NBER WORKING PAPER SERIES

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Working Paper 15141
http://www.nber.org/papers/w15141

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2009

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NBER Working Paper No. 15141
July 2009
JEL No. F4,G0

ABSTRACT

Data show that better creditor protection is correlated across countries with lower average stock market volatility. Moreover, countries with better creditor protection seem to have suffered lower decline in their stock market indexes during the current financial crisis. To explain this regularity, we use a Tobin q model of investment and show that stronger creditor protection increases the expected level and lowers the variance of stock prices in the presence of credit crunches. There are two main channels through which creditor protection enhances the performance of the stock market: (1) The credit-constrained stock price increases with better protection of creditors; (2) The probability of a credit crunch leading to a binding credit constraint falls with strong protection of creditors. These mechanisms are consistent with the patterns observed in the cross-country data. We find that except for OECD countries with low creditor protection, stock market return is negative in the crisis years and positive in non-crisis years.

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1 Introduction

A central problem in the credit market is that lenders are reluctant to make loans because they cannot easily determine whether a prospective borrower has resources to repay the loan. If the loan is made, the lender is concerned whether the borrower will engage in risky behavior that could lower the probability that the loan will be repaid. Collateral reduces this information asymmetry problem because good collateral (that is, assets that are easily valued and easy to take control of) significantly decreases the losses to the lender if the borrower defaults on the loan. Good collateral also reduces the moral hazard problem because the borrower is reluctant to engage in excessively risky behavior since now he or she has something to lose. Creditor protection enhances the ability of the lender to take control of the collateral in case of default and thereby alleviate credit constraints. Thus, creditor rights regulation helps mitigate the problems of information asymmetry and moral hazard between creditors and borrowers. This mechanism is the focus of our paper.

Recent literature on law and finance has emphasized the role of strong institutions, such as those that enhance creditor protection, in fostering the development of financial markets. Accordingly, creditor rights' protection affects the credit cycle, and credit market breadth. For example, La Porta et al. (1997) find that countries with poor creditor protection have smaller debt markets. Their findings are confirmed by Levine (2004) as well as Djankov, McLiesh, and Shleifer (2006), with broader country coverage. Burger and Warnock (2006) also find that countries with stronger creditor rights have more developed local bond markets, and their economies rely less on foreign–currency bonds. Furthermore, Galindo and Micco (2005) find that strong creditor rights can reduce the volatility of the credit market. Creditor protection also lowers a firm's borrowing costs and increases the firm's value (e.g., La Porta et al. (2000) and Bae and Goyal (2003)); and it also reduces cash–flow risk, operating income variability, and operating leverage (e.g., Claessens, Djankov, and Nenova (2001)). This literature focuses mainly on the credit market itself, but not on the effect of creditor protection on the stock market.

In this paper, we attempt to fill a gap in the literature by addressing the issue of how the protection of creditor rights affect the level and volatility of stock prices.[1] We develop a Tobin q model of stock prices, and show the mechanism through which creditor protection may affect the level and the volatility of stock prices. Our analysis is motivated by the empirical regularity that better creditor protection is associated with lower stock price volatility and that countries with better creditor protection suffered lower declines in their stock market indexes during current financial crisis. We also find broad empirical support for the mechanisms suggested by our model.

The remainder of the paper proceeds as follows. Section 2 contains a discussion of an empirical regularity. Section 3 develops the benchmark model of investment and stock prices in friction–free and in credit–constrained regimes. Section 4 analyzes the model in the presence of liquidity shocks and presents the main findings of the analysis. Section 5 demonstrates that these findings are consistent with the data. Section 6 concludes.

2 Empirical Regularity

In this section we present an empirical regularity which serves to motivate the analysis in the following sections.

As a proxy for creditor protection we use the creditor rights index (CRI) compiled by Djankov et al. (2007). This is a panel that covers 129 countries for 1978-2007. The creditor rights index is constructed in the same was as in La Porta, et al. (1998). It ranges from 0 to 4 with a higher number associated with better protection for creditors. The index is formed by adding one for each of the following four institutions: when the country imposes restrictions, such as requiring a firm to obtain creditor consent or pay minimum dividends to file for reorganization; when secured

[1] Some studies have examined how corporate control affects the dispersion of stock prices within a market. For example, Morck, Yeung, and Yu (2000) look at the stock price co-movement within a country. They find that co-movement is more pronounced in poor economies than in rich economies, which they contribute to cross-country differences in property rights. Our work is not concerned with the idiosyncratic dispersion of stock prices, but rather with the instability in the aggregate.

Table 1: Average change in the stock market index in 2008

CRI	Mean	Median	N. countries
0	-38.9	-36.0	4
1	-48.5	-50.4	14
2	-52.3	-51.5	15
3	-44.3	-47.3	13
4	-39.0	-37.4	3

Note: change in the stock market index from close on the last trading day in 2007 to the close on the last trading day in 2008.

creditors are able to gain possession of their security as soon as the reorganization petition has been approved (with no automatic stay); when secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm; and when the debtor does not retain the administration of its property pending the resolution of the reorganization. Appendix Table 1 shows 49 countries in our sample that fall into different categories of the creditor rights index in 2007.

Our first piece of motivating evidence comes from the current financial crisis. As Table 1 shows, with the exception of the four countries with credit rights index of 0, countries with better creditor protection experienced on average a lower decline in their stock price index in 2008. In particular, high levels of creditor protection, 3 or 4, are associated with lower decline in the stock market during the current crisis.

Looking further back in history, we can see that better creditor protection is associated with lower stock index volatility. Table 2 presents such evidence for the full sample as well as for the subsamples of OECD and non–OECD countries. We combine levels of creditor rights index of 0, 1 and 2 into an indicator of low level of creditor rights protection and level of creditor rights index of 3 and 4 into an indicator of high level of creditor rights protection. We then test for statistical significance of the difference in stock market volatility depending on the level of creditor protection.

To measure stock price volatility, we use stock market indexes from Global Financial Data. We use monthly data calculated by central banks, national statistical agencies, or stock exchanges themselves as of the end–of–month closes. We scale down all stock market indexes by the local CPI at the end of the month. To measure the stock return volatility (σ), we compute non–overlapping standard deviations for the monthly stock returns for each calendar year.

Top panel of Table 2 is based on the panel evidence for our 49 countries for years 1980-2007.[2] It shows strong evidence that in countries and years with high index of creditor rights stock market volatility is lower than in countries and years with low index of creditor rights. One possible concern with this evidence is that creditor rights index, while available for a panel of countries, does not change much over time, thus exaggerating significance levels of the t-tests. Thus, the bottom panel of Table 2 presents cross–country evidence with stock market volatility computed over the sample period as long as the data are available between 1980 and 2007. Here we define an indicator of high level of creditor protection as average CRI for a given country being higher than 2.5. We classify countries that joined OECD half–way through our sample period as non-OECD. We still find that stock market volatility is substantially higher in countries with low level of creditor protection, although for the OECD subsample the significance level of the difference is only 14.7%, not surprising, given small sample size.

Thus, we find that stock market volatility, historically, is higher in the countries with lower level of creditor protection. Moreover, we find that countries with higher creditor protection level suffered lower declines in their stock market indexes during current financial crisis. We now turn to the model that provides an explanation for this empirical regularity.

[2] We exclude 2008 in order not to capture the effect of the current crisis.

Table 2: Stock market volatiility and creditor protection

	Full sample	Non-OECD	OECD
Volatility of monthly stock returns			
Mean Low CRI	8.149	10.15	6.627
(N.obs)	(793)	(343)	(450)
Mean High CRI	6.705	7.588	5.869
(N.obs)	(471)	(229)	(242)
Difference	-1.445***	-2.558***	-0.758***
(P-value)	(0.000)	(0.000)	(0.003)
Volatility of annual stock returns			
Mean Low CRI	39.52	50.05	32.09
(N.obs)	(29)	(12)	(17)
Mean High CRI	29.81	33.14	26.81
(N.obs)	(19)	(9)	(10)
Difference	-9.719***	-16.92***	-5.286
(P-value)	(0.004)	(0.0006)	(0.147)

***significant at 1%

3 A Tobin q Model of Stock Prices

This section derives the analytical expression for the stock price by using the standard Tobin q model. We consider two regimes: a frictionless credit regime, and a credit constrained regime.

3.1 The Friction-Free Regime

Consider a small open economy facing a fixed world interest rate r. The production function of a single tradable goods is Cobb-Douglas:[3]

$$Y_t = A_t K_t^{1-\rho}, \tag{1}$$

where A_t, $1-\rho$, and K_t denote respectively the productivity shock parameter, the distributive share of capital, and the stock of capital. The productivity shock follows a first-order auto-regressive stochastic process:

$$\ln(A_{t+1}) = \gamma \ln(A_t) + \varepsilon_{t+1}, \tag{2}$$

where ε_{t+1} has a uniform distribution over $[-1, 1]$.

The cost-of-adjustment investment technology for gross investment (Z_t) is quadratic:

$$Z_t = I_t \left(1 + \frac{1}{2}\frac{1}{v}\frac{I_t}{K_t}\right), \tag{3}$$

where $I_t = K_{t+1} - K_t$ denotes net capital formation and $\frac{1}{v}$ is the cost-of-adjustment coefficient (depreciation rate is assumed to be equal to zero). As usual, gross investment exceeds net capital formation because of some additional reorganization and retraining costs associated with the installation of new capital.

Producers maximize the expected value of the discounted sum of profits subject to the available production technology and cost-of-adjustment investment technology. The Lagrangian of the

[3] For a similar model of stock prices, see Krugman (1998) and Frenkel and Razin (1996, Chapter 7).

optimization problem is:

$$L_t = E_t \left[\Sigma_{s=1}^{\infty} \frac{1}{(1+r)^s} \left(A_t K_{t+s}^{1-\rho} - Z_{t+s} + Q_{t+s} \left(K_{t+s} + I_{t+s} - K_{t+s+1} \right) \right) \right]. \tag{4}$$

The Lagrangian multiplier, Q_t, is interpreted as the marginal Tobin Q.

The first-order condition, derived from the maximization of the Lagrangian with respect to I_t, is given by:

$$1 + \frac{1}{v} \frac{I_t}{K_t} = Q_t. \tag{5}$$

The first-order condition, associated with the derivative of the Lagrangian with respect to K_{t+1}, is given by:

$$Q_t = \frac{1}{1+r} \left(E_t \left[R_{t+1} \right] + \frac{1}{2} \frac{1}{v} \left(\frac{I_{t+1}}{K_{t+1}} \right)^2 + E_t \left[Q_{t+1} \right] \right), \tag{6}$$

where R_{t+1} denotes period $t+1$ capital rental rate.

Competitive factor markets imply that

$$R_{t+1} = (1-\rho) A_{t+1} K_{t+1}^{-\rho}. \tag{7}$$

The investment rule in equation (6) states that the cost of investing an additional unit of capital in the current period must equal to the expected present value of the next period marginal productivity of capital, plus the next period decline in adjustment costs (resulting from the next period enlargement of the stock of capital due to present period investment), plus the continuation marginal value of units of capital which will remain in the future.

Let $\tilde{L}_t$ be the maximized value of L_t. The stock price is defined as

$$P_t = \frac{\tilde{L}_t}{K_{t+1}} \tag{8}$$

With a quadratic cost-of-adjustment function, the stock price, P_t, is equal to the marginal Tobin

q, Q_t. That is, $P_t = Q_t$.[4]

The deterministic steady state is given by

$$\bar{A} = 1,\ \ \bar{K} = \left(\frac{1-\rho}{r}\right)^{1/\rho},\ \text{and}\ \bar{Q} = \bar{P} = 1. \tag{9}$$

Log-linearizing the set of equations (5) and (7) around the deterministic steady state yields an approximated expression for Q_t, as follows[5].

$$P_t = Q_t = \frac{(1-\rho)\left(1+\rho\ln\bar{K}+\gamma a_t+\rho\left(v-k_t\right)\right)\bar{K}+E_t\left[Q_{t+1}\right]}{\left(1+r+v\rho\left(1-\rho\right)\bar{K}\right)}\ , \tag{10}$$

where $a_t = \ln\left(A_t\right)$ and $k_t = \ln\left(K_t\right)$.

The equilibrium level of P_t is a linear combination of the state variables, a_t and k_t, as follows:

$$P_t = B_0 + B_1 a_t + B_2 k_t. \tag{11}$$

Substituting equations (11) into equation (10), we solve for B_0, B_1, and B_2 by comparing coefficients for a_t and k_t:

$$\begin{aligned} B_0 &= \frac{(1-\rho)\left(1+v\rho+\rho\ln\bar{K}\right)\bar{K}-vB_2}{r+v\rho(1-\rho)\bar{K}-vB_2} \\ B_1 &= \frac{\gamma(1-\rho)\bar{K}}{1+r-\gamma-vB_2+v(1-\rho)\rho\bar{K}} \\ B_2 &= \frac{\left(Kv\rho-Kv\rho^2+r\right)-\sqrt{(Kv\rho-Kv\rho^2+r)^2+4v(K\rho-K\rho^2)}}{2v} \end{aligned} \tag{12}$$

Based on equations (5) and (12), the non credit-constrained equilibrium investment level is given by:

$$I_{t0} = vK_t\left(B_0 + B_1 a_t + B_2 k_t - 1\right). \tag{13}$$

Equation (13) implies that the non-credit-constrained investment increases if productivity rises

[4] See Hayashi (1982) for the equality between average Q (the price) and the marginal Q.

[5] See Appendix 1.

(that is, $B_1 > 0$) ; and that the investment falls if the stock of capital increases (that is, $B_2 > 0$), as expected.

3.2 The Credit-Constrained Regime

We assume that the collateral required by the creditors in the credit market is a fraction, ω, of the existing capital stock, K_t, minus liquidation expenses induced by the liquidity shock, W_t.[6]That is, the credit constraint is given by:

$$I_t \le \omega K_t - W_t, \tag{14}$$

The fraction ω is the creditor protection parameter (that is, better credit protection is associated with a larger ω).[7] The collateral insures the lender from any default on the firm's debt.

For simplicity, we assume that the aggregate liquidity shock, W_t, is permanent. We also assume that after the realization of W_t, no future shocks are anticipated. That is, upon the realization in period t of the liquidity shock, W_t, the investment constraint is a binding constraint in all present and future periods: $t, t+1, ..., \infty$. Thus, we assume that

$$I_s = \omega K_s - W_s \text{ for all } s \ge t. \tag{15}$$

3.2.1 Derivation of the credit-constrained stock price

The maximum value of the firm at the end of period t, L_t, is given by:

$$\hat{L}_t = \max E_t \left[\Sigma_{s=1}^{\infty} \frac{1}{(1+r)^s} \left(A_{t+s} K_{t+s}^{1-\rho} - Z_{t+s} \right) \right]. \tag{16}$$

[6]See the related literature of Bernanke and Gertler (1989), Hart and Moore (1994), Kiyotaki and Moore (1997), and Mendoza (2006a,b).

[7]In the literature on credit constraint and financial accelerator, the constraint tends to be based on a firm's market value $\omega q_t K_t$. However, if both q_t and K_t are endogenous as in Mendoza (2006b), then no tractable solution is available for q_t. By using ωK_t rather than $\omega q_t K_t$, we are able to provide tractable closed-form solutions for q_t and its volatility.

The ex-dividend stock price P_t, at the end of period t, is:

$$\begin{aligned} P_t &= \frac{\hat{L}_t}{K_{t+1}} \\ &= \frac{1}{1+r} E_t \left(A_{t+1} K_{t+1}^{-\rho} - \frac{Z_{t+1}}{K_{t+1}} + \frac{K_{t+2}}{(1+r) K_{t+1}} P_{t+1} \right). \end{aligned} \tag{17}$$

Because the credit constraint is binding, we also have

$$K_{t+s+1} = (1+\omega) K_{t+s} - W_t, \text{ for all } s = 0, 1, 2, ... \tag{18}$$

Using equations (16), (17) and (18), we write the stock price equation (expressed as a difference equation) as follows:[8]

$$\hat{P}_t = \frac{1}{1+r} E_t \left(A_{t+1} K_{t+1}^{-\rho} - \omega \left(1 + \frac{\omega}{2v}\right) + \frac{1+\omega}{1+r} \hat{P}_{t+1} \right). \tag{19}$$

Log-linearizing equation (19) around the deterministic steady state (see equation (9)), we get:

$$\hat{P}_t = \frac{1}{1+r} E_t \left(\bar{K} \left(1 + \rho \ln \left(\bar{K}\right) + a_{t+1} - \rho k_{t+1}\right) - \omega \left(1 + \frac{\omega}{2v}\right) + \frac{1+\omega}{1+r} \hat{P}_{t+1} \right). \tag{20}$$

We can now solve for the stock price $\hat{P}_t$, by "guessing" the linear equilibrium relationship between $\hat{P}_t$ and the state variables, a_t and k_t:

$$\hat{P}_t = C_0 + C_1 a_t + C_2 k_t. \tag{21}$$

The "guess" is verified by the substitution of equation (21) into (20), to get:

[8] To simplify the exposition, we assume that the realized value of W_t (which triggers the credit constraint to be binding) is equal to zero.

$$
\begin{aligned}
C_0 &= \tfrac{(1+r)\left(\bar{K}\left(\rho\ln\bar{K}-\rho\ln(\omega+1)+1\right)-\omega\left(\frac{1}{2v}\omega+1\right)-\bar{K}\rho(\ln(\omega+1))\frac{\omega+1}{r^2+2r-\omega}\right)}{r^2+2r-\omega} \\
C_1 &= \tfrac{\gamma(1+r)\bar{K}}{1-\gamma-\gamma\omega+2r+r^2} \\
C_2 &= -\tfrac{\rho(1+r)\bar{K}}{r^2+2r-\omega}.
\end{aligned} \tag{22}
$$

4 Effects of the Liquidity Crises and Creditor Protection

We can now use the above results to derive the relationship between creditor protection and stock price level and volatility in the presence of credit constraints and liquidity crises.

4.1 The Effect of Liquidity Crises on the Stock Price

We are now in a position to derive the expression for the expected returns in the stock market as a function of the probability of the credit crunch. Let U_t be a dummy indicator for the credit-constrained binding regime. That is, $U_t = 1$ when the credit constraint binds and $U_t = 0$ when the credit constraint does not bind. The expected value of the stock price is:

$$
E\left[P_t; a_t, k_t, \omega\right] = \Pr\left(U_t = 0\right) P_{t,unconstrained} + \Pr\left(U_t = 1\right)\ \ P_{t,constrained} \tag{23}
$$

The probability of a credit crunch, $\Pr\left(U_t = 1\right)$, is given by

$$
\Pr\left(U_t = 1\right) = \Pr\left(I_{t0} > \omega K_t - W_t\right). \tag{24}
$$

Note that

$$
\begin{aligned}
\frac{\partial E\left[P_t; a_t, k_t, \omega\right]}{\partial \omega} &= \frac{\partial \Pr\left(U_t = 0\right)}{\partial \omega}\left[P_{t,unconstrained} - \ \ P_{t,constrained}\right] \\
&\quad + \frac{\partial (P_{t,constrained})}{\partial \omega}\left(1 - \Pr\left(U_t = 0\right)\right).
\end{aligned} \tag{25}
$$

We can now state the following proposition:

Proposition 1: If the creditor protection becomes stronger, the expected stock price rises through two channels: (1) The probability of credit crunches diminishes; (2) The market value of the firm rises in the credit-constrained regime.

The proposition is proved by noting that:

i)

$$\frac{\partial \Pr(U_t = 0)}{\partial \omega} > 0,$$

because the expression $\Pr(I_{t0} > \omega K_t - W_t)$ depends negatively on ω.

ii) Lifting the constraint must raise the value function if the credit constraint binds. Therefore,

$$\frac{\partial(P_{t,constrained})}{\partial \omega} > 0.$$

iii) In general, the value function in the constrained regime cannot exceed the value function in the unconstrained regime. This implies that

$$P_{t,unconstrained} - P_{t,constrained} > 0.$$

4.2 The Effect of Liquidity Crises on Variance of the Stock Returns

By the variance decomposition rule, we have:

$$Var[P_t] = E[Var[P_t|U_t]] + Var[E[P_t|U_t]], \tag{26}$$

where $Var[P_t]$ is variance of P_t.

The first term on the right hand side of equation (26) is given by:

$$
\begin{aligned}
& E\left[Var\left[P_t|U_t\right]\right] && (27)\\
= \; & \Pr\left(U_t=0\right) Var\left[P_{t,unconstrained}|U_t=0\right] + \Pr\left(U_t=1\right) Var\left[P_{t,constrained}|U_t=1\right].
\end{aligned}
$$

Combining equations (11) and (21), we get:

$$
E\left[Var\left[P_t|U_t\right]\right] = \left(\Pr\left(U_t=0\right) B_1^2 + \Pr\left(U_t=1\right) C_1^2\right) Var\left[\varepsilon_t\right]. \tag{28}
$$

and

$$
Var\left[E\left[P_t|U_t\right]\right] = \Pr\left(U_t=1\right)\left(1-\Pr\left(U_t=1\right)\right)\left(P_{t,unconstrained}-P_{t,constrained}\right)^2, \tag{29}
$$

where $Var\left[\varepsilon_t\right]$ denotes the variance of the productivity shock.

The effect of ω on $Var\left[P_t\right]$ is, however, not easily tractable in the presence of productivity shocks. To focus on the effect of liquidity shocks, it is useful to shut off the productivity shock(i.e., $Var\left[\varepsilon_t\right]=0$). In this case,

$$
\begin{aligned}
Var\left[P_t\right] &= Var\left[E\left[P_t|U_t\right]\right]\\
&= \Pr\left(U_t=1\right)\left(1-\Pr\left(U_t=1\right)\right)\left(P_{t,unconstrained}-P_{t,constrained}\right)^2. && (30)
\end{aligned}
$$

The effect of ω on the variance is:

$$
\begin{aligned}
\frac{\partial Var\left[P_t\right]}{\partial \omega} &= \left(1-2\Pr\left(U_t=1\right)\right)\left(P_{t,unconstrained}-P_{t,constrained}\right)^2 \frac{\partial \Pr\left(U_t=1\right)}{\partial \omega}\\
&\quad + \Pr\left(U_t=1\right)\left(1-\Pr\left(U_t=1\right)\right)\frac{\partial\left(P_{t,unconstrained}-P_{t,constrained}\right)^2}{\partial \omega}. && (31)
\end{aligned}
$$

From the preceding subsection, we recall that

$$\frac{\partial \Pr\left(U_t = 1\right)}{\partial \omega} < 0. \tag{32}$$

Also, as shown above, we have:

$$\frac{\partial \left(P_{t,unconstrained} - P_{t,constrained}\right)^2}{\partial \omega} < 0 \tag{33}$$

Therefore,[9]

$$\frac{\partial Var\left[q_t\right]}{\partial \omega} < 0. \tag{34}$$

This result is stated as a proposition.

Proposition 2: If the creditor protection becomes stronger, the variance of stock returns declines through two channels: (1) The difference between the stock prices in the constrained regime and the unconstrained regime decreases with better protection of creditors; and (2) The probability of credit crunches declines with stronger protection.

We turn now to confront the main predictions of the model, in Propositions 1 and 2, with cross–country data. Specifically, we look for the presence of the mechanism we uncovered theoretically in the data.

5 Empirical support

Our model explains the empirical regularity presented in Section 2, higher stock market volatility in countries with lower level of creditor protection. Our explanation relies on a specific mechanism which we will now confront with the data. In particular, the model predicts that the volatility is

[9] If $Var\left[\varepsilon_t\right]$ is not equal to 0, then we can see that as ω rises, C_1 will increase, and hence the volatility of P_t will also increase in reaction to a shock to the technology, a_t. That is, when the constraint always binds, weak creditor protection will reduce the stock price volatility. The intuition is that a binding credit constraint would reduce the upside potential of good productivity shocks by constraining the firm growth.

generated by the crises and that creditor rights protection lowers volatility by lowering the frequency of the crises and by lowering the magnitude of stock market decline during crises.

First piece of evidence presented in Section 2, the fact that countries with higher level of creditor protection experienced less of a decline in the stock market index during the current financial crisis is indeed consistent with the predictions of our model. We want to make sure, however, that there is also historical evidence to support mechanisms described in our model. In particular, our model predicts that (1) the incidence of financial crises should be lower in countries with better creditor protection and that (2) the decline in the stock market index during crises should be lower in countries with better creditor protection.

We define a liquidity crisis as a sharp decline in bank credit to the private sector. We define observations in the top 10 percent tail of annual changes in the underlying variable as crises, listed in Appendix Table 2. This corresponds to the annual decline of credit to the private sector by 10 percent.[10] Thus, our liquidity crisis variable measures domestic liquidity crises and proxies for periods when credit constraints are likely to be binding.[11] By construction, the frequency of crises in the full sample is 10 percent.

Table 3 shows the relationship between the frequency of liquidity crises, as defined above and the level of creditor rights protection. The top panel shows average incidence of crisis years in a panel data, while bottom panel shows average share of years spent in crisis in the cross–country data set. First note that, as we would expect, the frequency of crisis is higher in non–OECD countries. More importantly, consistent with our model predictions, we find that countries with higher level of creditor rights protection are less likely to experience liquidity crises, even within the subsamples of OECD and non–OECD countries. These differences in the frequency of liquidity crises are statistically significant, with the exception of the cross–country OECD sample. Thus,

[10] We obtain the data on interest rates from IMF International Financial Statistics. We use line 22d for the bank credit to private sector and divide it by the CPI index. We then calculate annual percentage changes in this variable to identify liquidity crisis episodes.

[11] Note that because we are interested not only in the on–set of the crisis, but in the crisis *situation*, we keep our indicator to be equal to 1 in all the years that our procedure determines as crises, and not only in the first crisis year.

Table 3: Frequency of liquidity crises and creditor protection

	Full sample	Non-OECD	OECD
Incidence of liquidity crises			
Mean Low CRI	0.133	0.203	0.0706
(N.obs)	(799)	(374)	(425)
Mean High CRI	0.0578	0.0823	0.0339
(N.obs)	(467)	(231)	(236)
Difference	-0.0748***	-0.121***	-0.0367**
(P-value)	(0.000)	(0.000)	(0.0328)
Share of crisis years			
Mean Low CRI	0.137	0.197	0.0977
(N.obs)	(28)	(11)	(17)
Mean High CRI	0.0733	0.0961	0.0505
(N.obs)	(20)	(10)	(10)
Difference	-0.0634*	-0.101**	-0.0472
(P-value)	(0.0546)	(0.0232)	(0.328)

* significant at 10%; ** significant at 5%; ***significant at 1%

Table 4: Decline in stock market return during crises and creditor protection

	Full sample		Non-OECD		OECD	
	Low CRI	High CRI	Low CRI	High CRI	Low CRI	High CRI
Mean annual stock market return						
Crisis years	-0.197	-1.002	-0.756	-0.977	0.785	-1.050
(N.obs)	(80)	(26)	(51)	(17)	(29)	(9)
Non-crisis years	0.686	0.513	0.916	0.477	0.535	0.545
(N.obs)	(650)	(423)	(258)	(203)	(392)	(220)
Difference	0.884*	1.515*	1.672**	1.454	-0.250	1.596**
(P-value)	(0.0943)	(0.0502)	(0.0220)	(0.210)	(0.741)	(0.0138)

* significant at 10%; ** significant at 5%

the data support first of the two main predictions of the model.

Tables 4 and 5 show the relationship between the decline in stock market return during crisis years compared to the stock market return in non–crisis years. Table 4 simply presents average stock market return in crisis and non–crisis years, and the difference between these returns for countries with high and low levels of creditor protection.[12] We can see that in all subsamples, except for OECD countries with low creditor protection, stock market return is negative in the crisis years and positive in non–crisis years. For the full sample and for the non–OECD countries with low level of creditor protection, the difference between stock return in crisis and non–crisis years is statistically significant. However, only for the subsample of non–OECD countries do we observe a larger decline in the stock market index for countries with low level of creditor rights protection. Thus, the evidence in support of the second mechanism predicted by the model is limited.

Table 5 shows the "excess return" during crisis years, which is defined as a difference between median, or average, returns in crisis and non–crisis years for each country. We can see that in all

[12] Because our crisis indicator is a lagging variable and the stock market return is a leading variable, we lag our crisis indicator by one year. We do not test the significance of a difference in decline between countries with high and low creditor rights protection.

Table 5: Excess return in crisis years and creditor protection

	Full sample	Non-OECD	OECD
Difference in median returns (crisis — non-crisis)			
Mean Low CRI	-0.556	-0.626	-0.511
(N.obs)	(28)	(11)	(17)
Mean High CRI	-0.327	-0.201	-0.453
(N.obs)	(20)	(10)	(10)
Difference	0.229	0.425	0.0579
(P-value)	(0.116)	(0.190)	(0.658)
Difference in average returns (crisis — non-crisis)			
Mean Low CRI	-0.770	-1.073	-0.573
(N.obs)	(28)	(11)	(17)
Mean High CRI	-0.638	-0.535	-0.740
(N.obs)	(20)	(10)	(10)
Difference	0.132	0.539	-0.167
(P-value)	(0.615)	(0.275)	(0.610)

cases but one (OECD subsample with average returns difference), the decline in stock market return is larger during crisis for countries with lower creditor rights protection, which is exactly what our model would predict. Due to small samples, the difference are not statistically significant, although in some cases P-values are rather low. Thus, once again, we find that the data are consistent with the second mechanism predicted by our model, but that the evidence is not very strong.

Overall then, we definitely cannot reject the possibility that the relationship between historic stock market volatility or decline in stock market indexes during current crises and the level of creditor rights protection works in the way described by our model. Moreover, of the two main testable implications of the model, we find strong support for one (the frequency of crises) and weak support for another (change in stock market returns during crises). Thus, we are confident that our theory has empirical relevance.

6 Conclusion

In this paper we examine the connection between creditor protection, response to stock prices to liquidity crises, and the volatility of stock returns. Tobin q model of stock prices predicts that the strengthening of the creditor protection results in higher expected returns and reduced volatility. We find broad empirical support for both the prediction of the model and the mechanism through which creditor protection affects stock market returns.

Our paper thus demonstrates the importance of creditor protection for the development of a well–functioning stock market: strong creditor rights not only enhances stock market values, it also reduces the volatility of the stock returns.

Finally, there are other mechanisms through which creditor protection may affect the level and volatility of stock market prices. For instance, Hale, Razin, and Tong (2006) analyze the moral hazard channel.

References

[1] Alizadeh, Sassan, Michael Brandt and Francis Diebold, (2001) "Range–Based Estimation of Stochastic Volatility Models," Journal of Finance, 57, 1047-1092.

[2] Arellano, Manuel and Stephen Bond (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," Review of Economic Studies, vol. 58(2), pages 277-97.

[3] Bae, Kee-Hong and Vidhan Goyal, (2003) "Property Rights Protection and Bank Loan Pricing," Queen's University Working Paper.

[4] Bernanke, Ben and Mark Gertler (1989) "Agency costs, net worth, and business fluctuations," American Economic Review 79, 14-31.

[5] Burger, John and Francis Warnock (2006) "Foreign participation in local-currency bond markets," forthcoming, Review of Financial Economics.

[6] Calvo, Guillermo A., Izquierdo, Alejandro and Ernesto Talvi (2006) "Phoenix Miracles in Emerging Markets: Recovering without Credit from Systemic Financial Crises," NBER Working Paper 12101, March.

[7] Claessens, Stijn, Simeon Djankov and Tatiana Nenova (2001) "Corporate Risk around the World," in Reuven Glick, Ramon Moreno and Mark Spiegel (eds.) "Financial Crises in Emerging Markets," Cambridge University Press, pages 305-338.

[8] Djankov, Simeon, Caralee McLiesh, and Andrei Shleifer (2006) "Private Credit in 129 Countries," Journal of Financial Economics, 84(2), 299-329.

[9] Edwards, Sebastian (2006) "Capital Account Openness and Crises," Presented at SCCIE-JIMF Conference.

[10] Fama, Eugene (1991) “Efficient Capital Markets: II,” Journal of Finance 46(5), 1575-1617.

[11] Frenkel, Jacob and Assaf Razin (1996) ”Fiscal Policies and Growth in the World Economy,” with the cooperation of Chi-Wa Yuen, MIT Press.

[12] Galindo, Arturo, and Alejandro Micco (2005) “Creditor Protection and Credit Volatility?” Inter-American Development Bank Working Paper #528.

[13] Hale, Galina, Assaf Razin, and Hui Tong (2006), “Institutional Weakness and Stock Price Volatility,” NBER Working Paper 12127.

[14] Hart, Oliver, and John Moore (1994) ”A theory of debt based on the inalienability of human capital,” Quarterly Journal of Economics 109, 841-879.

[15] Hayashi, Fumio (1982), ”Tobin’s Marginal q and Average q: A Neoclassical Interpretation,” Econometrica 50, 213-24.

[16] Heckman, James (1978) ”Dummy Endogenous Variables in a Simultaneous Equation System,” Econometrica 46(4), 931-59.

[17] Kiyotaki, Nobuhiro, and John Moore (1997) ”Credit cycles,” Journal of Political Economy 105, 211-248.

[18] Krugman, Paul (1998) ”Bubble, Boom, Crash: Theoretical notes on Asia’s crisis,” MIT Mimeo.

[19] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1997) “Legal Determinants of External Finance,” Journal of Finance 52 (3): 1131–50.

[20] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (1998) ”Law and finance,” Journal of Political Economy 106, 1113-1155.

[21] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert Vishny (2000) “Investor Protection and Corporate Governance,” Journal of Financial Economics 58 (1-2): 3–27.

[22] Levine, Ross (2004) “Finance and Growth: Theory, Evidence, and Mechanisms,” In P. Aghion and S. Durlauf, eds. Handbook of Economic Growth. Amsterdam: North-Holland Elsevier Publishers.

[23] Livdan, Dmitry, Horacio Sapriza and Lu Zhang (2005), “Financially Constrained Stock Returns”, NBER Working Paper 12555.

[24] Mendoza, Enrique (2006a) ”Sudden Stops in a Business Cycle Model with Credit Constraints: A Fisherian Deflation of Tobin’s q,” University of Maryland Working Paper.

[25] Mendoza, Enrique (2006b) ”Lessons from the Debt Deflation Theory of Sudden Stops,” American Economic Review, May 2006.

[26] Morck, Randall, Bernard Yeung, and Wayne Yu (2000) ”The Information Content of Stock Markets: Why do Emerging Markets have synchronous stock price movements?” Journal of Financial Economics 58, 215-260.

[27] Razin, Assaf and Yona Rubinstein (2006) ”Evaluating Currency Regimes in the Presence of Sudden Stops,” Economic Policy, January.

7 Appendix I. Derivation of Stock Price Under Friction-Free Regime

The first-order condition, derived from the maximization of the Lagrangian with respect to I_t, is given by

$$1 + \frac{1}{\upsilon}\frac{I_t}{K_t} = Q_t. \tag{A1}$$

Linearizing $\ln(1 + \upsilon(Q_t - 1))$ at the steady state $\bar{Q} = 1$ yields:

$$k_{t+1} = k_t + \upsilon(Q_t - 1). \tag{A2}$$

Linearizing R_{t+1} at the steady state, $\bar{A}$ and $\bar{K}$, gives:

$$R_{t+1} = (1-\rho)\bar{K}\left(1 + a_{t+1} - \rho k_{t+1} + \rho \ln \bar{K}\right). \tag{A3}$$

Also,

$$\frac{1}{\upsilon}\left(\frac{I_{t+1}}{K_{t+1}}\right)^2 = \upsilon(Q_{t+1} - 1)^2, \tag{A4}$$

hence

$$Q_t = \frac{1}{1+r}E_t\left(\left((1-\rho)\bar{K}\left(1 + a_{t+1} - \rho k_{t+1} + \rho \ln \bar{K}\right)\right) + \frac{1}{2}\upsilon(Q_{t+1} - 1)^2 + Q_{t+1}\right), \tag{A5}$$

Around the steady state, $(Q_{t+1} - 1)^2$ is an order of magnitude smaller than the term $(Q_{t+1} - 1)$. Accordingly, we drop $(Q_{t+1} - 1)^2$ from the approximation equation (A5), and get:

$$(1+r)Q_t = (1-\rho)\bar{K}\left(1 + a_{t+1} - \rho k_{t+1} + \rho \ln \bar{K}\right) + E_t[Q_{t+1}]. \tag{A6}$$

Note that

$$a_{t+1} = \gamma a_t + \varepsilon_{t+1}. \tag{A7}$$

Combining equations (A2), (A5), and (A7), we get

$$Q_t = \frac{(1-\rho)\left(1 + \rho \ln \bar{K} + \gamma a_t + \rho\,(v - k_t)\right)\bar{K} + E_t\left[Q_{t+1}\right]}{\left(1 + r + v\rho\,(1-\rho)\,\bar{K}\right)} \tag{A8}$$

Appendix 2. Additional tables

Table A1. Creditor rights index as of 2007

Low creditor rights index	High creditor rights index
Creditor rights index = 0	Creditor rights index = 3
Mexico	Singapore
Colombia	Austria
France	Venezuela
Peru	Malaysia
	Germany
Creditor rights index = 1	Korea
Greece	Denmark
Ireland	Slovenia
Portugal	Israel
Brazil	Australia
Canada	South Africa
Argentina	Netherlands
Pakistan	Czech Republic
Poland	
Philippines	Creditor rights index = 4
Hungary	United Kingdom
United States	Hong Kong
Switzerland	New Zealand
Sweden	
Finland	
Creditor rights index = 2	
Italy	
Sri Lanka	
Norway	
Russia	
Romania	
Indonesia	
Chile	
Turkey	
China	
Thailand	
India	
Spain	
Japan	
Bulgaria	
Belgium	

Table A2. List of liquidity crises in the sample

Country	Years of financial crisis
Non-OECD countries:	
Argentina	1983-85, 1990-1991, 2001-2003
Brazil	1985-1987, 1990, 1994-1995, 1999
Bulgaria	1992-1995, 1997
Chile	1983, 1985-1986, 1991
China	1994
Colombia	1988, 1991, 1999-2000
Hong Kong	1991, 1999
Hungary	1988, 1991-1993, 1995
Indonesia	1998-1999
Israel	1981, 1985-1986
Malaysia	1987, 1990, 2000
Mexico	1982-1983, 1988
Pakistan	2000
Peru	1984-1987, 1989, 1991, 2000, 2003-2004, 2006
Philippines	1984-1986, 1998-1999, 2001, 2005
Poland	1982-1984, 1987-1990, 1992, 1994-1995
Romania	1991, 1997, 1999-2000
Singapore	2002, 2004
Slovenia	1992
South Africa	2002
Sri Lanka	1984, 1991
Thailand	1999-2001
Venezuela	1984, 1989-1990, 1993-1994, 2002-2003
OECD countries:	
Canada	2007
Czech Republic	1998-2002
Denmark	1991, 1993-1994
Finland	1993-1995, 1997
Japan	2001
Mexico	1995-1996, 1998-2001, 2003
Norway	1991
Portugal	1985-1987
Spain	1984
Sweden	1991, 1993-1995
Turkey	1988, 1994, 1998, 2001