than half of that employed in Table IV. Because this increases the standard error of each test, it makes it harder to reject the null.

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[9] The sample size is smaller because the first-stage probit is estimated for observations with non-missing values of the indices of political freedom, economic freedom, and corruption.

Switching Regression Model with Unknown Sample Separation. This section uses a switching regression model with unknown sample separation (Maddala, 1983) to test the hypothesis that risk-shifting incentives vary with the strength of a country's institutional environment. The switching model has three equations:[10]

$$B/V_1 = \alpha_1^0 + \alpha_1^1 \sigma_V + \varepsilon_1 , \tag{13}$$

$$B/V_2 = \alpha_2^0 + \alpha_2^1 \sigma_V + \varepsilon_2 , \tag{14}$$

$$I^* = Z\gamma + u . \tag{15}$$

Equations (13) and (14) are risk-control equations that characterize the behavior of banks in the alternate regimes. Equation (15) is a control-system selection equation. It expresses a bank's latent qualifications, I^*, to follow one or the other regime. I^* is specified to be a function of our three proxies for the quality of the institutional environment. The sign of I^* determines whether either B/V_1 or B/V_2 is observed:

$$B/V_{it} = B/V_{1it} \quad iff \ I_{it}^* < 0$$

$$B/V_{it} = B/V_{2it} \quad iff \ I_{it}^* \geq 0. \tag{16}$$

This switching regression model offers three advantages. First, it estimates differences in risk-shifting behavior endogenously, without having to specify in advance either what regime applies to each bank or the value of the sample breakpoint. Second, this model can investigate the individual and joint influence of several determinants of regime character. Because environmental characteristics jointly govern sample selection, the model incorporates more information into the process of separating risk-control regimes. Third, the model can assess the relative importance of our three proxies for institutional strength.

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[10] Three parallel equations are specified for the fair deposit insurance premiums, *IPP*.

Table XII estimates the switching model for leverage control, while Table XIII reports parallel estimates for risk shifting. Panel A reports the selection equations and Panels B and C present the alternate risk-control models. The coefficients reported in these tables are estimated by Maximum Likelihood. The likelihood function is as follows:[11]

$$L = \Phi(-Z_{it}\gamma)\phi(\varepsilon_{1it}) + [1-\Phi(-Z_{it}\gamma)]\phi(\varepsilon_{2it}), \tag{17}$$

where $\phi(.)$ is the density function and $\Phi(.)$ is the cumulative of the normal distribution.

The selection equations model institutional strength more plausibly than the catchall leverage and premium regressions presented in Table X. Every country characteristic receives the same sign in both equations. Political repression and corruption weaken the public contracting environment. Although economic repression is found to strengthen controls on bank leverage, its effect on net risk shifting is less strongly significant.

The risk-control equations confirm our previous findings. In weak contracting environments, background controls on private contracting are stronger, and introducing explicit insurance partially undermines environmental controls. In strong environments, explicit insurance improves leverage control though, on balance, the extent of risk shifting does not change significantly.

Regression Results by Geographic Region. As a final sensitivity test, we estimate the parsimonious risk-control equations featured in Tables XII and XIII for each of nine broad geographic regions. Of course, in any region where all member countries either do

[11] Shocks to leverage, B/V, and the shocks to the institutional environment are assumed to be uncorrelated. Attempts to estimate models that allow correlated errors in the risk-control and the selection equations

or do not offer explicit insurance, a slope-shift term for EI cannot be estimated. Table XIV reports the results.

Except between Eastern Europe and Latin America, leverage and risk-shifting coefficients vary significantly across all possible regional pairings. Leverage and risk-shifting control systems appear particularly strong in Australia (which has eschewed explicit insurance) and North America. Although leverage discipline is exerted on balance in every region, risk-shifting opportunities vary substantially. The coefficients for fair premiums are particularly high in Asia and Africa. Countries that have adopted explicit insurance systems in Eastern Europe, Latin America, and the Middle East have managed to restrain risk-shifting incentives, but Western European countries with explicit insurance appear to have intensified risk-shifting opportunities to some extent. However, some of the regional differences turn on some very small samples. For example, the subsample of Eastern European banks with no explicit deposit insurance consists of four observations derived from a single Russian bank. The subsample of Western European banks with no explicit deposit insurance consists of two observations of Greek banks and seven observations of Swedish banks. Therefore, the effect of explicit deposit insurance in Western Europe may be driven by strong risk-shifting constraints in Sweden.

In the fair premium regressions, the σ_v coefficient may be interpreted as a measure of the strength of implicit guarantees. On this reading, expectations of depositor bailouts are extremely high in Eastern Europe and Latin America and moderately high in Asia and Africa.

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encountered convergence problems.

V. Summary and Conclusions

Modern finance theory stresses that depositors and other creditors must mitigate incentives for opportunistic behavior by bank managers, owners, and borrowers. To bond their willingness to behave nonopportunistically, banks must convey to depositors a degree of informational transparency and an appropriate set of deterrent rights. Because individual efforts to monitor and police bank risk-taking exhibit wasteful overlaps, efficiency demands that depositor oversight be supplemented by some centralized program of monitoring and control. This centralized program must be able to establish, enforce, and dynamically readjust protocols for verification, disclosure, truth-telling, promise-making, promise-keeping, and conciliation.

In practice, risk-control protocols are imbedded in a financial safety net erected and managed by government officials. The ideal safety net is one that efficiently mitigates the particular monitoring and policing difficulties that present themselves in the contracting environment of a given country. These difficulties are apt to vary with informational, ethical, legal, and economic subcultures that govern the design and enforcement of financial contracts.

Public-choice theory recognizes that officials' incentives differ in important ways from those of private creditors. To persuade safety-net managers to make socially optimal choices, taxpayers must be able to observe and protect their stake in regulatory activities.

This paper investigates how well authorities in 56 different countries have restrained bank risk-shifting incentives in recent years. Results show that the effectiveness of private and governmental controls on bank leverage and deposit-insurance subsidies varies across contracting environments in predictable ways.

In any country, explicit deposit insurance threatens to displace more private discipline than official oversight can generate. In strong contracting environments, officials usually manage to avoid this result. Significant portions of the variation in the effectiveness of risk control are explained by differences in political climate, economic freedom, and government corruption. Regressions incorporating these environmental factors are sensitive to model specification, but results support the hypothesis that on balance explicit deposit insurance expands risk-shifting opportunities in poor contracting environments.

Our data show that discipline can be maintained and even intensified in systems that impose appropriate combinations of loss-sharing rules, risk-sensitive premiums, and coverage limits. Unfortunately, in poor contracting environments, explicit deposit insurance may generate subsidies to risky banks. Regression results confirm that recent adopters of explicit insurance have found it difficult to prevent a net decline in discipline.

Two important lessons follow. First, weaknesses in risk control can generate large fiscal and social costs under an explicit insurance regime, a truth that most recent financial crises underscore (Honohan and Klingebiel, 2002). Because the effectiveness of risk control depends on deposit insurance design and country circumstances, over long periods adopting explicit insurance can easily do more harm than good. Countries with a poor contracting environment should upgrade this environment before adopting explicit deposit insurance. Second, even in a good contracting environment, the benefits of explicit deposit insurance depend critically on safety-net design. Risk-mitigating features such as risk-based premiums, coinsurance and low coverage levels can curb bank risk-shifting. However, countries where government corruption is high and economic and political freedom is low find it difficult to adopt and enforce appropriate restraints.

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Table I

Panel A: Distribution of country-level variables

	Mean	Median	Minimum	Maximum	Obs.
Explicit Insurance Dummy	0.78	1	0	1	2255
Risk-Sensitive EI Dummy	0.21	0	0	1	1760
Coinsurance Dummy	0.15	0	0	1	1760
Coverage Limits Dummy	0.72	1	0	1	1486
Political Freedom Index	1.28	1	1	3	2192
Economic Freedom Index	2.39	2.3	1.3	4	1533
Corruption Index	6.44	6.7	1	10	1401

Panel B: Sample composition by country, year, and deposit insurance status

	Deposit insurance	Sample years				
	1 = Explicit 0 = Implicit	Date enacted	From	To	# of banks	Obs.
Argentina	1	1979	1993	1999	4	23
Australia	0	n.a.	1992	1999	9	59
Austria	1	1979	1993	1999	2	11
Bangladesh	1	1984	1992	1999	6	39
Brazil I	0	1995	1992	1994	6	7
Brazil II	1	1995	1995	1999	6	24
Canada	1	1967	1991	1999	9	57
Chile	1	1986	1994	1999	1	6
Colombia	1	1985	1992	1999	6	42
Cyprus	0	2000	1993	1999	3	18
Czech Republic	1	1994	1994	1999	4	22
Denmark	1	1988	1992	1999	42	309
Ecuador	0	1999	1994	1998	3	13
Finland	1	1969	1992	1999	1	7
France	1	1980	1991	1999	4	29
Germany	1	1966	1992	1999	5	35
Greece I	0	1993	1992	1992	2	2
Greece II	1	1993	1993	1999	4	23
Hong Kong	0	n.a.	1992	1999	10	59
Hungary	1	1993	1995	1999	2	10
India	1	1961	1992	1999	8	45
Indonesia I	0	1998	1992	1997	8	42
Indonesia II	1	1998	1999	1999	1	1
Ireland	1	1989	1992	1999	3	24
Israel	0	n.a.	1993	1999	3	18
Italy	1	1987	1992	1999	21	146
Japan	1	1971	1992	1999	16	126
Kenya	1	1985	1992	1999	3	22
Korea, Rep. of I	0	1996	1992	1995	15	52

Korea, Rep. of II	1	1996	1996	1999	16	47
Luxembourg	1	1989	1992	1999	2	16
Malaysia I	0	1998	1993	1997	9	36
Malaysia II	1	1998	1998	1999	9	16
Morocco I	0	1996	1993	1995	5	15
Morocco II	1	1996	1996	1999	5	19
Netherlands	1	1979	1992	1999	2	12
Norway	1	1961	1992	1999	11	66
Pakistan	0	n.a.	1992	1999	7	41
Peru	1	1992	1993	1999	4	21
Philippines	1	1963	1992	1999	10	64
Poland	1	1995	1995	1999	6	26
Portugal	1	1992	1992	1999	4	28
Russia	0	n.a.	1995	1998	1	4
Singapore	0	n.a.	1992	1999	6	45
South Africa	0	n.a.	1992	1999	4	29
Spain	1	1977	1992	1999	12	96
Sri Lanka	1	1987	1992	1999	3	16
Sweden I	0	1996	1992	1995	3	7
Sweden II	1	1996	1996	1999	3	12
Switzerland	1	1984	1992	1999	5	38
Taiwan	1	1985	1992	1999	15	76
Thailand I	0	1997	1991	1996	7	35
Thailand II	1	1997	1997	1999	5	13
United Kingdom	1	1982	1992	1999	8	60
United States	1	1934	1992	1999	19	133
Zimbabwe	0	n.a.	1993	1999	2	13
Total					390	2255

Notes: Countries that introduced deposit insurance during the sample period are reported twice – before and after the enactment of deposit insurance. n.a. indicates "not applicable". In Cyprus, explicit deposit insurance was introduced in March 2000, after the sample period. Although Thailand and Malaysia do not have an explicit deposit insurance fund, their governments introduced blanket guarantees in 1997 and 1998, respectively. In effect, these guarantees imply explicit deposit insurance.

Table II

Mean Leverage, Volatility, and Fair Insurance Premiums Found in Different Subsamples

The aggregate sample consists of 2,255 observations and covers risk-shifting behavior from 1991 to 1999. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. IPP is the banks' fair deposit insurance premium. σ_V is the standard deviation of the banks' asset returns.

	(1)	(2)	(3)	(4)
	All 56 Countries		Countries with a change in deposit insurance status	
	Years without Explicit Insurance	Years with Explicit Insurance	Years without Explicit Insurance	Years with Explicit Insurance
Merton model with minimal forbearance				
B/V	0.879	0.891**	0.884	0.914**
σ_V	0.049	0.039**	0.050	0.055
IPP (%)	0.180	0.127	0.211	0.617**
Ronn and Verma (1986) with forbearance				
B/V	0.903	0.915**	0.909	0.939**
σ_V	0.050	0.040**	0.052	0.056
IPP (%)	0.357	0.313	0.426	1.245**
Hovakimian and Kane (2000) with forbearance				
B/V	0.879	0.891**	0.885	0.918**
σ_V	0.050	0.040**	0.051	0.059
IPP (%)	0.264	0.211	0.325	1.029**
Sample Size	495	1760	196	155

*,** Significantly different from the value in the "Years Without Explicit Insurance" column at 5 and 1 percent, respectively.

Table III

Mean IPP Value for Each Sample Country

(Expressed as a % of Deposits)

Country	Merton model with minimal forbearance	Ronn and Verma (1986) with forbearance	Hovakimian and Kane (2000) with forbearance
Argentina	0.361	0.579	0.379
Australia	0.000	0.005	0.000
Austria	0.000	0.374	0.001
Bangladesh	0.067	0.769	0.165
Brazil	0.923	1.701	1.333
Canada	0.013	0.143	0.036
Chile	0.003	0.018	0.003
Colombia	0.039	0.107	0.056
Cyprus	0.043	0.097	0.043
Czech Republic	0.057	0.323	0.116
Denmark	0.091	0.178	0.097
Ecuador	0.062	0.176	0.070
Finland	0.010	0.109	0.015
France	0.004	0.105	0.006
Germany	0.000	0.152	0.000
Greece	0.183	0.408	0.187
Hong Kong	0.441	0.614	0.461
Hungary	0.078	0.422	0.099
India	0.192	0.603	0.305
Indonesia	0.466	0.798	0.600
Ireland	0.002	0.018	0.002
Israel	0.001	0.093	0.002
Italy	0.016	0.135	0.033
Japan	0.090	0.417	0.229
Kenya	0.708	1.018	0.843
Korea, Rep. of	0.280	0.853	0.526
Luxembourg	0.000	0.066	0.000
Malaysia	0.350	0.618	0.431
Morocco	0.002	0.042	0.002
Netherlands	0.003	0.030	0.003
Norway	0.002	0.174	0.004
Pakistan	0.078	0.403	0.172
Peru	0.350	0.670	0.436
Philippines	0.408	0.623	0.442
Poland	0.155	0.276	0.163
Portugal	0.005	0.058	0.006
Russia	1.928	2.943	2.205
Singapore	0.013	0.040	0.015
South Africa	0.054	0.211	0.059
Spain	0.051	0.073	0.052
Sri Lanka	0.112	0.358	0.130
Sweden	0.021	0.214	0.111
Switzerland	0.002	0.006	0.002

Taiwan	0.020	0.059	0.021
Thailand	0.780	1.189	0.956
United Kingdom	0.011	0.092	0.012
United States	0.002	0.009	0.002
Zimbabwe	0.536	1.157	0.803
Unweighted Sample Mean	0.139	0.323	0.222

Table IV

Evidence of Risk-Shifting Control, Using the Merton model with minimal forbearance

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premium, IPP, to the volatility of its return on assets, σ_V, and particular deposit-insurance design features. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input comes from the Merton single-period model of deposit with minimal forbearance. The sample consists of 2,255 observations covering risk-shifting behavior from 1991 to 1999. Estimates that differ significantly from zero at 5%, and 1% levels are marked *, and **, respectively.

Panel A. Unconstrained fair deposit insurance premium regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	9.600**	37.0	9.646**	37.2	9.527**	36.6	9.292**	32.2
σ_V	21.025**	57.2	22.580**	37.4	22.590**	37.6	23.238**	39.6
EI Dummy $\times\sigma_V$			-1.985*	-3.2	-1.647*	-2.7	2.658**	3.6
Risk-Sensitive Premium Dummy $\times\sigma_V$					-3.266**	-3.5	-3.622**	-3.9
Coinsurance Dummy $\times\sigma_V$							-3.510*	-2.4
Coverage Limits Dummy $\times\sigma_V$							-6.704**	-8.6
R-squared	0.727		0.728		0.730		0.759	
Sample Size	2255		2255		2255		1981	

Panel B. Leverage regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.723**	-25.9	-0.822**	-16.5	-0.806**	-16.3	-0.728**	-15.8
EI Dummy $\times\sigma_V$			0.129*	2.4	0.177**	3.3	0.477**	7.7
Risk-Sensitive Premium Dummy $\times\sigma_V$					-0.478**	-5.8	-0.597**	-7.6
Coinsurance Dummy $\times\sigma_V$							-0.692**	-5.7
Coverage Limits Dummy $\times\sigma_V$							-0.303**	-4.6
R-squared	0.774		0.775		0.779		0.792	
Sample Size	2255		2255		2255		1981	

Panel C. Constrained IPP regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	14.086**	34.0	14.651**	19.8	14.908**	20.3	16.470**	23.7
EI Dummy $\times\sigma_V$			-0.737	-0.9	0.036	0.0	7.086**	7.6
Risk-Sensitive Premium Dummy $\times\sigma_V$					-7.820**	-6.4	-9.171**	-7.8
Coinsurance Dummy $\times\sigma_V$							-9.940**	-5.5
Coverage Limits Dummy $\times\sigma_V$							-9.515**	-9.7
R-squared	0.530		0.531		0.541		0.611	
Sample Size	2255		2255		2255		1981	

Table V

Evidence of Risk-Shifting Control, Using the Adapted Ronn and Verma model with substantial forbearance

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and particular deposit-insurance design features. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input comes from the adapted RV model of deposit insurance with forbearance. The sample consists of 2,255 observations covering risk-shifting behavior from 1991 to 1999. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Unconstrained fair deposit insurance premium regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	12.640**	44.4	12.647**	44.4	12.543**	43.7	12.733**	39.8
σ_V	24.845**	59.8	25.097**	36.7	25.107**	36.8	25.987**	38.8
EI Dummy $\times\sigma_V$			-0.321	-0.5	-0.016	0.0	3.819**	4.5
Risk-Sensitive Premium Dummy $\times\sigma_V$					-2.953*	-2.8	-2.705*	-2.5
Coinsurance Dummy $\times\sigma_V$							-2.022	-1.2
Coverage Limits Dummy $\times\sigma_V$							-6.519**	-7.4
R-squared	0.769		0.769		0.770		0.792	
Sample Size	2255		2255		2255		1981	

Panel B. Leverage regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.743**	-25.8	-0.849**	-16.5	-0.833**	-16.3	-0.752**	-15.8
EI Dummy $\times\sigma_V$			0.138*	2.5	0.186**	3.3	0.492**	7.7
Risk-Sensitive Premium Dummy $\times\sigma_V$					-0.492**	-5.8	-0.613**	-7.6
Coinsurance Dummy $\times\sigma_V$							-0.705**	-5.7
Coverage Limits Dummy $\times\sigma_V$							-0.310**	-4.6
R-squared	0.774		0.775		0.779		0.791	
Sample Size	2255		2255		2255		1981	

Panel C. Constrained IPP regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	15.449**	30.3	14.360**	15.8	14.664**	16.2	16.408**	18.8
EI Dummy $\times\sigma_V$			1.420	1.4	2.321*	2.4	10.085**	8.7
Risk-Sensitive Premium Dummy $\times\sigma_V$					-9.130**	-6.1	-10.510**	-7.1
Coinsurance Dummy $\times\sigma_V$							-11.002**	-4.8
Coverage Limits Dummy $\times\sigma_V$							-10.469**	-8.5
R-squared	0.530		0.530		0.539		0.596	
Sample Size	2255		2255		2255		1981	

Table VI

Evidence of Risk-Shifting Control, generated from the minimal-forbearance Merton model for countries changing deposit insurance status during 1991-99

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and specified deposit-insurance design features: B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of 351 observations in countries that installed explicit insurance between 1991 and 1999. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Unconstrained fair deposit insurance premium regressions.

	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	13.703**	19.3	12.297**	16.2
σ_V	32.592**	24.0	32.069**	24.1
EI Dummy $\times\sigma_V$	-4.856**	-3.9	-1.549	-1.1
Risk-Sensitive Premium Dummy $\times\sigma_V$			8.866	0.8
Coverage Limits Dummy $\times\sigma_V$			-7.748**	-4.5
R-squared	0.844		0.854	
Sample Size	351		351	

Panel B. Leverage regressions.

	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.776**	-7.5	-0.712**	-7.6
EI Dummy $\times\sigma_V$	0.452**	4.6	0.798**	8.0
Risk-Sensitive Premium Dummy $\times\sigma_V$			-0.547	-0.6
Coverage Limits Dummy $\times\sigma_V$			-0.964**	-7.9
R-squared	0.624		0.692	
Sample Size	351		351	

Panel C. Constrained IPP regressions.

	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	21.961**	11.7	23.309**	13.9
EI Dummy $\times\sigma_V$	1.341	0.7	8.264**	4.6
Risk-Sensitive Premium Dummy $\times\sigma_V$			-2.143	0.1
Coverage Limits Dummy $\times\sigma_V$			-19.605**	-9.0
R-squared	0.643		0.722	
Sample Size	351		351	

Table VII

Differences in Risk-Shifting Control Across Environments Marked by Differences in Political Freedom, using Merton Model with Minimal Forbearance

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premium, IPP, to the volatility of return on assets, σ_V. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input come from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of 2,192 observations covering risk-shifting behavior from 1991 to 1999. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively. In each panel, the last row reports the p-value of the F-test that the coefficients in the subsample regressions are the same.

Panel A. Unconstrained fair deposit insurance premium regressions.

	Free		Partly Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	7.645**	26.3	7.762**	16.3	17.797**	6.1
σ_V	11.969**	11.5	16.329**	13.6	31.070**	3.5
EI Dummy $\times\sigma_V$	4.805**	4.8	3.723**	3.5	-3.649**	-0.4
R-squared	0.812		0.811		0.731	
Sample Size	1639		502		51	
F-test (p-value)	0.00					

Panel B. Leverage regressions.

	Free		Partly Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-1.258**	-13.9	-1.317**	-12.1	-1.847**	-4.7
EI Dummy $\times\sigma_V$	0.417**	4.5	0.640**	5.9	1.650**	3.8
R-squared	0.850		0.759		0.677	
Sample Size	1639		502		51	
F-test (p-value)	0.00					

Panel C. Constrained IPP regressions.

	Free		Partly Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	2.355*	2.0	6.104**	4.6	-1.806	-0.2
EI Dummy $\times\sigma_V$	7.992**	6.5	8.690**	6.6	25.710*	2.3
R-squared	0.717		0.681		0.458	
Sample Size	1639		502		51	
F-test (p-value)	0.00					

Table VIII

Evidence of Risk-Shifting Control Across Environments Marked by Differences in Economic Freedom, using Merton's Minimal-Forbearance Model

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premium, IPP, to the volatility of its return on assets, σ_V. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of 1,533 observations covering risk-shifting behavior from 1995 to 1999. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively. In each panel, the last row reports the p-value of the F-test that the coefficients in the subsample regressions are the same.

Panel A. Unconstrained fair deposit insurance premium regressions.

	Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	6.718**	15.2	9.316**	19.0
σ_V	20.986**	29.8	14.768**	10.2
EI Dummy $\times\sigma_V$	-6.013**	-6.0	4.791**	3.6
R-squared	0.765		0.754	
Sample Size	820		713	
F-test (p-value)	0.00			

Panel B. Leverage regressions.

	Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.229**	-3.6	-1.354**	-12.0
EI Dummy $\times\sigma_V$	-0.838**	-9.8	0.760**	6.8
R-squared	0.899		0.783	
Sample Size	820		713	
F-test (p-value)	0.00			

Panel C. Constrained IPP regressions.

	Free		Not Free	
	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	19.451**	23.7	2.151	1.3
EI Dummy $\times\sigma_V$	-11.646**	-10.6	11.869**	7.2
R-squared	0.675		0.589	
Sample Size	820		713	
F-test (p-value)	0.00			

Table IX

Evidence of Risk-Shifting Control Across Environments that Differ in Corruption

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premium, IPP, to the volatility of its return on assets, σ_V. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of 1,401 observations covering risk-shifting behavior from 1995 to 1999. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively. In each panel, the last row reports the p-value of the F-test of the hypothesis that the coefficients are the same across each pair of subsamples.

Panel A. Unconstrained fair deposit insurance premium regressions.

	Less Corrupt		More Corrupt	
	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	6.089**	19.4	11.140**	17.4
σ_V	19.574**	34.7	17.914**	6.2
EI Dummy $\times\sigma_V$	-6.889**	-10.6	5.965*	2.3
R-squared	0.795		0.807	
Sample Size	915		486	
F-test (p-value)	0.00			

Panel B. Leverage regressions.

	Less Corrupt		More Corrupt	
	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.479**	-7.3	-2.138**	-9.9
EI Dummy $\times\sigma_V$	0.061	0.8	1.468**	7.0
R-squared	0.870		0.788	
Sample Size	915		486	
F-test (p-value)	0.00			

Panel C. Constrained IPP regressions.

	Less Corrupt		More Corrupt	
	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	16.656**	24.7	-5.906*	-1.7
EI Dummy $\times\sigma_V$	-6.517**	-8.1	22.319**	6.6
R-squared	0.682		0.630	
Sample Size	915		486	
F-test (p-value)	0.00			

Table X

Evidence of Risk-Shifting Control Incorporating Deposit-Insurance Design Features and Country Characteristics

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and specified deposit-insurance design features: B is the face value of the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. Higher values of political freedom index correspond to less freedom. Higher values of economic freedom index correspond to less freedom. Higher values of corruption index correspond to less corruption. The sample consists of observations in countries for which the included country indices exist. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Leverage regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-1.056**	-12.6	-0.229	-1.8	-0.852**	-6.9	-1.464**	-3.5
EI $\times\sigma_V$	0.646**	10.2	0.624**	9.0	0.606**	7.6	1.175**	12.3
Risk-Sensitive Premium Dummy $\times\sigma_V$	-0.564**	-7.4	-0.507**	-5.6	-0.524**	-4.9	-0.417**	-4.1
Coinsurance Dummy $\times\sigma_V$	-0.650**	-5.5	-0.556**	-4.7	-0.544**	-4.4	-0.521**	-4.4
Coverage Limits Dummy $\times\sigma_V$	-0.252**	-3.9	-0.444**	-6.2	-0.657**	-8.4	-0.263*	-2.5
Political Freedom Index $\times\sigma_V$	0.064	1.4					0.164	1.8
Economic Freedom Index $\times\sigma_V$			-0.218**	-4.0			-0.059	-0.6
Corruption Index $\times\sigma_V$					0.039*	2.4	-0.030	-1.2
R-squared	0.800		0.857		0.847		0.866	
Sample Size	1918		1332		1193		1092	

Panel B. Fair deposit insurance premium regressions.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	9.913**	7.6	14.963**	8.8	24.141**	16.6	1.084	0.2
EI $\times\sigma_V$	8.525**	8.7	10.860**	11.5	6.582**	7.0	16.712**	16.6
Risk-Sensitive Premium Dummy $\times\sigma_V$	-8.565**	-7.3	-6.620**	-5.4	-4.093**	-3.3	-1.512	-1.4
Coinsurance Dummy $\times\sigma_V$	-8.706**	-4.8	-6.198**	-3.9	-4.380**	-3.0	-3.182**	-2.6
Coverage Limits Dummy $\times\sigma_V$	-8.604**	-8.7	-13.544**	-14.0	-15.759**	-17.2	-8.228**	-7.4
Political Freedom Index $\times\sigma_V$	2.948**	4.2					7.140**	7.6
Economic Freedom Index $\times\sigma_V$			-0.680	-0.9			-0.001	0.0
Corruption Index $\times\sigma_V$					-1.180**	-6.2	-1.735**	-6.6
R-squared	0.592		0.702		0.770		0.808	
Sample Size	1918		1332		1193		1092	

Table XI

Evidence of Risk-Shifting Control, generated from the minimal-forbearance Merton model allowing for self-selection

Fixed-effects regressions using Heckman's (1976, 1978) two-step method relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and particular deposit-insurance design features. B is the face value of a bank's debt, including deposits. V is the market value of a bank's assets. The dependent variable of the first-stage Probit model is a dummy variable that indicates whether the design feature is selected or not. As design features we consider risk-sensitive premiums (column 1), coinsurance (column 2), and coverage limits (column 3). Regression input for the second-stage regression comes from the minimal-forbearance Merton model of deposit insurance. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Leverage regressions

	Risk-Sensitive Premia				Coinsurance				Coverage limit			
	Self-selection		OLS		Self-selection		OLS		Self-selection		OLS	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.708**	-18.5	-0.710**	-18.4	-0.652**	-16.9	-0.670**	-17.4	-0.255**	-3.7	-0.245**	-3.6
Risk-Sensitive Premium Dummy $\times\sigma_V$	-0.192	-1.3	-0.205	-1.5								
Coinsurance Dummy $\times\sigma_V$					-0.426**	-3.9	-0.421**	-3.9				
Coverage Limits Dummy $\times\sigma_V$									-0.506**	-5.8	-0.539**	-6.2
Lambda	-0.012**	-4.9			-0.007**	-3.4			0.539*	-2.4		
R-squared			0.295				0.300				0.267	
Sample Size	928		928		975		975		541		541	

Panel B. Constrained IPP regressions

	Risk-Sensitive Premia				Coinsurance				Coverage limit			
	Self-selection		OLS		Self-selection		OLS		Self-selection		OLS	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	12.645**	20.6	12.633**	20.5	13.455**	21.8	13.175**	21.5	25.736**	23.8	25.818**	23.9
Risk-Sensitive Premium Dummy $\times\sigma_V$	-2.074	-0.8	-5.144*	-2.4								
Coinsurance Dummy $\times\sigma_V$					-6.656**	-3.8	-6.581**	-3.8				
Coverage Limits Dummy $\times\sigma_V$									-18.495**	-13.3	-18.767**	-13.6
Lambda	-0.094*	-2.3			-0.105**	-3.2			-0.044	-1.3		
R-squared			0.316				0.327				0.533	
Sample Size	928		928		975		975		541		541	

Table XII

Switching Regression Model of Leverage Control with Sample Selection Based on Country Characteristics

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and specified deposit-insurance design features: B is the face value of the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of observations in countries for which the included country indices exist. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Weak institutional environment selection equation.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Intercept	4.126**	7.0	-1.671**	-8.7	-1.077**	-4.0	1.300**	7.7
Political freedom Index	0.695**	4.3	1.088**	7.3				
Economic freedom Index	-1.176**	-7.5			0.329**	3.1		
Corruption Index	-0.365**	-9.5					-0.241**	-9.5
Observations	1280		1280		1280		1280	

Panel B. Risk-shifting when the institutional environment is weak.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-1.746**	-14.0	-1.674**	-12.7	-1.722**	-13.2	-1.747**	-13.6
$EI\times\sigma_V$	1.234**	10.6	1.272**	10.2	1.325**	10.7	1.291**	10.7
Observations	1280		1280		1280		1280	

Panel C. Risk-shifting when the institutional environment is strong.

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-1.451**	-14.8	-1.418**	-11.2	-1.463**	-19.4	-1.440**	-18.6
$EI\times\sigma_V$	-0.282**	-2.9	-0.334**	-2.6	-0.300**	-3.9	-0.317**	-4.1
Observations	1280		1280		1280		1280	

Table XIII

Switching Regression Model of Fair Deposit Insurance Premiums with Sample Selection Based on Country Characteristics

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and specified deposit-insurance design features: B is the face value of the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. The sample consists of observations in countries for which the included country indices exist. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A: Weak institutional environment selection equation

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Intercept	1.418**	3.5	-1.657**	-16.0	-2.371**	-13.4	1.680**	15.8
Political freedom Index	0.594**	6.8	1.202**	15.4				
Economic freedom Index	-0.247*	-2.2			0.922**	12.5		
Corruption Index	-0.281**	-10.6					-0.299**	-17.4
Observations	1280		1280		1280		1280	

Panel B: Risk-shifting when the institutional environment is weak

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-0.673	-0.7	-0.655	-0.6	-0.655	-0.6	-0.676	-0.7
$EI\times\sigma_V$	10.322**	11.0	10.324**	10.9	10.320**	10.9	10.320**	11.0
Observations	1280		1280		1280		1280	

Panel C: Risk-shifting when the institutional environment is strong

	(1)		(2)		(3)		(4)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	0.056*	2.1	0.049	1.6	0.050	1.9	0.053*	2.1
$EI\times\sigma_V$	0.032	1.2	0.041	1.3	0.040	1.5	0.034	1.4
Observations	1280		1280		1280		1280	

Table XIV

Evidence of Risk-Shifting Control Across Regions

Fixed-effects regressions relating a bank's leverage, B/V, and fair deposit insurance premiums, IPP, to the volatility of its return on assets, σ_V, and specified deposit-insurance design features: B is the face value of the market value of a bank's assets. Regression input comes from Merton's single-period model of deposit insurance with minimal forbearance. Higher values of political freedom index correspond to less freedom. Higher values of economic freedom index correspond to less freedom. Higher values of corruption index correspond to less corruption. The sample consists of observations in countries for which the included country indices exist. Estimates that differ significantly from zero at 5% and 1% levels are marked *, and **, respectively.

Panel A. Unconstrained fair deposit insurance premium regressions.

	Western Europe		Eastern Europe		North America		Latin America		Middle East		Africa		South Asia		East Asia		Australia	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Leverage	6.916	18.5	3.721	8.1	0.452	3.8	10.434	11.4	0.027	1.0	17.622	7.0	4.094	5.8	9.280	20.0	0.005	3.6
σ_V	10.952	9.9	23.348	21.3	1.216	4.4	34.462	23.4	0.533	9.0	21.782	3.7	14.218	13.4	21.436	21.9	0.021	4.3
EI $\times\sigma_V$	3.264	3.0	-14.176	-11.7			-17.894	-9.8	-0.262	-4.3	4.485	0.7			4.067	4.1		
R-squared	0.691		0.970		0.359		0.861		0.723		0.717		0.738		0.797		0.416	
Sample Size	939		62		190		177		52		64		100		612		59	

Panel B. Leverage regressions.

	Western Europe		Eastern Europe		North America		Latin America		Middle East		Africa		South Asia		East Asia		Australia	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	-1.045**	-10.7	-0.418	-1.2	-2.069**	-24.9	-0.481**	-3.7	-0.704*	-2.1	-0.676*	-2.2	-0.854**	-6.3	-0.843**	-9.9	-3.190**	-10.2
EI $\times\sigma_V$	0.231*	2.3	-0.780*	-2.1			-0.533**	-3.3	-1.533**	-5.9	0.512	1.5			0.551	6.0		
R-squared	0.859		0.843		0.955		0.759		0.886		0.699		0.856		0.666		0.803	
Sample Size	939		62		190		177		52		64		100		612		59	

Panel C. Constrained IPP regressions.

	Western Europe		Eastern Europe		North America		Latin America		Middle East		Africa		South Asia		East Asia		Australia	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
σ_V	3.724**	3.0	21.794**	13.1	0.281*	2.2	29.449**	15.2	0.515**	9.1	9.876	1.3	10.723**	10.4	13.617**	11.4	0.006*	2.1
EI $\times\sigma_V$	4.864**	3.8	-17.078**	-9.6			-23.455**	-9.6	-0.303**	-6.7	13.505	1.5			9.176**	7.1		
R-squared	0.558		0.928		0.302		0.733		0.716		0.450		0.630		0.639		0.256	
Sample Size	939		62		190		177		52		64		100		612		59	