The Macroeconomic Impact of Legal Uncertainties

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Abstract
In the light of the recent financial crisis, many regulatory measures have been introduced or implemented as a response to laxest rules being implemented before the crisis. However one of the main questions is whether more regulatory apparatuses are needed or whether the quality of regulation should increase. I tried answering this question through the lens of a macro-finance framework, which also takes into account the passive observed behavior of spread, slow recovery both in output and credit and procyclicality of leverage, as observed facts during the financial crisis. I argue that the low quality of regulation and the possibility of legal negotiation over financial misconducts, create an environment in which the value of intermediaries finds a co-movement with their misdeeds. Within such an environment, an adverse financial shock of the same magnitude and volatility could generate different recoveries in output and credit. Regulators should increase the quality of regulation to dampen the impact of the adverse financial shock. More regulation and weakly implementing them may not address the co-movement problem adequately.

Keywords: Financial regulation and negotiation, quality of regulation, asymmetrical information, slow recovery

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1 Introduction

In the light of the recent financial crisis, many regulatory measures have been introduced or implemented as a response to laxest rules being practised before the crisis. However one of the main questions is whether more regulatory apparatuses are needed or whether the quality of regulation should increase? I tried investigating this question through the lens of a macro-finance framework arguing that since there are some deficiencies associated with new regulations, they could create exit strategies for the intermediaries. This concept will be elaborated further.

By deficiency, here I mean regulatory entities may overlook some of the intermediaries’ behaviors, since they do not have the necessary resources or even the incentives in some occasions to monitor the activities of intermediaries. One very good example for lack of incentives is the “Voluntary Regulation of 2004”, which SEC proposed a system of voluntary monitoring under the Consolidated Supervised Entities programs, allowing investment banks to hold less capital to increase leverage. With this deal, brokerage firms would voluntarily submit reports to the SEC regarding their assets and activities. This system, which came under heavy criticisms at the onset of the financial crisis, relied on the internal computer model of these firms, outsourcing the job of monitoring risk to the firm themselves (Sherman, 2009).

Even if regulatory entities conduct their due diligence in terms of monitoring, in case of observing a malfeasant act from intermediaries, usually a legal fine shall be imposed for settling down the case. Once the case is settled, the information regarding the case will not become publicaly disclosed. Such legal fines hamper creditors’ trust in financial system. That is why in the recent financial regulations, the Dodd-Frank act, more emphasis has been given on the transparency side, since because of the presence of legal fines; intermediaries may set aside a portion of their assets to deal with legal litigations.

The lack of regulation permits the intermediaries to undertake unassumed risks or conducting financial misdeeds. In some cases, intermediaries may also divert their assets for illegal activities. However they could do so because of lack of regulation and presence of legal fines. So I consider laxest regulations and legal fines as ”exit strategies” for intermediaries. Knowing this in advance will exacerbate the risky behavior in allocating more of their resources for such activities.

More regulation is aimed at increasing the quality of regulation, however the fear still remains of how to implement such regulations at low costs to achieve such a goal. Delayed regulatory implementation usually decreases the quality, which could have aggregate macroeconomic impact.
In order to introduce the quality of regulation within a macro-finance framework, I introduce probabilities associated with the partial observations and legal outcomes. These probabilities can be best thought of exit strategies for intermediaries upon committing wrong acts. Moreover the macro-finance framework should also replicate some of the macroeconomic features of the recent financial crisis, which are:

- The passive behavior of spread, which could not possibly take into account any profit accruing to any intermediaries (Hall, 2010)
- Recovery is sluggish both in output and credit
- Leverage procyclicality of financial intermediaries (Adrian and Shin 2010)

Intermediaries suffered a severe loss in their equity value due to the real-estate crash. Spreads between BAA and Treasury yields of the same maturity widened stunningly but then came back to normal values way faster than expected to account for any persistence slump (Hall 2010). The amplification mechanism which yields into spread could be due to asymmetrical information on the supply side of the credit as in Gertler and Kiyotaki (2010). The model is deep since it is a hybrid framework of financial intermediary and liquidity constraint and it is also aimed to explain the puzzling increase in corporate spreads (Christiano and Zha 2010). These spreads reflect concerns about default even though the feared default is never observed. In the model there is a default threshold which occasionally binds in a sense that if equity value falls below a certain threshold, then intermediaries find it profitable to default by absconding a fraction of their funds rather than continuing their business. The notion of default, as I will elaborate shortly is not very appealing with this explanation.

Recovery is slow which is a disappointment but not very surprising according to Reinhart and Rogoff (2010) whom have presented evidences that recession associated with a systemic banking crisis tend to be deep and protracted. Claessens et al (2011) and Papell and Prudan (2011) show that financial crises are longer and deeper. Despite the slow recovery in output, the credit also seems to have a slow recovery pace. According to the IMF World Economic Outlook (WEO 2009) credit growth typically turns positive seven quarters after the resumption of output growth, but due to the disruption of financial intermediaries, the “creditless” nature of the recovery prevails. The given explanation of this creditless nature is the inability of firms to raise funds through issuing debt due to market imperfections, which impedes the degree of credit substitution. With this explanation the magnitude of slow recoveries are associated with the degree of exogenous disturbance. Here I argue that a possible explanation for the creditless nature of the economy could be the ex-ante fears of creditors from ex-post moral hazard problems of intermediaries, which makes the pace of
the recovery slow. Adrian and Shin (2010) have documented procyclical trend of leverage across financial intermediaries. They have considered “pure play” investment banks that are not part of bank holding companies so as to focus attention on their behavior with respect to capital market. In another work, Nuno and Thomas (2011) they have documented that leverage cycles depend on the type of the entity, for US-chartered banking leverage has a negative comovement with the GDP and for security brokers and dealers such a relationship is mildly cyclical. The leverage of regulated banks tends to be less than that of unregulated ones. Authors propose a framework where investors may impose credit constraint on intermediaries. This is due to the limited liability of firms by taking riskier projects. Any credit constraint for any given net-worth creates deleveraging spirals.

Having explained the facts above, I argue that it is important to take into account the ex-post moral hazard problems in frameworks with asymmetrical information on the supply side of the credit. In Gertler and Kiyotaki (2010) framework, intermediaries abscond a fraction of fund if their constraint becomes binding. For the sake of simplicity, they have assumed that following a diversion intermediaries are put into default. However, such default mechanism cannot be observed in real life. The missing link to rationalize such a concept is then to introduce regulatory entities. The proposed timeline is like following: after the realization of liquidity risk (or financial shock that would affect the confidence of creditors), intermediaries’ incentive constraint become binding, hence they could divert a fraction of their assets. This act of diversion can be observed either partially or always. Hence the ability of regulatory entities in observing the malfeasance behavior of intermediaries can be thought as an exit strategy for intermediaries themselves. I also argue the problem may not be very trivial, since in the event should intermediary get caught by regulatory entities, there is a negotiation process, which its outcome is determined probabilistically. The outcome may manifest itself as a form of some legal fines.

By taking into account the ex-post moral hazard problem, several conclusions could be drawn. First partial investigation and subsequent negotiation affect the incentive constraint of intermediaries by making it more stringent by creating different exit strategies. This could be read as relaxing the behavior of intermediaries. Any changes in the incentive constraint of firms affects the leverage. A leverage multiplier can be obtained for the same level of shock

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1The explanation in the IMF World Economic Outlook is very general and must be nailed down to one visible point. One argument could be why firms were unable to issue equity to raise the necessary funds for their projects. This could come straight from the intervention of governments in bailing out some companies, which has severely diluted their equity shareholders. Creditors will also start bidding down the stock price of the firm, hence the creditless phenomena may persist (Ayotte and Skeel, 2009). Here I do not look at this problem, but rather from an intermediary point of view the problem has been investigated.
by taking into account the aftermath of diversion. Secondly, the spread dynamics may not necessarily be due to asymmetrical information on the supply side of the credit, but also on the behavior of regulatory entities in observing any malfeasance behavior of intermediaries. Third, output and credit recovery could become sluggish for the same level of financial shock, since creditors rationally take into account the deficiencies and imperfections which exist in regulatory systems. Creditors are rationally concerned with what intermediaries might do with their money but this fear cannot be easily alleviated in presence of an imperfect regulatory framework.

This work is related to the existing literature on credit spread puzzle \(^2\) and slow recovery \(^3\) but the core argument of this work deviates from other works by bringing the regulatory entity but from a different perspective. This work may also be related to the literature on macroeconomic impact of earning restatements \(^4\). The paper is divided into case studies, model and simulation followed by an extension.

## 2 Case Studies

To give an example of more regulation or increasing the quality of regulation, let’s have a look at what Sarbanes-Oxley and Dodd-Frank Acts say about executive compensations clawbacks. Sarbanes-Oxley Act (SOX) has been signed in the early 2000 in the light of some revelations on financial and fraud scandals of well known companies like Enron, Tyco and WorldCom. The compensation clawback under SOX was only for CFOs and CEOs but under Dodd-Frank Act it is for all five “named executive officers” listed in the proxy statement. Clawbacks was limited to past 12 months but Clawbacks under Dodd-Frank acts goes to

\(^2\)The definition of the puzzle is that spreads on corporate bonds tend to be many times wider than what would be implied by expected default losses. The corporate literature has given some plausible explanations. Amato et Remolona (2003) state that it could be due to expected loss on corporate bonds. Elton et al. (2002) state that it could be due to the risk premia. The impact of liquidity premia has been investigated by Schultz (2001), since the transactions of corporate bonds are usually done in thin and illiquid markets, hence investors may ask for a liquidity premia.

\(^3\)Some argue that this is not surprising since recessions associated with financial crises are often followed by sluggish recoveries (Claessens et al 2010, Reinhart and Rogoff 2010, Jordà et al 2011). Others attribute the slow recovery to policy uncertainty and analysts point to the very rare synchronization of Euro and US crises as a major cause for the sluggish recovery.

\(^4\)Notable works regarding the impact of fraudulent activities on the economy have been investigated in the works of Kedia et Philippon (2009), Bergstresser et Philippon (2006) and Benmelech et al. (2010). Kedia et Philippon (2009) has developed a model where fraudulent accounting has important economic consequences. The implicit idea in this work is that the earning restatement or asset substitution increases the default threshold, since it captures the risky behavior of financial intermediaries. The asset substitution may be modeled as diverting a fraction of funds in the simplest terms. However to capture the asset substitution phenomena, one needs to introduce two distinct assets with different yeilds, which is not the aim of this paper.
back to three years. Clawbacks under SOX is based on fraud but under Dodd-Frank Act it is based merely on error. However one could argue stronger Section 404 of SOX could do the same, which explains about enhanced internal control.

Section 404 obliges financial transaction properly authorized and recorded, but then the reporting side got affected by Voluntary Regulation. However despite new regulations, I believe the sources of compensation should be at the center of debate, which the former falls within the realm of the quality of regulation rather than how retrieving the money back.

If the quality of regulation decreases, it creates an environment in which intermediaries could divert or abscond more of their assets for risky projects or financial misdeeds. The Dodd-Frank Act has been enhanced on its whistleblowing provisions to protect those employees who reveal information on their companies’ risky activities. The concept of ”diversion” or ”absconding a fraction of fund” needs to be elaborated further. What is a diversion and what consequences could it possibly have? Qualitatively it is hard to answer this question due to lack of data, but qualitatively there are some anecdotal evidences.

Diversion of assets could be thought as asset reallocation or using a fraction of assets to commit risky projects without having the assent of creditors. Risky projects may yield in higher returns, but then creditors may put a class action law suit against such activities.

This asset reallocation is observed partially by the regulatory entities (or even by creditors). There are some recent examples that point to the partial observation of such activities:

**Lehman Brothers:** in 2010 the report of the bankruptcy examiner drew attentions to the use of ”Repo 105” transactions agreements to boost the bank’s apparent financial position around the date of the year-end balance sheet by 50 billions more in their cash (booking repo transactions as sale rather than loans) and 50 billions less in their toxic assets\(^5\). Allbeit the bankruptcy examiners reckoned that the collapse of Lehman Brothers was due to the decline in the value of mortgage asset-backed securities and not asset reallocations.

**Madoff Investment LLC:** the very first allegation against the Madoff Investment LLC had been filed prior to the 2000 technology bubble crash. Pointing to the fact that literally it was impossible to legally make such profits Madoff was claiming i.e. achieving such profits using “conventional” investment strategies. Later SEC dropped all charges against the company.

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\(^5\) An excellent description of this activity has been given in the work of Skeel and Jackson (2012). Authors argue the special protections for derivatives and repos from a legal perspective. The case of Lehman Brothers and their ”Repo 105" was rather an accounting problem. "For accounting purposes, rapo transactions are ordinarily characterized as financing, rather than a sale. But Lehman interpreted the accounting rules to allow a repo seller to treat as a sale, if the underlying securities, are worth at least 105% of the cash paid by the repo buyer... Through this interpretation, Lehman characterized the repos as sales rather than financing - debt to buff up its balance sheet in late 2007, 2008. This recharacterization of repos as sales shaved 38.6 billion from Lehman’s debt in the fourth quarter of 2007, and 49.1 billion and 50.38 in the first and second quarters of 2008 respectively” (Skeel and Jackson, 2012)
Madoff since they had not found “any major sources of violation or concerns”. This problem continued to the very last minute where the company was trying to meet the nonlasting avalanche of fund withdrawal by leverage money and manipulating its account to show the company being stronger than what it should be (such as paying bonuses to employees). The company bankrupted, which deepened the impact of financial crisis by shattering the confidence of creditors.

**Stanford Financial Group**: it took only four days from the day where the regulation probe started to the day when the group is forced into default. The allegation was the issuance of 8 billion dollars of certificate deposit with improbable high interest rates. Later SEC revealed that the company was running under massive earning restatements and their records had been falsified.

**Deutsche Bank**: during global financial meltdown it has been announced that the bonuses are slashed by 60 percent on February 2009. This act has been praised by many pointing to the firm’s responsibility towards its community. A year later, the firm paid the highest level of bonuses in Europe in March 2010. The stock market had increased from 16 to 39 dollars a share, whereas SEC in 2011 announced its intention of investigating the firm over hiding billions of losses during the same period. There is no doubt amongst financial analysts that had such a restatement been noticed from the beginning firm would have asked for a government bailout.

Whether the asset diversion is used for risky project or committing fraudulent activities, this behavior creates a non-zero “default threshold”. Ideally in a perfect world, default threshold should be zero, i.e. the value of bank should go to zero to default. However asset reallocation changes the default threshold upward. A positive shift in the default threshold makes the intermediary face its default position quicker, since the default constraint binds more rapidly. By taking into account the continuation value of intermediaries following a diversion, default threshold increases even more. Hence the concept of continuation value is very important in the capital structure of firms.

To summarize, more regulation needs supervision of how these new regulations are enforced. Since supervisions are always partial, intermediaries find exit strategies. Moreover, even if an intermediary is found to be not complying with the law, they usually engage in negotiations to settle down the case by paying some legal fines. Hence, instead of creating more regulations and partially imposed, this paper argues the quality of regulation should increase, i.e. the observatory power, to shut down the continuation which exists after committing the asset diversion.

To this end I propose the following timeline depicted in the Figure-I. Upon committing reallocating their assets, this malfeasance behavior is observed partially by the regulatory
entities (or even creditors). In the event should intermediaries get caught, they engage in intense negotiations with regulatory entities to settle the case. The outcomes are probabilistic. If the negotiation is favorable (with a given probability) then intermediaries are forced to pay some legal fines. If the outcome is not favorable, the intermediaries are put into default.

Moreover I assume that these events are taking within the same time-line. Although that the anecdotal evidences point to the fact that usually the SEC investigations take place after a couple of quarters.

Scenario-I

Liquidity Risk Realizes

No Diversion  Diversion

Partial Observation  Perfect Observation

Default

Partial Investigation.

Scenario-II

Diversion

Partial Observation  Perfect Observation

Negotiation is favorable  ... Fails  Negotiation is favorable  ... Fails

Default  Default

Partial Observation with Negotiation.
3 Modeling

3.1 Physical Setup

The physical setup of the model is composed of firms of mass unity located on a continuum of islands. Each firm produces according to an identical Cobb-Douglas production function $Y_t$ with capital $K_t$ and labor $L_t$ as inputs. Capital is not mobile but labor is mobile across islands. Because of this labor mobility, the aggregate production function can be expressed as:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha}$$

where $\alpha$ is the elasticity of capital share in aggregate production, $A_t$ is aggregate productivity shock which follows a Markov process of order one. To motivate liquidity shortage across islands, investment opportunities arrive randomly at a fraction $\pi^i$ of islands. The arrival of investment opportunities is i.i.d across time and across islands. If $I_t$ denotes aggregate investment and $\delta$ the depreciation of capital, the law of evolution of capital would be:

$$K_{t+1} = [I_t + (1 - \delta) K_t]$$

Competitive producers across different islands operate a constant returns to scale technology with capital and labor. Since labor is perfectly mobile the wage satisfies the following equation

$$W_t = (1 - \alpha) \frac{Y_t}{L_t}$$

The gross profit per unit of capital could then be written as:

$$Z_t = \frac{Y_t - W_t L_t}{K_t} = \alpha A_t \left( \frac{L_t}{K_t} \right)^{1-\alpha}$$

Aggregate output is made up of aggregate household’s consumption $C_t$, investment expenditure and government expenditures $G_t$,

$$Y_t = C_t + \left( 1 + f \left( \frac{I_t}{I_{t-1}} \right) \right) I_t + G_t$$

where, $f \left( \frac{I_t}{I_{t-1}} \right) I_t$ reflects physical adjustment costs such that $f(1) = f'(1) = 0$ and

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6This liquidity need by firms has been explained in details in Kiyotaki (2008). This investment opportunity also implies investment probability due to the law of large numbers.
\[ f'' \left( \frac{L_t}{L_{t-1}} \right) > 0 \] For the sake of simplicity, government expenditure is modeled by a Markov process of order one and is best thought of as a total aggregate shock to the resource constraint.

Household’s preference function is a standard New Keynesian utility function with external habit formation in consumption and disutility part from working. The expected discounted value of preference is given by

\[
E_t \sum_{i=0}^{\infty} \beta^i \left( \ln \left( C_{t+i} + \gamma C_{t+i-1} - \frac{\chi}{1 + \varepsilon} L_{t+i}^{1+\varepsilon} \right) \right)
\]

where \( \beta \) is the discount factor, \( \chi \) is the weight of disutility from working, \( \varepsilon \) is the inverse Frisch elasticity of labor supply and \( \gamma \) denotes the external habit.

To introduce financial intermediaries in a tractable framework, there is a representative household with a continuum of members of measure unity. Within the household there are \( 1 - f \) workers and \( f \) bankers. \( f \) is an i.i.d. draw that determines whether the household members are bankers or workers. This i.i.d. probability by the law of large numbers is also the fraction of bankers within the household’s member.

Households deposit funds in banks (i.e. financial intermediaries). Deposits are riskless one period securities. Households may also hold riskless one period government debt, which is a perfect substitute for bank deposits. Households maximize their utilities with respect to the following budget constraint:

\[
C_t + D_{ht+1} + T_t = W_t L_t + R_t D_{ht} + \Pi_t
\]

where \( D_{ht} \) denotes the quantity of riskless debt held, \( R_t \) is the gross return on riskless debt, \( \Pi_t \) is the net distribution from ownership of both banks and non-financial firms and \( T_t \) is lump sum tax. The right hand side of the above equation represents the current aggregate consumption, the purchases of next periods riskless debt and lump sum taxes which should be financed from the revenue earned on supplying labor, income from depositing funds at banks and the distributed net profit.

### 3.2 Capital producer

Capital producers operate in a national market, they make new capital using input of final output and subject to adjustment costs. They sell new capital to firms on investing islands at the price \( Q_t^i \). Given that households own capital producers the objective of a

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\[ \text{These restrictions make the aggregate production function of capital goods producers decreasing returns to scale in the short-run and constant returns to scale in the long-run.} \]
capital producer is to choose $I_t$ such that:

$$\text{Max} \mathbb{E}_t \sum_{t=\tau}^{\infty} \Lambda_{t, \tau} \left\{ Q^t \right\}_t = \left[ 1 + f \left( \frac{I_\tau}{I_{\tau-1}} \right) \right] I_\tau$$

(8)

From profit maximization and by specifying a quadratic adjustment cost, the price of capital goods is equal to the marginal cost of investment goods production as follows:

$$Q^t_i = \left( 1 + \frac{\psi}{2} \left( \frac{I_t}{I_{t-1}} - 1 \right)^2 \right) + \frac{\psi}{2} \frac{I_t}{I_{t-1}} \left( \frac{I_t}{I_{t-1}} - 1 \right) - \mathbb{E}_t \psi \Lambda_{t, t+1} \left( \frac{I_{t+1}}{I_t} \right)^2 \left( \frac{I_{t+1}}{I_t} - 1 \right)$$

(9)

, where $\psi$ is the investment adjustment parameter.

### 3.3 Equilibrium

Labor market clearing condition requires that

$$(1 - \alpha) \frac{Y_t}{L_t} E_t u_c(t) = \chi I_t^\phi$$

(10)

Because of Walras’ Law, once the market for goods, labor, securities and interbank loans is cleared, the market for riskless debt will be cleared automatically

$$D_{ht} = D_t + D_{gt}$$

(11)

where $D_{gt}$ is supply of government debt. These equilibrium conditions complete the description of the model.

The model has analytical solutions for two special cases, perfect and imperfect interbank market, however for other ranges of interbank market efficiencies the model needs to be solved numerically.

### 3.4 Financial Intermediaries

**Partial Observation** Each period a lending takes place between financial intermediaries and firms. This process is a perfect debt contract in a sense that firms are not subject to any default. This abstraction permits us to investigate how the behavior of financial intermediaries could affect the aggregate macroeconomic variables. To finance lending in each period, bank raises funds from workers. At the beginning of the period, each bank raises deposits $d_t$ from households in the retail markets, which are to be remunerated at rate $R_t$. With an interbank borrowing $b^h_t$ and deposit $d_t$ they issue equity (to firms) $s^h_t$ at price
$Q^h_t$, where $h$ stands for the type of island the intermediary is situated, which also captures the liquidity risk.

The liquidity problem here arises due to limited market participation, in the spirit of Allen and Gale (1994). This is because banks are allowed to lend loans to firms on the same island. Moreover banks on investing island cannot raise more funds from depositors due to the limited market participation. Hence to finance their existing and newly arrived investment projects, they will therefore need to borrow funds from the interbank market.

Since bankers are financially constrained they will continue accumulating assets and wealth. In presence of no motivation for paying dividends, they may find it optimal to accumulate wealth up to a point where their financial constraint would no longer be binding. To rule out this situation, with an $i.i.d.$ probability $1 - \sigma$ bankers become workers, which gives an average survival rate of $\frac{1}{1 - \sigma}$. Upon exiting a banker transfers retained earnings to the household and becomes a worker. Therefore, in each period $(1 - \sigma)f$ workers become bankers, keeping the number in each occupation constant. Each new banker also receives a start-up fund from the family it belongs, to start the banking business. This start-up transfer is funded from the total assets of the family.

Bankers are subject to an endogenous constraint for raising funds. Bankers may divert a fraction of their funds for their own personal gains or to risky project, which would not be beneficial to creditors. This constraint limits the amount of fund bankers could raise from creditors. Hence bankers choose the optimal portfolio composition (i.e. their assets and liabilities) taking into account their constraint.

The incentive constraint for intermediaries not to deviate any fraction of funds should satisfy the following inequality:

$$V_t \left( s^h_t, b^h_t, d_t \right) \geq \theta \left( Q^h_t s^h_t - \omega b^h_t \right)$$

(12)

The possible divertable amount

$\theta$ and $\omega$ are parameters that govern the amount that could be diverted from total amount of assets and interbank market $^8$ respectively and are called the tightening margins $^9$. In the original framework, authors claim that the diversion must take place at the end of the period, i.e. after the realization of the liquidity risk that determines its type but before the realization of aggregate uncertainty in the following period (i.e. diversion takes place during the night) $^{10}$.

$^8$ $\omega$ may also capture the notion of efficiency, i.e. $\omega = 0$ designates the imperfect interbank market.

$^9$ Here no diversion takes place from the deposits. The reason is that short term debt provides disciplines the behavior of bankers. The need to meet continual non-contingent payments reduces the degree to which the bank can act in the interest of its owners rather than its creditors (Calomiris and Kahn 1991).

$^{10}$ Here I assume intermediaries always divert. A rather realistic way of modeling is to associate probabil-
To make the impact of investigation and negotiation more tangible, we could simply extend this timing framework. In this time-line once they have diverted a fraction of funds, this behavior can be observed partially and if it is observed then intermediaries default. Suppose, the probability of being observed is \( \pi \), then the incentive constraint becomes:

\[
V_t (s^h_t, b^h_t, d_t) \geq \theta_t \left( Q^h_t s^h_t - \omega b^h_t \right) + \pi (1 - \theta_t) s^h_t, (1 - \omega \theta_t) b^h_t, d_t)
\]

where \( \theta_t \) designates a confidence shock (see discussions below). The property of the above incentive constraint is that, it is more stringent and because of partial observation the incentives for diversion increases \(^{12}\). As \( \pi \rightarrow 1 \) the original GK framework incentive constraint can be obtained, meaning that following a diversion, this malfeasance behavior is always observed. However there are some normative issues, which are beyond the scope of this paper. These points are relegated to the discussion section.

The above problem can be solved by guess and verification process. The value function could be guessed by the following linear form:

\[
V_t (s^h_t, b^h_t, d_t) = \nu_{st} s^h_t - \nu_{bt} b^h_t - \nu_t d_t
\]

where, \( \nu_{st} \) is the marginal value of assets at the end of period \( t \), \( \nu_{bt} \) is the marginal cost of interbank debt and \( \nu_t \) is the marginal cost of deposit.

The liquidity risk (i.e. the investment opportunities) arrive randomly. In order to rule out

\(^{11}\)Observation is probabilistic. Usually the auditing committees get together a couple of times in a year for a short time to audit the firms’ accounts. This short period of time increases the probability of overlooking some facts in accounting.

\(^{12}\)The dynamical system properties in terms of chaos theory has been investigated by Gu et al (2012, 2013). Authors take into account a simple model where credit arises when one agent needs to deliver the consumption good of the second agent in the second sub-period. This raises a limited commitment problem. They argue that this problem could be observed partially. They also go one step further by endogenizing the probability of getting caught (by minimizing a cost function for auditing firms). However the behavior of auditing firms is not that trivial, since in many cases they provide services other than auditing to their clients.

Moreover, they interpret the RHS of such an incentive constraint as a debt limit. They argue that the debt limit decreases as probability of getting caught following a diversion increases. However in this work, the RHS of the proposed incentive constraint is not necessarily a debt limit, but a default limit. Hence following a partial observation the default limit region expands for intermediaries. The expansion of default limit does not necessarily mean that intermediaries would behave, on the contrary, the expansion of default limit itself is a consequence of behaviors being made by intermediaries in presence of partial observation (the act of absconding).
the possibility that bankers accumulate wealth to a point where their financial constraint
is not longer binding, with an exogenous probability, they exit $\sigma$ and they give all their
wealth to the family they belong to. Hence the value of function is (it is worth noting that
the expectation is really on the location of banks, where they will be situated in the next
period)

$$V_{t-1} (s^h_{t-1}, b^h_{t-1}, d_{t-1}) =$$

$$E_{t-1} \beta \frac{U_c(t)}{U_c(t-1)} \sum_{h=i,n} \pi^h \left( (1 - \sigma) n_t^h + \sigma \max_{d_t} \left( \max_{s_t} u_t V_t(s^h_t, b^h_t, d_t) \right) \right)$$

(15)

By writing the Lagrangian and introducing $\eta^1_t = 1 - (1 - \pi)(1 - \theta_t)$ and $\eta^2_t = 1 - (1 - \pi)(1 - \omega \theta_t)$, the first order conditions are

$$\nu_{bt} \left( 1 + \eta^2_t \lambda_t \right) - \nu_t \left( 1 + \pi \lambda_t \right) = \theta_t \omega \lambda_t$$

(16)

$$\lambda^h_t = \frac{\nu^h_t - \nu_{bt}}{\theta_t (1 - \omega) - (\eta^1_t \nu^h_t - \eta^2_t \nu_{bt})}$$

(17)

$$\left( \theta_t + \pi \nu_t - \eta^1_t \frac{\nu_{st}}{Q^h_t} \right) Q^h_t s^h_t - \left( \theta_t \omega - \eta^2_t \nu_{bt} + \pi \nu_t \right) b^h_t \leq \nu_t n^h_t$$

(18)

The 3rd equation can be further simplified to:

$$Q^h_t s^h_t \leq \frac{1}{\theta_t (1 - \omega) - (\eta^1_t \nu^h_t - \eta^2_t \nu_{bt})} \left[ (\eta^2_t \nu_{bt} - \theta_t \omega) n^h_t - (\theta_t \omega - \eta^2_t \nu_{bt} + \pi \nu_t) d_t \right]$$

(19)

By using the method of undetermined coefficients the marginal value of net-worth is given by

$$\Omega^h_t = 1 - \sigma + \sigma \left( \nu_{bt} + \lambda^h_t \left( \eta^2_t \nu_{bt} - \theta_t \omega \right) \right)$$

(20)

Interestingly the partial observation changes the expected gains and costs of assets and liabilities through changing the stochastic marginal value of net-worth. Imperfect observation decreases the marginal value of assets, since these assets could be subject to diversion. The leverage ratio is then given by:
\[ \phi_t^h = \frac{(\eta_t^2 \nu_{bt} - \theta_t \omega)}{\theta_t (1 - \omega) - (\eta_t^1 \nu_{bt}^t - \eta_t^2 \nu_{bt})} \]  

(21)

The leverage ratio is affected by the partial observation of legal authorities.

**Legal Fines** The incentive constraint can be extended to take into account a situation where intermediaries ought to pay legal fines over their action to regulatory entities. In the event of getting caught by legal authorities, the intermediaries negotiate with them to prevent disclosure of detailed description of their activity. Suppose with probability \( \pi_r \) the outcome of negotiation fails and with \((1 - \pi_r)\) the negotiation results in a favorable verdict that intermediaries must pay a legal fine \( F(Q_t^h, s_t^h, b_t^h) = \theta_t (Q_t^h s_t^h - \omega b_t^h) \) proportional to the amount they have absconded, therefore the above incentive constraint could be written:

\[
V_t(s_t^h, b_t^h, d_t) \geq \theta_t (Q_t^h s_t^h - \omega b_t^h) + \pi_r \begin{cases} 
\pi_r, & \text{Negotiation fails} \\
0, & \text{Negotiation is favorable} 
\end{cases} + (1 - \pi_r) \cdot V_t((1 - \theta_t) s_t^h, (1 - \omega \theta_t) b_t^h, d_t)
\]

(22)

The possible divertable amount

The marginal value of net-worth is given by:

\[
\Omega_t^h = 1 - \sigma + \sigma (\nu_{bt} + \lambda_t^h (\eta_t^2 \nu_{bt} - \theta_t \omega (1 - \pi_r (1 - \pi_r))))
\]

(23)

At equilibrium, total securities issued on investing and non-investing islands correspond to aggregate capital acquired by each type

\[
S_t^i = I_t + (1 - \delta) \pi^i K_t
\]

(24)

\[
S_t^n = (1 - \delta) \pi^n K_t
\]

(25)
Using the above identities, we could infer that $S_t = K_{t+1}^{13}$.

4 Imperfect Markets and financial shock

Here I investigate the case of imperfect interbank market, i.e. $\omega = 0^{14}$. It implies to symmetric frictions in whole sale and retail financial market and the bank’s ability in committing diversion become independent of the sources of financing. From the first order conditions we have

$$\nu_{bt} (1 + \eta^2_t \lambda_t) - \nu_t (1 + \pi_t \lambda_t) = \theta_t \omega \lambda_t \rightarrow \nu_{bt} = \nu_t$$

It means the marginal cost of raising interbank loans and deposits are equal across all islands (regardless of island type). Another implication of this equality is that the interest rate of the interbank bank market would be equal to the interest rate on the loans raised from the depositors i.e. $R_t = R_{bd}^{15}$. This is regardless of perfect or imperfect investigation. The excess value of assets $\mu^h_t = \frac{\nu_{st} Q^*}{Q^h_t} - \nu_t$ and since the quantity of assets are higher in investing island than non-investing island, the price of asset is higher in non-investing island respectively i.e. $Q^i_t < Q^n_t$ and likewise $\mu^i_t > \mu^n_t \geq 0$. However the leverage ratio is affected by the partial investigation, compared to the case of perfect investigation $^{16}$.

Leverage ratio on investing-islands, ceteris paribus, is higher when legal observation is not perfect. The reason is that within this framework, the leverage ratio is endogenously determined through an asymmetrical information on the supply side of the credit, which has been captured by the incentive constraint. Investors might accept a widening of spread so intermediaries do not divert (Hall 2011), however diversion may take place to lever up

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$^{13}$It is worth noting that the type of contract between firms and intermediaries are state-contingent abstract any default concerns.

$^{14}$Here I do not consider the case of perfect interbank market. The reason is straightforward from the first order conditions of financial intermediaries, i.e. for $\omega = 1$

$$\lambda^h_t = \frac{\nu_{st} Q^n_t - \nu_{bt} \theta_t (1 - \omega)}{\eta_1 \nu_{st} Q^n_t - \eta_2 \nu_{bt} \theta_t} \rightarrow \frac{\nu_{st}}{Q^i_t} = \nu_{bt}$$

Hence regardless of where the bank is situated, the prices of assets are equalized, which means the liquidity risk has no impact at all.

$^{15}$Another interesting point is that, since interbank loans and deposits become perfect substitute, bankers cannot divert from interbank loans. Since this perfect substitution has disciplinary role for bankers as stated by Calomiris and Kahn.

$^{16}$It is worth mentioning that the model is solved by taking into account that the incentive constraint on the non-investing islands are not binding. Since on the non-investing island, no investment opportunities arrive, then the financial intermediaries situated on these islands are not facing any liquidity problem, hence their incentive constraint will no longer be binding. Then the (effective) leverage ratio on non-investing island is given by $\frac{Q^n_t \nu_{st}^2}{\eta_1^2} \leq \phi^n_t$
on their existing assets through absconding a higher fraction of their funds in the case of imperfect investigation.

For the purpose at hand, I investigate the impact of a financial shock by defining an exogenous process for $\theta_t$. This shock could be thought as a change in beliefs of depositors of what intermediaries might do with their fund. The dynamical behavior of this shock has been investigated in the work of Dedola et al (2012). Realization of a financial shock will force the financial intermediary to cut back on their loans and deposits (a contraction) in the fear of what depositors might do (such as deposit withdrawal). Although this reaction may comfort the depositors but cutting back loans could trigger a slowdown in the economy. The impact of this shock becomes important when there is a partial investigation (or subsequently a negotiation when the malfeasance behavior is observed). The problem can be intensified when depositors also accept a widening of spread so the equity value of intermediaries do not fall below a certain threshold, which that threshold itself is governed by imperfect legal observation$^{17}$.

5 Simulations

Here the stylized facts mentioned in the introductory part are simulated, i.e. passive spread, sluggish recovery both in output and credit, and the procyclicality of leverage by taking into account the legal uncertainties.

The model is calibrated to hit the following two targets, a spread of 100 basis point and an average leverage of 4 (asset over net-worth) across all intermediaries. The persistence of confidence shock is calibrated as 0.66 and its standard deviation to 5% $^{18}$. The habit formation is calibrated to be 0.75. The survival rate of bankers is calibrated to be 0.972 which is roughly equivalent to a 10 years life span. Depreciation of capital is calibrated to $^{17}$

$^{17}$Other interpretation of this exogenous trigger in the beliefs of agents could be a change in their confidence. Hence it will not be too far fetched if one calls it a "confidence shock". This is due to the finding of Perri and Quadrini (2011) which have shown that sunspots could appear in economies where financing constraints are occasionally binding.

As it has been explained to alleviate the effect of this confidence shock, intermediaries cut back on their loans and deposits. Cutting back on deposit may be interpreted as tightening of credit standards to intermediaries. As it has been observed, while causality is difficult to establish, most observer believe that fear resulting from the Lehman Filing and its implication for Reserve Primary Fund, spilled over into redemption requests to other money market funds. A request that destroyed Madoff Investment LLC.

Another form of this confidence shock also appeared in the repo market. Many intermediaries finance their long term position with short-term commercial papers borrowing issued in money market. Commercial papers are the safest but in the event of bankruptcy, they are at the end list of absolute priorities (i.e. creditors start feeling unsecured). Hence the filing of Bear Stearn exacerbated this fear, and as a result the repo rates skyrocketed in the money market.

$^{18}$Usually confidence shocks are persistent and highly volatile, but changing the persistance and volatility of this shock does not change the final results.
hit the 10 percent annual rate of capital depreciation. The share of government expenditure is 20 percent. The convexity of capital adjustment cost is chosen to be 10. Also it is assumed that the probability of investment opportunity arrival is 25 percent.

The seizure rate and transfers to new bankers is a function of how diversion is observed. If the behavior of intermediary in absconding a fraction of fund is always observed, then less amount can be diverted (in expectation). Whereas intuitively, if there is an imperfect observation, we should observe higher seizure rates. The relationship is depicted in the Figure-I. The square points show the seizure rate when the observation is partial. The points depict a nontrivial relationship. The line shifts up if we consider the possibility of legal fines when observation is done with a probability of 75 percent 19.

By comparing different incentive constraints it can be discussed why more diversion takes place in presence of an imperfect regulatory system. In the original GK framework, the following constraint is always binding:

$$V_t(s^h_t, b^h_t, d_t) \geq \theta_t \left( Q^h_t s^h_t - \omega b^h_t \right)$$

(26)

The possible divertable amount

By comparing the imperfect and perfect interbank markets respectively, i.e. for cases $\omega = 0, 1$ we have

$$V_t(s^h_t, b^h_t, d_t) \geq \theta_t \left( Q^h_t s^h_t - b^h_t \right)$$

Divertable pool of assets shrinks

$$V_t(s^h_t, b^h_t, d_t) \geq \theta_t Q^h_t s^h_t$$

(27)

Divertable pool of assets increases

In GK framework, the steady-states govern the value of the firm, since the conditions must be binding, the left hand side does not change for different $\omega$. However the right hand side does change. For the case of perfect interbank market, the pool of divertable assets decreases, hence seizure rate must increase compared to that of an imperfect market. In case of partial observation, the constraint becomes the following:

$$V_t(s^h_t, b^h_t, d_t) \geq \theta_t \left( Q^h_t s^h_t - \omega b^h_t \right) + (1 - \pi) V_t \left( (1 - \theta_t) s^h_t, (1 - \omega \theta_t) b^h_t, d_t \right)$$

(28)

Since the value functions can be approximated by a linear solution, the above incentive

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19It worth mentioning that here I have not tried pinning down the probabilities of interest. The aim of this work is to show how the quality of regulation could impact the economy. I have obtained the probabilities by hitting only two steady states targets, i.e. the spread and leverage. To pin down the probabilities, another moment is needed. However, this requires an extensive knowledge of how regulatory entities are working (to find out which of their actions pin down which moment).
constraint boils down to the following:

\[ V_t(\pi, \theta) \geq \theta_t (Q_t h_t - \omega b_t^h) \]  

For the case of imperfect interbank market we have:

\[ \frac{V_t(\pi, \theta_t)}{\theta_t} \geq Q_t s_t^h \]  

The above constraint tells us two points. First there is a co-movement between the value of the firm and the seizure rate across different regulatory qualities, since this time the RHS of the incentive compatibility constraint is governed by the steady states. The partial observation creates this co-movement. Second the interpretation of the constraint becomes completely different. Without taking into account the possibility of continuation value, the original constraint captures the fear of default through diversion, whereas in the modified constraint, it captures the possibility (not a fear) of a co-movement between the value of the firm and diversion. Therefore, the role of the regulatory becomes very complicated. If the policies are aimed at breaking this co-movement, then the interpretation of the constraint differs from possibility to fear. At the same time, if no action takes place in breaking the co-movement, risky behaviors can be exacerbated because of the co-movement and this risky behavior shows itself in heavy leveraged balance sheet.

This problem cannot be addressed even adequately by adding more regulation. If the quality of regulation increases it could help in reducing the risky behavior of bankers. This point is illustrated further in the next section.

The impulse response functions are drawn following a 5 percent change in the confidence of creditors over what intermediaries could do with their deposits. Intermediaries to alleviate fear cut back on their deposits and thus on their loans. Cutting back loans exert negative pressure on the asset prices, hence asset prices fall. Fall of asset prices increases the expected returns, which increases the spread. This rise in spread permits the banks to continue their business. Cutting back on loans is also interpreted as deleveraging, hence less loans are issued (or less firm’s securities are purchased in this framework) to finance the newly arrived investments, therefore a contraction takes place and economy goes into a recession.

When diversion is perfectly observed, the seizure rate is the lowest however situations are somewhat different when there is a partial observation over what intermediaries would do. Partial observation makes the incentive constraint of intermediaries more stringent, hence the seizure rate is higher. Despite the same confidence shock, depositors would demand a stronger action from the intermediaries’ side. Within this situation, intermediaries try to alleviate the depositors’ concerns by cutting back more deposits and thus loans., because
now creditors rationally take into account the imperfection of the regulatory system.

The asset prices fall of roughly equal order however there seems to be a multiplier in leverage between perfect and imperfect observation. This can be explained using a very simple example in Adrian and Shin (2010). Suppose a firm has 100 in their assets, 10 as in their equity (net-worth in this framework) and 90 in their debt (which is deposit in this framework). This balance-sheet has a leverage ratio of 10. A 2 percent drop in the asset value leads to an asset level of 98 and since it is conventional to think that debt value does not change, the equity is then reduced to 8. The leverage is now \( \text{Asset/Equity} = 12.25 \), which is slightly higher than 10, so asset side must be reduced by 18 to obtain a leverage ratio of 10. Hence the deleveraging comes from the target value set by leverage ratio. However, suppose the firm conducts a risky behavior (including all types of activities, off-balance-sheet, fraud etc) and 5 percent gets diverted. So the workable asset side is now reduced to 95. Now a 2 percent drop in asset value is equivalent to 93.1 and since no diversion cannot take place from deposits (due to regular services, which the intermediary should provide) and the debt value does not change, it induces an equity level of 3.1. Hence the leverage ratio will be \( \text{Asset/Equity} = 93.1/3.1 = 30 \), which is three times more than the target value 10. To obtain the leverage target, deposit must fall by more than 3 times to 26.9 to satisfy the leverage constraint. Hence the deposit dynamic in this framework is associated with slow recovery due to lack of trust in creditors in giving money.

Through the above example it is eminent that the fall in asset prices of the same magnitude may have different leverage cycle behaviors, depending on how intermediaries act on their asset sides and how those actions are observed by the regulatory entities. The imperfect regulatory framework relaxes the constraint in diverting more funds, which leads to leverage multiplier.

These scenarios could shed some light on the credit spread puzzles but by taking into account the impact of legal authorities. The behavior of legal authorities on observing the seizure rate affects the incentive constraint of intermediaries, which affects the confidence (i.e. fear) of investors. Therefore spreads are high, to curb the pressure coming from a confidence shock (or a change of perception of creditors). Fear of investors may rise in presence of an imperfect legal entity, hence intermediaries respond to this fear by cutting more loans.

The leverage and spread do not alter substantially when one takes into account the possible legal fines after being caught. However the recovery of real variables are much more slower (by an order of more than several quarters). The reason is due to the probabilistic nature of negotiation with legal authorities. The slow recovery points to an inherent presence of uncertainty within the economy, which is implicitly captured by the uncertainty associated with the outcome of negotiations. This highlights the impact of negotiation, since in reality,
markets are observing with care the outcome of SEC allegations.

This point has been well illustrated in Fig - V. Different recovery rate can be obtained with the same level of a shock. As the probability of observation declines, the recovery in output and credit become very sluggish. The apparent reason is due to presence of the continuation value of a firm following a malfeasance behavior, which is controlled by $\pi$ (as it lowers, the impact of the continuation value becomes more significant). Due to the co-movement between the value of the bank and risky behavior, creditors demand much higher premiums during downturns. These simulations show the behavior of intermediaries might differ to elements which might change their incentive constraint accordingly. This leads us to the discussions of the necessary policies, which could address the problem.

6 Normative Discussions

6.1 Quality of Regulation vs More Regulation

It has been argued through the lens of the model that partial observation creates a co-movement between the risky behavior of intermediaries and the seizure rate, and partial observation exacerbates the risky behavior. This complicates the role of the regulatory entities. If the focus is to break this co-movement then $\pi$ i.e. the probability of observation must increase. The probability of observation can be increased by increasing the quality of the current regulatory apparatuses or by implementing effective corporate governance. Although, effective corporate governance is a task difficult to be achieved, since the value of the firm increases with risky behavior within this environment, which could create potential agency problems for designing the best possible dividend and corporate governance policies. However the point is, more regulation may not also be an answer since, more regulation makes the problem complicated but does not address the co-movement problem. More regulation can also be contradictory, which is illustrated in the following.

Banks and financial intermediaries are subject to different regulatory probes and regulatory entities themselves are fragmented (Marinc and Vlahu, 2012). A multinational bank may be subject to both national and international regulatory investigations. Although the interaction of such regulatory probes requires detailed analyses, but usually such regulatory apparatuses are imperfect (both in terms of national and international). This could be modeled with the above proposal.

Suppose $\pi^l$ and $\pi^b$ designate the probabilities of getting caught by legal authorities whom watch the loan market and interbank market respectively. Moreover we assume that the
probabilities of negotiation of an event getting caught by one of these legal authorities is $\pi'$ and $\pi''$ for loan and interbank market respectively. The incentive constraint becomes:

$$V_t(s^h_t, b^h_t, d_t) \geq \theta (Q^h_t s^h_t - \omega b^h_t)$$

(31)

The possible divertable amount

$$+ \begin{cases} \pi^l \cdot \theta t (1 - \pi') \cdot \kappa' \theta (-Q^h_t s^h_t) \\ \pi^l \cdot 0 \quad \text{Negotiation fails} \\ \pi^l \cdot 0 \quad \text{Negotiation is favorable} \end{cases}$$

Getting caught in loan market

$$+ \begin{cases} \pi^b \cdot \theta t (1 - \pi'') \cdot \kappa'' \theta (\omega b^h_t) \\ \pi^b \cdot 0 \quad \text{Negotiation fails} \\ \pi^b \cdot 0 \quad \text{Negotiation is favorable} \end{cases}$$

Getting caught in loan market

$$+(1 - \pi^b) (1 - \pi^l) V_t ((1 - \theta) s^h_t, (1 - \omega \theta) b^h_t, d_t)$$

in the event of not getting caught

I assume if intermediaries get caught over one of their malfeasance behaviors with a high probability i.e. $\pi^l \rightarrow 1$ or $\pi^b \rightarrow 1$ then they will subject to investigation and the continuation value after diversion approaches zero. This framework enables one to investigate whether having one common legal watchdog is preferred with respect to a situation where different legal entities scrutinize financial intermediaries over their malfeasance behaviors.

The presence of different legal frameworks affects the incentive constraint of financial intermediaries to commit diversion or not. In another word, heterogeneous legal frameworks can make the incentive constraint of financial intermediaries more relaxed or more stringent, depending on their strengths in observing the behaviors of intermediaries.

By re-arranging the terms, again we have now an incentive compatible constraint which resembles to the following one (for simplicity $\pi'$ and $\pi''$ are 1 and $\omega = 0$ ) :

$$\frac{V_t (\theta, \pi^l, \pi^b)}{\theta_t} \geq Q^h_t s^h_t$$

(32)

The co-movement between the value function and risky behavior is still present since the core of the problem is not lack of regulation, but the possibility of continuation due to imperfect observations. The problem will become more complicated, if following negotiations,
bankers get to continue, albeit at a lower value compared to their initial value. In that case the value function becomes a function of probability of observations and probability of success in terms of negotiation with regulatory entities.

Although an interesting question could be how these probabilities are determined. In this piece of work they are determined so as to hit a certain set of steady state targets. However from Fig-I over the past 15 years, the major cases of bankruptcies happened during economic turmoils. During the same economic turmoil it seems that the activities of SEC become more intense. Since In this work, I captured the behavior of SEC by assigning probabilities, the natural extension would be to understand the behavior of SEC or regulators, since this behavior affects the constraint of intermediaries.

7 Conclusion

I have investigated the impact of a confidence shock in presence of partial observations over the behavior of financial intermediaries. Through the lens of the model two interpretations can be given for the impact of the imperfect observation: given the steady state targets, imperfect observation creates a co-movement between the value of the firm and risky behavior and because of this co-movement. As a result, since creditors ex-ante take into account such a co-movement, the recovery of the economy for the same level of shock becomes more slowly in presence of an adverse financial shock. The co-movement between the value of the firm and risky behavior cannot be addressed by more regulation. If the objective of the regulatory entities is to diminish the impact of such co-movement on the economy, then the quality of regulation should increase.
### Table-I

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### Table-II

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### Table-III

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The nonlinear relationship between seizure rate and probability of observation with legal fine

\[ \pi = 0.75 \]

Shift due to the probabilistic outcome of negotiation as a legal fine.

Fig -II: The possible relationship between seizure rate and probabilities hitting two steady state targets (leverage of 4 and a spread basis of 100 basis point)
Fig -II: Impulse response functions to financial shock for Different Scenarios
Marginal Excess Value of Asset

Marginal cost of raising deposit

Marginal value of net-worth

Net-worth

Asset Prices

Deposit/Credit

Fig -III: Impulse response functions to confidence shock for Different Scenarios
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