Abstract

We construct a strategic model of financial regulation, to argue for an institution that should be isomorphic to the World Trade Organization and that we call the World Finance Organization (WFO) consisting of a space for bilateral rather than multilateral bargaining on financial regulation, and subject to the same two rules of bilateral trade negotiations: reciprocity and most-favored-nation. We follow Bagwell and Staiger (1999) in showing how these two rules allow a solution to the bilateral prisoner’s dilemma Nash equilibrium that sustains weak financial regulation and irresponsible behavior from banks, and allows a viral expansion of correctly regulated free capital markets when negotiations are repeated and replicated across countries. We also provide a different justification, from the traditional, for a Tobin Tax. We include in our model a “Tob-in” tax that allows for the improvement of the incentives to participate in the WFO and thus of financial regulation, and a “Tob-out” tax that attenuates the moral hazard problem making banks internalize the cost involved with bailouts in possible default scenarios.

Keywords: International Finance, Regulation, International Relations, International Political Economy, Lender of Last Resort.

JEL Classification Numbers: F34, F36, F51, F53, F55
1 Introduction

The discussion (both academic and public) on the need of a new international financial architecture is quite old. It is present in policy and academic discussions on international finance at least since the financial crises of the 1980s, which is when the rapid expansion of globalized capitalism faced its first turbulence. However, this discussion has flared up again with intensity after the subprime crisis of 2008, and is bound to restart once the governments of the developed nations are able to model their way through the fiscal insolvencies that have resulted from the current financial crisis. Every couple of months we see the leaders of the main industrialized nations getting together to discuss the need for international financial regulation. Every time we see them make declarations that are interpreted by the markets in different ways but that don’t seem to have any concrete expression. Since 2008 all relevant changes in regulations that have occurred have done so at a national level. The regulations introduced in England and the United States, as well as those introduced in Ireland, Iceland and other countries have nothing to do with multilateral discussions on financial regulation, but rather on domestic policy driven by domestic politics. There is clearly something wrong in the multilateral approach towards international financial regulation. This paper attempts to provide an explanation as to why isn’t working and what we should do to make it work.

To do this we construct a strategic model of financial regulation, and build the argument for an institution that should be based on the same cornerstone principles as the World Trade Organization (WTO) and that we call the World Finance Organization (WFO). We argue that the international discussion should no be over financial regulation itself, but of the institutional arrangement that could endogenously create the appropriate financial regulation to build healthier international finance. We argue, also, that the WFO should be a space for bilateral rather than multilateral bargaining on financial regulation. Furthermore, the rules that the WFO should follow should be similar to those of the WTO. The two rules that govern bilateral trade negotiations are: reciprocity and most-favored-nation. Bagwell and Staiger (1999) have shown how these two rules make up a institutional frame that allows to solve the bilateral prisoner’s dilemma Nash equilibrium that sustains high tariff rates, and allows a viral expansion of trade liberalization when negotiations are repeated and replicated across countries. We follow the structure of Bagwell and Staiger (1999) to emphasize that it represents a similar problem to the one faced in creating a new international financial framework. In their case the Pareto inferior world that was trying to be dealt with was one of high tariffs and less than optimal international trade. In our model the Pareto inferior world that we are trying to deal with is one of low regulation and more than optimal lending. However, we will show how the two principles that guide the WTO have a very clear application in the WFO. We also include in the model a new role for a Tobin Tax. Traditionally, the Tobin tax is argued to be a necessary deterrent for short-term capital flows. In our model, we include a “Tob-in” tax as a part of the institutional framework that will allow to improve the incentives to participate in the WFO and thus to foster a better, and broader, financial regulation. In our model, it is a deterrent from nonparticipation in the WFO and the rules governing its bilateral negotiations. It is finally, it works as an instrument to foster better financial regulation agreements between countries. We also include a “Tob-out” tax, that attenuates the moral hazard problem associated with bailouts and the existence of a lender of last resort. This helps to address the issue of default scenarios that are possible even in the presence of optimal financial regulation. In our model, the institutional arrangement of financial regulation makes it possible to generate the incentives to solve the traditional moral hazard problem associated with bailouts.

The model we present is extremely stylized and designed to make a point: the multilateral approach
towards international finance reform is mistaken. World leaders should not be meeting to discuss financial regulation itself, but rather the institutional structure that will allow for a mechanism of bilateral negotiations that will eventually drive endogenously the world towards free and healthy finance in the same way that the institutions for bilateral trade negotiations have driven the world towards free and healthy trade.

The structure of the paper is as follows: in section 2 we briefly discuss the literature on new financial architecture; in section 3 we develop a simplified model where financial regulation appears as a result of a classical commons problem; in section 4 we discuss the bilateral regulation problem between two countries that trade financial flows; in section 5 we discuss the functioning of a bilateral finance agreements and the role of the first of the two principles that should govern the WFO: reciprocity; in section 6 we discuss the second principle: nondiscrimination or most-favored-nation; in section 7 we conclude.

2 A New Financial Architecture in the context of Financial Crisis

The fundamentals that derive in a financial crisis, have changed since the 1930 and 1980’s crisis. However the main change that has affected transmission mechanisms is the consolidation and spread of global financial integration (Sturzenegger and Zettelmeyer (2006)). Late 1990’s crises in Asia and Latin America had more financial or currency aspects than those previous crises in which sovereign debt was the main issue. As Blanchard et al. (2010) state, it seems that during the last years most of what was supposed to be known is not perfectly known, the increasing capital flows in financial markets and the creation of new assets have complicated the feasibility of using monetary policy as a tool for asset price stabilization. This makes direct financial regulation the tool for achieving international stability in contemporary finance markets.

As a consequence of last century recessions, international economic policy conventions have been developed and have emphasized fiscal and monetary policy issues rather than financial regulation, developing a financial architecture based on the International Monetary Fund actions and, in a more passive way, the Bank of International Settlements that acts to avoid the when it rains it pours syndrome (Kaminsky et al. (2005)). No international institutions have been created to address the increasing relevance of financial integration on the transmission and spread of global crises.

The beginning of the new century has changed the role of governments in crises, although there are sovereign debt problems such as the ones in Spain, Italy, Portugal and Greece, an important role for governments in crises is now deeply related to financial market regulations. After all, in many of these cases the sovereign debt problem is basically a result of the nationalization of private insolvencies resulting from weak financial regulation.

Main features of the most recent sub-prime crisis, as an example, or failures of current financial architecture are discussed by Stiglitz (2010) and Crotty (2009). Stiglitz (2010) analyzes international system from a theoretical and formal view. Free capital flows and financial markets, although good for risk sharing, can be pretty dangerous in the presence of adverse situations and unregulated contagion channels. So there might be an optimal degree of financial integration, since a Nash equilibrium won’t be efficient as long as the economy departs from Arrow-Debreu benchmark. As main causes of this results Stiglitz analyzes externalities as those effects on prices that affect the joint action (houses prices for example). Other sources of instability are non concaveness of tech-
nologies or utility functions which are also behind the correlated behavior of banks that can lead
to a crises.

Crotty (2009) worries mainly about the problems of collective action amongst banks when they are
in a financial bubble. In this situations there are perverse incentives that create excessive risk. In
this framework, every bank or financial institution has the incentive to maximize the loans without
considering whether they are sound. Another important issue of current financial architecture was
that regulators allowed banks to hold assets off balance sheet with no capital required to support
them. The financial architecture facilitated the growth of dangerously high system-wide leverage.

Most questioned failures of current architecture are related to regulation. Persaud (2008) remarks
that low regulation in quiet times would not be a problem, but if times are noisy deregulation
can have destructive consequences. He also remarks an externality problem between banks and
tax payers. Since regulation implies that some funds must be destined to alleviate the bailout,
in that case banks don’t assume the social costs of their actions and costs are assumed by tax-
payers. The author proposes the creation of a market in which banks pay to taxpayers a bailout
risk premium insurance. Akyuz (2002) documents the conflicts of interest in regulation previous
to the crises in developing countries. Surveillance might be needed not only in fiscal and monetary
policy but in regulation in order to achieve sustainability of capital flows. Based on the former,
it is straightforward to think of an international finance organization since macro and financial
policy and regulation are a step behind trade policy in terms of strong and developed multilateral
institutions.

At the same time, there is a new research agenda that studies externalities generated by capital
flows that causes aggregate financial instability. Korinek (2011) develops the idea that financial
crisis are generated by externalities that are not incorporated in the agents decisions. These agents
don’t internalize their contribution to aggregate financial instability and so this literature builds a
theoretical justification for capital controls (and regulation of capital flows in general) as a mecha-
nism to assign a correct value to these externalities. We are not going to talk about capital flows,
because we understand that our proposal goes further. But we recognize in this literature, the same
mechanism we will exploit: there are market failures associated with financial behavior that leads
to financial instability and that these must be addressed institutionally in order to avoid future
financial crisis.

The new facts discussed in the preceding paragraphs are directing the debate towards the impor-
tance of regulation beyond traditional fiscal and monetary policy, in particular, towards a global in-
stitution with surveillance concerns in order to decrease financial instability (Cartapanis and Herland
(2002)). As shown by the literature, in a globalized economy the idea of an international institution
that can manage financial regulation issues and can integrate emerging economies in a representa-
tive way is part of the debate. This need is reinforced with some criticism towards existing
international organizations.

There is a growing literature concerning proposals for a new financial architecture: Blanchard et al
(2010), Crotty and Epstein (2008), Rodrik et al. (1999) and Rogoff (1999). Precautionary finan-
cial policy and regulation are a very important principle in all of those proposals. To attain such
a goal, most policy prescriptions and institutional framework building suggestions are related to
the establishment of a global lender of last resort: an international debt insurance corporation
joint with a bankruptcy court. This task is usually proposed to be done in a way that the new
organization represents all members and gives importance to heterogeneous strategies. Our basic approach gives a first light in order to set the basis of international finance bargaining and regulation. A lot of discussion has also emerged in relation to a lender of last resort as a way of regulating also financial markets through better and more sound conditions of international bailouts like IMF (Cartapanis and Herland (2002)). Despite this, some critics have reinforced the relevance to go beyond the issue of a lender of last resort and focus on market failures (Stiglitz (1999)).

The basic ideas mentioned here are not enough for a multilateral agreement since pervasive incentives and externalities remain strong, specially for developing countries (Akyuz (2002)). As a consequence there is a need of instruments that help enforcement in this collective action required for the reform of the global finance system. A broadly discussed issue in enforcement achievement is the one about Tobin taxes which have to be analyzed in order to be part of the building up of global finance system. Palley (2003) and Baker (2003) discuss several aspects of Tobin taxes, applications and enforcement considerations. We will give de Tobin Tax a different role than usual. These modifications and their discussion are crucial for the new financial architecture. Our theoretical framework to be presented in the next sections relies on several of the topics discussed above1.

We will take care of the externality and collective action problem of international financial regulation and contribute to a theoretical understanding (and propose a solution) of today’s financial instability. We first discuss the endogenous probability of default from an externality problem in banking system; second, show how this banking problem can be translated to a regulation externality problem; and finally, develop a set of rules that try to solve the pervasive incentives problem through the creation of an international organization of finance. This shapes the institutional design that will allow for the endogenous creation of a new financial architecture.

3 International Banking System and Externalities

3.1 A One Country Default-Risk Economy: Benchmark

In this section we describe a two period endowment economy as the one developed in Diamond and Dybvig (1983) and Chang and Velasco (2000). Our aim is to discuss some of its features and show the effects of including regulation in that environment. Later, we will use this framework to show that in a two country set up with free capital flows the demand deposit contract is no longer efficient and hence there is some scope for financial regulation. The source of inefficiency is an externality problem between banks and their liquidity decision which can also be translated into an externality problem between regulators.

Consider a two period endowment economy. There is a continuum of ex ante identical agents (depositors) whose measure is normalized to one. There is a planning period \((t = 0)\) in which depositors decide to allocate their endowment \(w \geq 0\) in order to satisfy future liquidity needs and to make a long run partially illiquid investment in the representative firm of the economy. There is an exogenous source of uncertainty in this baseline model. Consumers may be impatient and derive utility only through consumption of the only completely perishable good in period \(t = 1\) \((c_1)\) or may be patient and derive utility only from period \(t = 2\) consumption \((c_2)\), there is a proportion \(\lambda\) of patient consumers and a proportion \(1 - \lambda\) of impatient ones. In the planning period, in which

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1We will not address all the currency issues related to financial instability and assume a framework of real economy without currency because in our model there is only one non-tradable consumption good.
they make their investment choices, they do not know which type of consumers they are, although they do know it in \( t = 1 \), this uncertainty makes a demand deposit bank contract Pareto efficient as in conventional literature \(^2\). Though efficient, the demand deposit equilibrium is compatible with an allocation that triggers a run such that there is a bank run probability \( p \) as explained in Chang and Velasco \((2000)\).

If a run takes place, there is a no-default probability \( q \) that depends on the bank’s liquidity investments and the system’s liquidity potential needs: \( q = \frac{b_0 + \rho L}{c_1} \) where \( b_0 \) represent liquid investment made by the bank in the planning period, \( L \) represents the long term investment and \( \rho \) represents the proportion of the long run investment the bank gets when redeeming it before period two. This means that long run investment is not completely liquid or that liquidation of the investment is costly. The existence of a default probability may be explained by the existence of asymmetric information: agents trust in the banking system although they don’t know how the system allocates its deposits and whether it manages its capital structure in a responsible way. A default is possible as long as \( c_1 \geq b_0 + \rho L \) holds. This means that default is possible as long as available liquidity is less than the maximum liquidity demand the bank can face.

Although a demand deposit contract economy is efficient\(^3\), two types of equilibrium exist in this model: a no default equilibrium and a default equilibrium. The latter is triggered as a consequence of rational expectations of depositors that may ask for their money back according to the exogenous probability \( p \). If a run takes place each depositor gets her money back in a first come first served way. If the bank holds enough liquidity the bank run is irrelevant and Pareto efficiency is attained. On the contrary only some depositors are served and default takes place. Depending on model parameters or certain constraints, it may be the case that it is optimal for a bank to default. Considering the former mechanism the Bank invests some of its resources in a liquid zero return asset \( b_0 \) and in capitalizing the representative firm which has a linear production function \( y = f(L) = RL \) with \( R > 1 \)\(^4\) and pays a return \( r_L \) for the capital \( L \) invested.

In order to analyze financial regulation issues with enough flexibility, our first innovation is to modify the Chang and Velasco \((2000)\) model by incorporating a regulated non-pecuniary punishment in the spirit of Dubey et al. \((2005)\)\(^5\). We will leave out non default equilibrium and will focus in solutions in which banks are able to default. With endogenous probability \( q \) the bank will account all its liabilities and with probability \( 1 - q \) the bank will stop paying its debts. If default takes place under a bank run (with probability \( p(1 - q) \)) the bank may incur in an exogenous utility cost \( F \) that could represent legal, administrative or government punishments. As long as \( F \to 0 \) our model collapses into Chang and Velasco \((2000)\) model. Under a demand deposit contract the depositors simply surrender their financial decisions to the bank by depositing their whole endowment in the bank during the planning period. Given the resources the bank gets from depositors, it decides how to allocate the funds between liquid short term assets and long term illiquid investments. In period \( t = 1 \) the types of depositors are revealed and the bank gives back the deposits to impatient consumers.Finally, in period \( t = 2 \), the bank pays back the patient consumers with the returns from the long term investment plus excess of liquidity kept from the first period. The bank solves:

\(^2\)Like in [Chang and Velasco \((2000)\). This demand deposit contract implies that the bank behaves as a mutual.

\(^3\)This type of contract implies that agents surrender their investment decisions to the bank and the bank tries to maximize its owners utility. That means that under uncertainty the bank takes advantage of the law of large numbers in order to achieve an efficient allocation.

\(^4\)It could also be interpreted as an illiquid long term asset.

\(^5\)In our case, and for simplicity, the punishment does not depend on the default magnitude.
\[ \begin{align*}
\max_{c_1, c_2, b_0, b_1, L} & \quad (1 - p)(\lambda u(c_1) + (1 - \lambda)u(c_2)) + pqu(c_1) - p(1 - q)F \\
\text{s.t.} & \quad b_0 + L \leq w \\
& \quad \lambda c_1 + b_1 \leq b_0 \\
& \quad (1 - \lambda)c_2 \leq R(L) + b_1
\end{align*} \] (1)

A demand deposit contract equilibrium is a set of allocations \( \hat{b}_0, \hat{b}_1, \hat{L}, \hat{c}_1, \hat{c}_2 \) such that given \( p \) and \( F \) the bank problem \( (1) \) is solved.

**Proposition 1.** Introducing regulatory default punishments in an efficient demand deposit model leads to an increase in liquidity reducing default probability at the cost of a welfare loss due to consumption reduction.

The formal proof is provided in Appendix. In equilibrium, the classic demand deposit contract, where optimal regulation is zero \((F = 0)\), is Pareto efficient and expected period one consumption is completely covered by liquid asset investment \( \lambda \hat{c}_1 = \hat{b}_0, \hat{b}_1 = 0 \). When regulation is present, since bank dislikes illiquidity, it will hold more proportion of its deposits in liquid assets than in the Pareto efficient allocation. Complementary, depositors, represented by the bank, will reduce their liquidity demands in period one in order to reduce default probability. As a result, the bank will hold an excess of liquidity that will be given back to patient consumers in period 2 reducing their consumption in second period since less funds have been invested in the firm. As a consequence, the utility derived will be lower. Although default is less likely to occur, impatient type consumers are punished by the regulation. Therefore there is a welfare cost of regulatory punishment in this economy. In terms of welfare the optimal punishment set by government should be zero because in an one country framework, the problem of the bank is the same as the problem of the government so there is no role for financial utility punishment.

### 3.2 A Two Country Default-Risk Economy: Liquidity externalities in Banking

Our second innovation is an extension of the model of [Chang and Velasco (2000)](Chang2000) to a two country case which will consist in the second stage of a sequential game that allows government fix regulatory punishments considering banks’ optimal responses. Consider a two country world where a unique non-tradable consumption good is produced in both countries and agents decide their consumption and savings choices in a context of perfect international capital mobility and the same type of uncertainty described before. The international financial system consists of two demand deposit banks, a home bank and a foreign bank; each bank will offer long run loans to each country’s representative firm and will provide long term debt to each other through deposits. Each bank will maximize its depositors’ expected utility.

Each country is represented by a continuum of ex ante identical consumers with concave utility functions \( u(c_t), v(x_t) \) for home depositors and foreigners respectively. There is a proportion \( \lambda \) of impatient consumers who derive utility only from period one consumption and a proportion \( 1 - \lambda \) of patient agents who derive utility only from second period consumption in home country. A \( \lambda^* \) proportion of foreign consumers are also impatient. There are also 2 periods plus a planning period. In the planning period \((t = 0)\) all consumers deposit their endowments \((w, w^*, \bar{w} = w + w^*)\) to

We represent home country variables with no asterisk and foreign variables with asterisk.
each country’s bank and the bank makes financing and investment decisions without knowing each depositor type\(^7\). Each bank decides whether to keep all deposits for liquid and illiquid investments or to transfer funds to the foreign bank and receive a return at \(t = 2\). This is possible since there is perfect capital mobility of deposits and each country has different default probabilities \(q\) and \(q^*\) that add uncertainty to planning decisions. In the same way, the bank could demand some deposits from the foreign country that will help to increase its investment funds. We depart from traditional diversification approaches, in which a bank will invest in other country because of technological or return uncertainty, by allowing each bank to have different liquidity preferences and hence different probabilities of default \(^8\). As an example we could think of current investment decisions in the context of the European crisis. Spanish investors won’t invest in foreign assets because of uncertainty in returns. They are probably investing abroad because those financial institutions are more reliable. With its financing decision taken, the bank decides how to allocate available resources between short term liquid assets \(b_0\) and long term investments in firms (\(L\) for home bank and \(L^*\) for foreign bank).

There exists a non-idiosyncratic bank run probability \(p\) that affects the whole world banking system. If a run occurs, each bank presents a no default probability \((q, q^*)\) that is a function of system’s exogenous regulatory punishments \(\bar{F}(F, F^*)\) and of the system’s liquidity holdings \(h\):\(^9\)

\[
q = q(\bar{F}, h) \\
q^* = q^*(\bar{F}, h) \\
h \equiv \frac{b_0 + b_0^* + \rho L + \rho^* L^*}{c_1 + x_1} \\
q', q'' > 0, q''', q'''', < 0
\]

In period \(t = 1\) the bank gives deposits back to impatient agents in order to satisfy their consumption needs \((c_1 \text{ or } x_1)\) and the bank reallocates the excess of liquidity (if it exists) as a transfer to second period consumers \((b_1, b_1^*)\). In second period \(t = 2\), the domestic bank receives returns from its investments in the representative firm, and pays returns to foreign deposits \(z^d\) made in the planning period.

Under a demand deposit contract, the domestic bank solves\(^10\):

\[
\max(1 - p)(\lambda u(c_1) + (1 - \lambda)u(c_2)) + p \left[ \frac{d}{w} q + \frac{d^* s}{w} q^* \right] u(c_1) - p \left[ 1 - \frac{d}{w} q - \frac{d^* s}{w} q^* \right] F \tag{2}
\]

s.t.

\[
d + d^s \leq w \\
b_0 + L \leq d + z^d \\
\left[ \frac{d + z^d}{w} \right](\lambda c_1 + \lambda^* x_1) + b_1 \leq b_0 \\
(1 - \lambda)c_2 + (1 + r_w)z^d \leq RL + b_1 + (1 + r_w) d^s \\
c_1, c_2, b_0, b_1, L, d, d^s, z^d \geq 0
\]

\(^7\)No home-bias is assumed either for domestic nor foreign consumer deposits.

\(^8\)For simplicity we impose complete home bias in firm investments. The implications and nature of the problem in the model are the same in that case since firm long run investment diversification decisions do not affect liquidity choices.

\(^9\)In case of a bank run each depositor receives her money in a first come first serve basis.

\(^{10}\)Foreign bank solves the same problem.
The first constraint represents resources availability at planning period and implies that the bank may decide to invest in foreign bank $d^{ss}$ in order to manage default risk. Second constraint represents bank balance sheet and the tradeoff between liquid and illiquid investments. Third constraint implies that liquidity investment must be enough to cover the share of bank’s expected liquidity demand and liquidity investment in period 1. Fourth constraint implies that expected second period consumption is bounded by foreign investments returns net of loans payments and home production. Each country has a linear production function for the representative firm. It is noteworthy that we assume, for simplicity, that truth telling constraint ($c_2 + x_2 \geq c_1 + x_1$) and ($c_1 + x_1 \geq b_0 + \rho L + \rho^* L^*$) are not binding Chang and Velasco (2000).

The objective function takes into account the joint probability of a bank run and the no default probability $q, q^*$ of each bank weighted by the proportion of deposits in each bank as a share of global endowment ($\bar{w} = w + w^*$). There is also a government punishment that is triggered if the bank defaults as discussed in the previous section. Since default probabilities depend on the banking system liquidity and on total potential liquidity demand there is room for strategic behavior of banks. Each bank solves its problem taking as given the variables concerning the other as if they were in a Cournot way$^{11}$.

Equilibrium is a set of allocations $\{c_1, c_2, b_0, b_1, L, d, d^{ss}, z^d\}$ and $\{x_1, x_2, b_0^*, b_1^*, L^*, z, z^{ss}, d^d\}$ and a set of prices $\{R, R^*, r_w, r_w^*\}$ such that, given prices, each bank solves its problem and international market clearing conditions hold:

$$d^{ss} = d^{dd}$$
$$z^s = z^d$$
$$\lambda c_1 + \lambda^* x_1 + b_1 + b_1^* = b_0 + b_0^*$$
$$(1 - \lambda)c_2 + (1 - \lambda^*)x_2 = RL + R^* L^* + b_1 + b_1^*$$

In equilibrium each bank equals net marginal utility of first period consumption (potential liquidity demand) to marginal utility derived from second period consumption:

$$\left[1 - p + \frac{p}{\lambda} (\frac{d}{w} q + \frac{d^{ss}}{w} q^*)\right] u'(c_1) - \frac{ph}{\lambda (c_1 + x_1)} \left[\frac{d}{w} q' + \frac{d^{ss}}{w} q'^*\right] (u(c_1) + F) = u'(c_1) (1 - p) (\frac{d + z^d}{w})$$

In the same way each bank equals net marginal revenue of maintaining liquidity to long term investment marginal benefit:

$$\frac{p(1 - \rho)}{c_1 + x_1} \left[\frac{d}{w} q' + \frac{d^{ss}}{w} q'^*\right] (u(c_1) + F) = u'(c_2) (1 - p) (R - 1)$$

$^{11}$The model here is solved using an strategic approach for simplicity, the same logic applies in a multi-country framework as long as the number of banks is low enough. For a large number of banks, the influence of each bank in the system’s total liquidity is very small and hence the strategic approach will not hold and $h$ won’t be determined endogenously from each bank’s strategy. For our model to work, we need some market power to influence global liquidity. Nevertheless $h$ will be endogenously determined in equilibrium and will affect banks’ behavior with a similar reasoning than in the strategic case.
If the home country has a higher default probability it will have to offer higher returns to foreign investments in home firm than the returns home bank receives for its deposits on the other bank:

$$\frac{p(q - q^*)}{\bar{w}} \left[ u(c_1) + F \right] = u'(c_2)(1 - p)(r_w^* - r_w)$$

(6)

These relations hold for foreign bank as well and let both entities equal inter-temporal marginal substitution from consumption and also marginal gains and losses from liquid and illiquid investment decisions. Note that all returns gaps disappear as long as default probability for each country gets closer to the one of the other.

**Proposition 2.** In a two country environment, demand deposit contracts are not efficient anymore. Inefficiency is caused by an externality problem. As a result liquidity level in the economy is lower than optimal.

Formal proof is found in the Appendix. Since default probability depends on aggregate liquidity $b_0 + b_0^*$ each country’s optimal reaction is to keep less liquidity and benefit from the stability signal that the system would show as a consequence of the responsible behavior of foreign country. This situation represents an externality in the liquidity decision of banks. In equilibrium both banks have enough incentives to keep less liquidity than the level they would keep if they solved a joint problem. This conclusion holds also when $F, F^* \to 0$.

The following graph illustrates this relation:

![Diagram](image)

**Figure 1:** Liquid assets allocation and externalities

The figure above depicts reaction functions in both cooperative and no cooperative solutions. As shown above, under a non-cooperative solution each bank holds less liquidity ($\tilde{b}_0, \tilde{b}_0^*$) than in the
cooperative case \((\tilde{b}_0, \tilde{b}_0^*)\) so aggregate liquidity and no crisis probability are lower. Optimal response will be to hold less liquidity than the centralized socially optimal solution. The former result shows that demand deposit contracts although solve uncertainty problems they are not able to solve externalities problems in an international interaction framework.

Although in the single country model regulation means welfare losses, in the two country framework regulatory punishments make banks dislike defaults and hold more liquidity than in the non-cooperative solution. Regulatory punishments have costs in terms of consumption and long term investments for home country. On the other hand, since foreign regulation forces the other bank to be more liquid and hence to have a lower default risk, optimal reaction for home bank is to keep higher levels of consumption and long term investments. There is a tradeoff between stability and consumption that governments could face when choosing the magnitudes of punishments, this tradeoff and the interconnection of the economy easily lead to an externality problem in regulation too. What’s more, if banks colluded and acted in an efficient way, government’s regulation decision would still have the externalities problem since system default probability depends on joint regulatory effort, translating a private banking problem to a public policy problem. We will discuss this issue in detail in the next section.

4 Liquidity Externality extended to Regulation Externality

As shown in the former section, governments will be interested in a reliable system and in maximizing the probability that a bank accounts for its liabilities and attains optimal results since demand deposit contracts are not efficient anymore. Nevertheless, the only way a government can offset default incentives is by increasing default punishment, but this action implies costs in terms of consumption and liquidity needs. In our complementary set up, to be presented below, the effectiveness of government punishment depends on how committed with international system reliability the neighbor government is. In general, the externality problem, generated in an international bank interaction environment, is traduced to a government problem and to a public policy strategic regulation environment problem.

We describe the first stage of the two stage game: government have to decide their optimal financial regulation level \((F)\). In a similar way as in Bagwell and Staiger (1999) there is an effect of home country behavior in foreign country welfare. Each country would like to benefit from an international reliable financial system but, since this result depends on collective action and since there is an intervention cost, each country will establish a punishment lower than the one that is optimal in order to preserve a reliable system, all of this will lead to an externality problem with a sub optimal allocations. This is true as a result of the solution to the model presented in the former section, since we supposed that no default probability for each bank \((q, q^*)\) are functions of \(h\) and aggregate regulation \(\bar{F} = F + F^*\).

Given the equilibrium allocations it is possible to derive expected indirect utility functions for both countries:

\[
U = U(\hat{c}_1(F, F^*), \hat{c}_2(F, F^*), q(\bar{F}, \hat{h}(F, F^*)), F)
\]

\[
V = V(\hat{x}_1(F, F^*), \hat{x}_2(F, F^*), q^*(\bar{F}, \hat{h}(F, F^*)), F^*)
\]

As a consequence of Proposition 1 it can be shown that: \(\frac{dc_1}{dF} < 0, \frac{dc_2}{dF^*} < 0, \frac{db_0}{dF} > 0, \frac{dx_1}{dF^*} < 0, \frac{dx_2}{dF^*} < 0, \frac{db_0^*}{dF^*} > 0\). From optimality conditions it can be shown that: \(\frac{dc_1}{dF^*} > 0, \frac{dc_2}{dF^*} < 0, \frac{db_0}{dF^*} < 0, \frac{dx_1}{dF^*} > 0\)
0, $\frac{dF}{dF} < 0$, $\frac{dB}{dB} < 0$. Assuming that direct effects are bigger than externality effects (that is: $|\frac{dF}{dF}| > |\frac{dc}{dc}|$, $|\frac{dF}{dF}| > |\frac{dx}{dx}|$ and $|\frac{dB}{dB}| > |\frac{db}{db}|$) it can be shown that $\frac{dF}{dF}$, $\frac{dB}{dB} > 0$. For simplicity and following Bagwell and Staiger (1999) we collapse our value function to a generic welfare function. This is important since it allows us to arrive to conclusions that will not depend on a particular welfare specification and of particular political objectives of the regulator. Welfare functions can be presented as$^{12}$:

$$W = W(F, F^*, \bar{F})$$

$$W^* = W^*(F, F^*, \bar{F})$$

With: $\frac{\partial W}{\partial F} < 0$, $\frac{\partial W}{\partial F} > 0$, $\frac{\partial W^*}{\partial F} < 0$, $\frac{\partial W^*}{\partial F} > 0$, $\frac{\partial W}{\partial \bar{F}}$, $\frac{\partial W^*}{\partial \bar{F}} > 0$. As derived above, welfare decreases with stronger single country regulation because of consumption consequences and increases with aggregate regulation because no default probability improves.

Suppose now that governments decide their optimal regulation before banks solve (2) considering each bank’s optimal reaction. The timing is as follows: In a first stage, governments planning period, each government will try to decide optimal regulatory punishment to allocate in order to maximize its generic welfare function ($\frac{\partial W}{\partial F} = 0$, $\frac{\partial W^*}{\partial F} = 0$) given each bank optimal responses. In a second stage, the banks’ planning period, each bank decides how to finance its investment decisions given each governments (and aggregate) revealed regulation effort. Periods $t = 1$ and $t = 2$ are similar to the two bank former setup.

The game’s equilibrium comes from a backward solving solution. In the first stage:

$$\max_{F} W = W(F, F^*, \bar{F}) \quad (7)$$

Foreign government solves a similar problem.

**Proposition 3.** Given the optimal bank game allocations, there is an externality problem at the government level in terms of regulation.

**Proof.** Given optimal banks responses, non-cooperative first order conditions imply:

$$\frac{\partial W}{\partial F} + \frac{\partial W}{\partial \bar{F}} = 0 \quad (8)$$

If both countries cooperated, first order conditions would imply:

$$\frac{\partial W}{\partial F} + \frac{\partial W^*}{\partial F} + \frac{\partial W}{\partial \bar{F}} + \frac{\partial W^*}{\partial \bar{F}} = 0 \quad (9)$$

Given fix regulatory punishments $F, F^*$ the marginal welfare net gain in the non-cooperative case is smaller than the social marginal welfare gain. Hence, regulation is lower in the non-cooperative case. As a result of that, system reliability is lower than the socially optimal. In general, a country will react in an opposite way to its neighbors regulation effort.

$^{12}$These function can be interpreted as monotonic transformations of indirect utility functions
In fact, if foreign country increased regulation effort, since a more reliable system would be likely, home country would like to benefit from that stability without incurring in expensive bank regulations. What’s more, government will have the incentive to take advantage of a trusted global system and to release own countries regulations.

Under a non cooperative solution each government chooses the regulation effort that is the best response given optimal behavior of foreign country. Given the externality problem described before, the Nash equilibrium \( \{\hat{F}, \hat{F}^*\} \) implies that regulation in each country is lower than socially optimal regulation and global regulation is lower than maximum welfare regulation. There are no incentives to be committed to a cooperative arrangement since extra benefits could be attained by no cooperation and free rider behavior. This conclusion leads to an important problem of public policy, is it possible to brake incentives to deviate from a cooperative game? Is it possible to set a normative framework that allows both country reach socially optimal results?

5 Solution to the Externality Problem: Principles for a World Finance Organization (WFO)

Let’s suppose an economy with two identical countries that face up the same prisoners dilemma as the one described above, which should be the agreement that leads both countries to Pareto optimal results?. In this case the solution would be straightforward. since both countries are identical, it is enough with a protocol that establishes that default punishments will be equal across countries. The former arrangement is pretty simple and of costly implementation because of the strong assumption that the two countries are identical in welfare functions and in their financial situation. This last assumption is a strong one that may not be likely to hold in most of cases. A more realistic agreement that allows countries to internalize the external effects of its actions would have to be a little bit more sophisticated and would have to take into account differences in size of financial systems of each country and the costs of regulation associated to that.

Bagwell and Staiger (1999) develop a conceptual and analytical framework that solves a prisoners dilemma in the context of international trade by establishing an agreement based on two strong principles that rule bilateral and multilateral negotiations, those two principles are the base idea behind the GATT (later to become the World Trade Organization). In our framework, using those principles will allow us to show that the externality problem in a public policy environment may be solved, both principles make no assumptions about symmetry between countries and lead us to more general conclusions than the ones of the previous approach. These principles may be conceived as the cornerstone of an international organization that we will call World Finance Organization.

5.1 World Finance Organization First Principle: Reciprocity

In international trade, reciprocity may be understood as a change in tariffs such that total imports vary in the same way in both affected countries. This principle does not mean that tariffs are the same across countries but it does imply that tariffs effects are equal. That way, powerful and small economies are compensated by their policy’s decisions. In our framework, reciprocity would imply that consequences of a change in regulation tools \( F \) and \( F^* \) will be the same across countries.

Departing from our previous set up, reciprocity may be defined as a change in \( F \) and/or \( F^* \) such that relative changes in one countries consumption will equal relative changes of its neighbor.
We define home consumption as:

\[ C \equiv \lambda \tilde{c}_1 + (1 - \lambda)\tilde{c}_2 \]
\[ X \equiv \lambda^* \tilde{x}_1 + (1 - \lambda^*)\tilde{x}_2 \]

So given a change from \( F^0 \) and \( F^{\ast 0} \) to \( F' \) and \( F'^{\ast} \), the reciprocity principle would imply:

\[ \frac{\Delta C}{C^0} = \frac{\Delta X}{X^0} \]

Where \( \Delta C \equiv C' - C^0 \), \( \Delta X \equiv X' - X^0 \).

**Proposition 4.** A cooperative efficient regulatory agreement is possible if the principle of reciprocity holds.

**Proof.** Using each bank first and second period resource constraint from (2) and using market clearing conditions for the banks problem:

\[ \Delta C = (\Delta (B_0) + \Delta RL + R^* L^*) \frac{C^0}{C^0 + X^0} \]
\[ \Delta X = (\Delta (B_0) + \Delta RL + R^* L^*) \frac{X^0}{C^0 + X^0} \]

(10)
(11)

Where \( B_0 = b_0 + b_0^* \). Reciprocity rule states that both countries will share the same aggregate revenues in terms of profits given a change of regulation effort. Under the arrangement of a cooperative solution, if there is not a reciprocity rule, each country will have the incentive to lower regulation effort thinking that foreign country will take care of that problem, that incentive means that a country can have extra benefits and let the other country assume the losses. Since the unique incentive to deviate from a regulatory agreement is to get extra earnings given the neighbor actions and despite the neighbor’s welfare losses, by imposing reciprocity and sharing aggregate variations there is no incentive at all for a country to deviate from arrangement. In fact under the reciprocity the only regulatory changes are the ones that improve the economy result as a whole and let both banks better off. With this agreement Pareto inferior Nash equilibrium is broken and both countries are better off because reciprocity rules out regulation changes that do not improve welfare as a whole.

\[ \square \]

Not only are social marginal gains (losses) shared, the way they are shared depends on how big a country is in relation to the other. This implies that larger economies will assume a higher share of the costs in case a crisis is triggered as a consequence of non cooperative behavior.

The previous issues discussed above are behind reciprocity principle. A small country could decide to lower regulation effort in order to get extra benefits from the externality problem, but as long as reciprocity is arranged, the small country will get a low share of the benefits its governors where willing to take. Conversely, a big country could be tempted to be less worried about regulation since it will get a higher share of the benefits. Nevertheless a small change in its regulation behavior will have great impact on world economy so a bank run and a crisis could be triggered offsetting possible benefits of lowering regulation. So reciprocity, regardless of country size, makes a country commit to a cooperative behavior.

The no discrimination principle is a rule that allows the reciprocity principle to be extended to a multilateral arrangement environment. In our case, given a multilateral bargaining context the application of most favored nation principle (MFN) will allow the bilateral reciprocal agreement to extend to the rest of the members with no regard of their negotiation status. In a financial context, an agreement that extends obligations of a greater (lower) regulation between two countries in a bargaining group will have to be extended to the rest of the members of the group as a consequence of the application of reciprocity principle and the most favored nation status for all agreement members. The main idea of this section is to apply this MFN principle to a multilateral negotiation in order to solve an extended externality problem when several countries interact.

First principle (reciprocity) allows a bilateral regulatory arrangement to hold and solve the externality problem that our basic two country model implies. Nevertheless, this principle is not enough when the analysis is extended to a multi-country set up. Although two countries can make a reciprocal agreement, when there is a third one, the country that is not in the agreement may have benefits from the responsible behavior of the other two countries at no regulation cost. In this case reciprocity would not be enough since the third country knows that with certainty the other countries will cooperate. A new principle is necessary to ensure an agreement with third party and enforcement of such arrangement.

To solve this problem, we include in our model a rule that incorporates the “Tob-in” tax. Let’s consider a three country framework. Countries 1 and 2 achieve an agreement under reciprocity principle and they behave as if their regulators behave in a cooperative way, so the externality problem is solved between the two countries in the same way it does in previous section. Since country three does not achieve the arrangement countries 1 and 2 decide to apply the following rule:

**“Tob-in” Tax Rule:** If country 3 does not achieve the arrangement, a tax rate $\tau$ is applied to deposits in country 3 banking system and to the loans provided from country 3. If it does, no discrimination principle is applied.

The former rule can be shown as an extension of the two country framework. Consider as an example the three period problem of country 1’s bank under the tax rule\(^{13}\):

\[
\max(1-p)(\lambda u(c_1) + (1-\lambda)u(c_2)) + p \left[ \frac{d}{w + w^*}q + \frac{d^s}{w + w^*}q^s \right] u(c_1) - p \left[ 1 - \frac{d}{w + w^*}q - \frac{d^s}{w + w^*}q^s \right] F \\
\text{s.t.} \quad d^s + d^{ss} \leq w_1 \\
\quad b_0 + L \leq d + z d \\
\quad b_1 + \frac{d + z d}{w + w^*} [\lambda c_1 + \lambda^* x_1] \leq b_0 \\
\quad (1-\lambda)c_2 + (1+r_w)(1+\tau_z)z \leq RL + b_1 + (1+r_w^*)(1-\tau_d)d^{ss} + T
\]

\(^{13}\)The same intuition is applied for country 2
Where in this example \( d = d_1 + d_2 \) is an aggregation of the coalition deposits in the coalitions bank and \( T = \tau_z (1 + r_w) z d + \tau_d (1 + r_w^*) d^* \). The tax on deposits international revenue is denoted by \( \tau_d, \tau_z \).

For simplicity we assume that debt and deposits returns within coalition countries (1 and 2) are the same\(^{14}\) and are represented in this case by \( r_L, r_w \) respectively.

As a consequence of the distortions, in equilibrium, for a same default probability and same liquidity costs:

\[
1 + r_w = \frac{1 - \tau_d}{1 + \tau_z} (1 + r_w^*)
\]

In this case the tax structure distorts deposit returns and country three will have to offer a higher return to coalition deposits in order to be attractive. If the incentive created by the “Tobin” tax acts correctly, in equilibrium, this tax should be zero because every country should participate in the WFO.

If we consider the problem of countries 1 and 2 this tax \( \tau \) has two important effects: there is an endogenous “coalition bias” in deposit markets, so the joint country 1 and 2 system has more funds, this implies lower lending interest rates for the third country banking system and lower bank profits.

Country 3 banking system’s demand for funds from coalition banks will be lower, so its return for deposits will. As a result of the tax structure the costs of financing loans with coalitions capital will be higher, profits will decrease and country 3’s bank share in global system will be lower and in aggregate country 3’s consumption possibilities will be bounded.

In the model presented in this paper there is full home bias in long term investment or long run loans. In a model with international flows, the tax structure described before, will have strong effects on capital flows between country 1 and 3 and between country 2 and 3. For the economies that commit in the reciprocal agreement, intra group financial flows will be free as opposed to flows from/to country 3. As shown above there will be “coalition bias” and a consequence of this will be a segregation of country 3 banking system. Also, the application of the tax leaves country 3 worst off since its financing and lending possibilities are affected. If only country three would change its mind and decide to negotiate countries 1 and 2 will have to apply the Most Favored Nation(MFN) principle and capital flows to/from country three will not be taxed. The tax menace will serve as an enforcement device to make country 3 change its mind and incur in a negotiation process, so the application of no discrimination principle in the negotiation will eliminate the multi-country externality problem.

Country 3 will accept the arrangement and cooperates if both, participation and incentives constraints are fulfilled:

\[
W^3 (\{ \hat{F} \}, F^3 + F) \geq W^3 (\{ \tau_d, \tau_z \}, F^3 + F)
\]

\[
W^3 (\{ \tau_L = \tau_K = \tau_w = 0 \}, \hat{F}^3 + \hat{F}) \geq W^3 (\{ \tau_d = \tau_z = 0 \}, F^3 + F)
\]

Where \( W^3 \) denotes welfare from country 3 as a function of taxes and global regulation. \( F^3 \) and \( F = F^1 + F^2 \) represent country 3’s regulation and joint coalition regulation respectively, \( \hat{F}^3 \) and \( \hat{F} \) represent optimal regulation under a reciprocal arrangement.

\(^{14}\)This assumption is possible since it is a result of a two country model with no taxes.
First equation shows that country 3 will decide to negotiate with countries 1 and 2 if and only if the welfare attained by the tax alleviation and a more responsible (costly) regulation is greater than welfare in a taxed-no regulation situation. So if countries 1 and 2 choose a tax that leaves country 3 worst off, the participation of country three in the negotiation process will be possible. Second constraint means that country 3 will accept the agreement with a responsible behavior if and only if welfare associated to a responsible regulation is greater than welfare under a free riding strategy. Since reciprocity breaks the prisoners dilemma, second constraint is satisfied.

Application of MFN principle when a bunch of countries decide to discuss an arrangement about regulation derives in a free capital flows environment once the arrangement is set. MFN rules out the scenarios in which a country tries to tax international flows in order to modify its externality exposure and its neighbor’s. This result implies that under the two principles stated above free capital flows and responsible banking behavior induced by regulatory punishment and institutional background are possible.

We also have demonstrated the use of a Tobin Tax different to the approach it originally had. This Tobin Tax is for generating the incentives necessary for participating in multilateral agreements rather than to deter short term capital inflows. We call this the “Tob-in” tax.

5.3 World Finance Organization Third Principle: Fundamentals for a Lender of Last Resort and the “Tob-out” tax

We have demonstrated that with the two principles presented the market failure, that arises due to the externality problem of each banking system holding less liquidity than the optimal, is solved. Although with the international organization proposed this problem is solved, there is still a non-negative probability of default for the banking system of each country. Due to this, the role of a lender of last resort (LOLR) to address this default possibility is necessary. Furthermore, the actual context prevailing in the euro crisis and the subprime crisis has revived the discussion of the need and roles of a global LOLR.

The literature has discussed the role of the LOLR (assumed by Central Banks), following the ideas of Bagehot (1873), in which under certain conditions, commercial banks facing liquidity problems can turn to them for obtaining short-term loans. The market failure that justifies this type of action arises because during crises banks have difficulties to transmit credible information to agents in relation to the credit capacity of the banks and the sustainability of their holdings. The traditional view of Bagehot (1873) of lending to illiquid solvent financial institutions has been challenged by other views. Freixas and Rochet (2008) resumes these three different views in which the first complements the one of Bagehot (1873) saying that solvency is not relevant because illiquid banks are all under the suspicion of the public that they are insolvent. The second challenging view argues that the LOLR function must be restricted to the use of open market operations. Finally, the last challenging view argues that the market would lead to a better allocation than a public LOLR would. The introduction of a LOLR in our model will follow the view of the first critics of Bagehot (1873).

The evidence on the effect of the creation of a LOLR mechanism points with no doubts to the conclusion that it has helped to avoid bank panics (Freixas and Rochet (2008)). Either way, there are social costs and externalities associated with the existence of a LOLR like contagion, panics, effects on securities markets and moral hazard problems. So, though the use of a LOLR has been
proved useful in avoiding bank panics, there is a need of taking care of these social costs.

In this context, the WFO should be complemented with the existence of a global LOLR to address the possibility of default (although this probability is lower if the WFO exists under the principles we have proposed). Efforts of modeling the role of a LOLR have been scarce. We follow the approach of Goodhart and Huang (2005), to include a LOLR in the model presented in this paper. We first include the LOLR with the moral hazard problem in the basic one-country model, show its effects and show how to address these effects with the WFO.

We include the decision $S$ of a LOLR in the economy presented in section 3.1 to support the demand of liquidity of the public to banks that are illiquid. If the LOLR decides to support the bank ($S = 1$), the demand of liquidity of the public will be fulfilled. However, there is a relation between this decision and the default probability $(1-q)$ due to the moral hazard problem. Following Goodhart and Huang (2005), since the LOLR knows that the existence of this rescue mechanisms affects negatively the decision of how many assets maintain in liquid form, the LOLR, in order to minimize his loss function, will be less disposed to support a specific bank if the probability of default is higher. This generates a negative relation between these two variables. Thus, the problem of the bank presented in (1) with this extension is:

$$
\max_{c_1, c_2, b_0, b_1, L} \quad (1-p)(\lambda u(c_1) + (1-\lambda)u(c_2))
+ \left[ \left( \frac{b_0 + \rho L}{c_1} \right) u(c_1)(1-S) + \left( 1 - \frac{b_0 + \rho L}{c_1} \right) S u(c_1) \right] p
- \left( 1 - \frac{b_0 + \rho L}{c_1} \right) pF
$$

s.t.

$$
\begin{align*}
\frac{b_0}{\lambda_1 + b_1} & \leq b_0 \\
(1-\lambda)c_2 & \leq R(L) + b_1 \\
g_0 + g_1 \left( 1 - \frac{b_0 + \rho L}{c_1} \right) & \leq S
\end{align*}
$$

The formal proof of the following proposition is shown in the appendix.

**Proposition 5.** Introducing a LOLR in the demand deposit economy reduces the amount of liquid assets and the effect of financial regulation of inducing banks to hold efficient levels of liquid assets.

The interpretation of this result is that now, the bank has incentives to hold less amount of liquid assets due to the moral hazard problem. Evenmore, the existence of a LOLR attenuates the effect of regulation towards holding optimal liquidity levels in the presence of the externality problem. This happens because as the bank knows that now, in the case of an illiquid situation, the LOLR will support the cash demand, the cost of regulation will not offset the effect of the rescue. This is one of the effects of having a LOLR that induces a moral hazard problem: now the bank does not have the incentives to be responsible of a possible default scenario and maintains less liquidity.

---

15 This relationship will be linear. The demonstration of this, thanks to a quadratic loss function of the LOLR, can be found in Goodhart and Huang (2005).
The goal of this section is to include the role of LOLR, as the evidence has proved it effective towards decreasing bank panics, but avoiding the negative effects that are associated with moral hazard. The proposed WFO could provide a solution to the moral hazard issue. We include a deposit insurance as a way of banks taking care of the cost of the role of LOLR in order not to induce the moral hazard problem. In this way, the bank would not have the incentives to hold less liquid assets because in the default situation, it would imply to lose the funds of the deposit insurance. Though Chang and Velasco (2000) have emphasized the costs associated with a deposit insurance, if this is implemented at a global level for members of a World Finance Organization that provide less financial volatility the moral hazard issue could be better addressed at the same time that rescue schemes induce reducing social costs of bankruptcy.

We include in the problem a deposit insurance. Banks of countries that participate in the WFO have to hold \( z \) funds to supply the enough amount of requirements to finance a possible default situation\(^{16}\). This funds, if not used, are turned back to the banks at the end of the game.

To make this work we include the following rule:

**“Tob-out” Tax Rule:** If a country achieves an agreement in order to belong to the WFO, a bank of this country will qualify for bailouts at a cost of an exogenous rule \( z \). If it is not used, it is returned to the bank.

Consider the problem extended to a country that belongs to the WFO and decides to qualify for bailouts:

\[
\max_{c_1,c_2,b_0,b_1, L} \quad (1 - p)(\lambda u(c_1) + (1 - \lambda)u(c_2)) \\
+ \left[ \left( \frac{b_0 + \rho L + z}{c_1} \right) u(c_1)(1 - S) + \left( 1 - \frac{b_0 + \rho L + z}{c_1} \right) Su(c_1) \right] p \\
- \left( 1 - \frac{b_0 + \rho L + z}{c_1} \right) pF \\
\text{s.t.} \\
b_0 + L \leq w - z \\
\lambda c_1 + b_1 \leq b_0 \\
(1 - \lambda)c_2 \leq R(L) + b_1 + z \\
g_0 + g_1 \left( 1 - \frac{b_0 + \rho L + z}{c_1} \right) \leq S
\]

**Proposition 6.** Introducing a deposit insurance leads increase the effectiveness of financial regulation in inducing optimal levels of liquidity.

The formal proof is provided in the appendix\(^{17}\). This goes in the direction discussed previously. Now, banks have the incentives to react more intensively to financial regulation because the effects

\(^{16}\)We don’t take care of how different banks distribute the costs of possible rescue plans mainly because our model works with one bank. Either way, it is possible to think of a structural rescue fund that is contributed by banks to finance possible default situations and don’t foster a moral hazard problem.

\(^{17}\)Such as the last problem, the extension of this problem to a two country framework does not change the main results. We preferred to expose this extension in a one country framework to simplify the presentation of the solution to the moral hazard created by the presence of the LOLR.
of the LOLR are financed by their decision and thus, moral hazard issues are less significant. It is even possible to think of an endogenous level of deposit insurance from historic bank behavior to counteract completely the negative effects moral hazard has. The incentives are aligned with the participation in the WFO: not only the role of LOLR is less necessary thanks to improved financial agreements, but better addressed since now there are incentives to create better regulation agreements since bailout of a LOLR, without the issue of moral hazard, is conditioned to the participation in the WFO. By this, we incorporate a new role for deposit insurance: to boost the participation in the WFO in conditioning bailouts and to address the moral hazard problem. We call this deposit insurance “Tob-out” tax.

6 Concluding Remarks

Two main problems arise when talking about international financial markets. The first concerns a externality problem of liquidity decisions between banks. We have shown that although demand deposit systems are efficient in a single country framework because they solve uncertainty problems such as shown by Diamond and Dybvig (1983) and Chang and Velasco (2000), they cannot solve the externality problem that appears when banks have no incentives at all to hold enough liquidity since the whole financial stability lies on aggregate liquidity holdings. Although in an efficient environment regulation is not welfare improving, under inefficient allocations, regulation is a tool to narrow the probability of a default scenario when bank runs appear since it encourages banks to behave in a responsible way.

The second is related to the fact that regardless of banks’ cooperative or non cooperative behavior, in an integrated multinational financial system, regulation is a matter of two. Therefore, given the banks’ optimal decisions, the externality problem is still present at the policy maker level. As shown by Proposition 1, regulation is costly in terms of consumption, hence each policy maker would have benefits of having lower regulatory punishments while the other regulator makes deeper efforts. These two problem have been some of the main characteristics of recent financial crisis; what’s more, the mechanisms and nature of the externality problem are the same that would arise when analyzing governments and debt holding for example.

Given the global nature of the problems, we have shown that the solution to them is global as well. Since policy makers are trapped in a Pareto inferior Nash equilibrium, there is a need for a global institutional framework that helps both regulators make an agreement about regulation efforts that ensures Pareto optimality. In this sense, we have shown with Proposition 4 that applying the reciprocity rule, as the WTO would do, results in aggregate benefit sharing. This results ensures that under reciprocity principle no country will have the incentives to change regulation and benefit itself in detriment of the other, in fact the only regulation changes might be agreements that leave both countries better off.

Though reciprocity is a strong rule, it can only assure enforcement in a bilateral arrangement by itself. In a multinational environment there is a need for a mechanism that can make countries start negotiating a financial agreement. Tobin taxes could be a tool for that. Cooperating countries could tax non cooperating countries financial flows while letting financial transactions free within cooperating countries. As long as this situation is costly for non cooperative countries they would agree to negotiate a regulation agreement under reciprocity. Once they start negotiations, MFN principle applies and international financial flows are once more free. Moreover, not only...
does MFN reinforces reciprocity principle in a strategic way, together they assure free capital flows and responsible bank behavior as a consequence of a regulation agreement based on two strong institutional principles. By this, we show a new justification for what we call a “Tob-in” Tax. In this WFO, it serves the objective of inducing appropriate financial regulation agreements instead of the traditional role of deterring short term capital flows.

As with the WFO the probability of default could still be non negative, we include a LOLR with a deposit insurance, that we call “Tob-out” tax, that conditions bailouts and attenuates the moral hazard problem. The WFO is useful to induce countries to contribute to a better functioning of a LOLR.

We have constructed a strategic model of financial regulation, to argue for an institution that should be isomorphic to the WTO and that we call the World Finance Organization consisting of a space for international regulation bargaining, and subject to the same two rules of bilateral trade negotiations: reciprocity and most-favored-nation. Just as Bagwell and Staiger (1999) did for the WTO we have shown how these two rules make up an institutional frame that allows to bring down the bilateral prisoner’s dilemma Nash equilibrium that sustains high tariff rates, and allows a viral expansion of trade liberalization when negotiations are repeated and replicated across countries. We do not suggest the creation of a defined financial institution, but the mechanism to endogenously generate the appropriate institution for a better functioning of world finance.

World leaders should not be meeting to discuss financial regulation itself, but rather the institutional structure that will allow for a mechanism of bilateral negotiations that will eventually drive the world towards free and healthy finance in the same way that the institutions for bilateral trade negotiations have driven the world towards free and healthy trade.

References


A Appendix

A.1 Formal proof of Proposition 1

Proof. We will proof proposition 1 showing first that liquidity holdings increase as a consequence of regulatory punishment. Afterwards, we will show that regulatory punishment leads to decreases in consumption in period one an period two. Consider (I) and first order conditions (15) and (16).

\[
\left[(1 - p) + \frac{p}{\lambda} \left(\frac{b_0 + \rho L}{c_1}\right)\right] u'(c_1) - \frac{p}{\lambda c_1} \left(\frac{b_0 + \rho L}{c_1}\right) [u(c_1) + F] = (1 - p)u'(c_2) \tag{15}
\]

\[
p \left[1 - \rho + \frac{R - 1}{\lambda} \left(\frac{b_0 + \rho L}{c_1}\right)\right] u(c_1) + F = (R - 1) \left[(1 - p) + \frac{p}{\lambda} \left(\frac{b_0 + \rho L}{c_1}\right)\right] u'(c_1) \tag{16}
\]

From (16) it is possible to take derivatives of liquidity holdings \(b_0\) with respect to the regulatory punishment \(F\), fixing the rest of the variables:

\[
\frac{\partial b_0}{\partial F} = -\frac{\lambda(1-p) + b_0 + \rho L}{u(c_1) + F - u'(c_1)} > 0
\]

Former expression is positive since de denominator must be negative for complying with second order conditions. It shows that liquidity holdings increase as long as regulatory punishments. From the bank’s balance sheet, it can be inferred that \(b_0\) increases despite of a long term investment \(L\) decrease.
Another way of showing the former relation is by analyzing first order conditions for $b_0$ in (1):

$$\frac{pu(c_1) + F}{c_1} - \mu_1 + \mu_2 = 0$$

Where $\mu_1$ and $\mu_2$ are Lagrange multipliers associated to the bank’s balance and first period constraint, respectively. For the same level of consumption, long term investment and $b_0$ the marginal utility of holding liquidity is greater when regulation is present than in a case where $F = 0$. That means that the optimal investment in liquid assets has to be greater when regulation is present since it lowers marginal utility since objective function is concave.

Making $F = 0$ in (15) allows us to derive the first order condition for the no regulation case:

$$\left[ (1 - p) + \frac{p}{\lambda} \left( \frac{b_0 + \rho L}{c_1} \right) \right] u'(c_1) - \frac{p}{\lambda c_1} \left( \frac{b_0 + \rho L}{c_1} \right) u(c_1) = (1 - p)u'(c_2) \quad (17)$$

For a given level of second period consumption, difference between (15) and (17) is $\frac{p}{\lambda c_1} F > 0$ and since $u'' < 0$, first period consumption is smaller when regulatory punishment is present. Hence there is a welfare loss because of consumption reduction. Since $c_1$ decreases and $b_0$ increases, given that in equilibrium $\lambda c_1 + b_1 = b_0$, there is an excess of liquidity that is transferred to second period $b_1 > 0$. Finally, considering resource constraint for period $t = 2$, the fact that as a consequence of regulation there is an excess of liquidity $b_1$ transferred to period $t = 2$ from first period, and that long term investment $L$ decreases as a consequence of the liquidity increase, the available resources for consumption in $t = 2$ are lower when regulation is present since long term investment have positive returns($R > 1$). Thus, with lower consumption in both periods there is a welfare loss due to regulation.

A.2 Formal proof of Proposition 2

Proof. Consider the problem in (2). First order conditions for liquidity holdings $b_0$ in home country imply$^{18}$:

$$\frac{p}{c_1 + x_1} \left( u(c_1) + F \right) \left[ \frac{d}{dq^*} + \frac{d^*}{dt} q^* \right] - \mu_1 + \mu_2 = 0 \quad (18)$$

Where $\mu_1$ and $\mu_2$ are Lagrange multipliers associated to the bank’s balance sheet and to the first period constraint. From the former expression it is straightforward to note that reaction function’s slope is $\frac{db_0}{db^*} = -1$.

Now consider the centralized solution to the two banks problem.

$^{18}$This relation also holds for foreign country
max(1-p)\{(\lambda u(c_1) + (1-\lambda)u(c_2)) + \lambda^* v(x_1) + (1-\lambda^*)v(x_2)\}
\quad + \frac{p(d + z\, q + d^* + z^*\, q^*)}{w + w^*\, q - d^* + z^*\, q^*)(F + F^*)}
\quad \frac{\partial b_0}{\partial S_{LOLR}} = -p \left[ \frac{(b_0 + \rho L)\left(\frac{u(c_1)}{c_1} - 2u'(c_1)\right) + u(c_1)2\lambda(1-\rho)}{R - 1} \right] < 0
\quad \frac{\partial b_0}{\partial S_{LOLR}} = -p \left[ \frac{u(c_1)\,(1-2S) + F - u'(c_1)(1 - 2S)}{c_1} \right] - \mu_4 \frac{\partial \theta}{\partial c_1} < 0

Again we suppose that truth telling and default crisis probability constraints are not binding. A cooperative demand deposit equilibrium in this two country world is a set of allocations \{\tilde{c}_1, \tilde{c}_2, \tilde{x}_1, \tilde{x}_2, \tilde{b}_0, \tilde{b}_1, \tilde{b}_1^*, \tilde{L}, \tilde{L}^*\}, such that, given the set of prices \{R, R^*\}, solve the former centralized problem.

First order conditions for liquidity holdings in home country imply \(b_0\):

\[
\frac{p}{c_1 + x_1} \left[ \frac{d + z\, q'}{w} + \frac{d^* + z^*\, q^*}{w} \right] (u(c_1) + v(x_1) + F + F^*) \theta_1 + \theta_2 = 0 \quad (19)
\]

Where \(\theta_1\) and \(\theta_2\) are Lagrange multipliers associated to global banking balance sheet and first period constraint. Consider (19) and (18). For fixed levels of consumption, long run investments and liquidity holdings for each country; the difference between optimality conditions is:

\[
\frac{p}{c_1 + x_1} \left[ \frac{d + z\, q'}{w} + \frac{d^* + z^*\, q^*}{w} \right] (u(c_1) + v(x_1) + F + F^*) > 0
\]

Former expression is positive and represents the marginal social benefit from liquidity not accounted by the noncooperative solution. Optimality requires that equations (19) and (18) are equal to zero. Since for a fixed level of liquidity (19) is bigger than (18), the only way to rise private marginal liquidity revenues in (18) is to choose lower levels of liquidity in the case of home country. In a similar way, foreign country in a noncooperative solution holds less liquidity than socially optimal. As a result aggregate liquidity in the global banking system is lower than the socially optimal level.

A.3 Formal proof of Proposition 5

Proof. From first order conditions of the problem in (13) we can prove that:

\[
\frac{\partial b_0}{\partial S_{LOLR}} = -p \left[ \frac{(b_0 + \rho L)\left(\frac{u(c_1)}{c_1} - 2u'(c_1)\right) + u(c_1)2\lambda(1-\rho)}{R - 1} \right] < 0
\]

This expression is negative since the first element in brackets in the denominator is negative and the first element in brackets in the numerator is positive due to second order conditions, \(g_1\) is negative

\[19\text{This also holds for } b_0\]
by definition and $\mu_4$ is the positive lagrange multiplier. With this, we prove that liquid holdings are smaller in the presence of the action of a LOLR (S). This result represents the problem of moral hazard: with the LOLR the optimal behavior of the bank is to be less concerned with the liquidity of the system.

The second conclusion of Proposition 5 is that with the inclusion of a LOLR, the effectiveness of regulation (F) to induce the appropriate level of liquid assets is smaller. From Proposition 1 we know that:

$$\frac{\partial b_0}{\partial F} = -\frac{\lambda(1-\rho)}{R-1} + \frac{b_0 + \rho L}{c_1} + \frac{g_1}{\lambda pc_1} > 0$$

In this case, the inclusion of a LOLR with moral hazard makes this relation still positive, but smaller:

$$\frac{\partial b_0}{\partial F_{LOLR}} = -\frac{\lambda(1-\rho)}{R-1} + \frac{b_0 + \rho L}{c_1} + \frac{g_1}{\lambda pc_1} > 0$$

The denominator is negative since the first two expressions are altogether negative due to second order conditions and $\mu_4\frac{g_1}{\lambda pc_1}$ is negative since $g_1$ is negative by definition and $\mu_4$ is positive by construction. By this, the expression is positive and as $\mu_4\frac{g_1}{\lambda pc_1}$ it is direct to evidence that:

$$0 < \frac{\partial b_0}{\partial F_{LOLR}} < \frac{\partial b_0}{\partial F}$$

This way, we prove that with the inclusion of this LOLR, the effectiveness of regulation decreases and thus, banks are no longer induced to hold efficient levels of liquid assets.

A.4 Formal proof of Proposition 6

Proof. In this setup, the effectiveness of regulation in inducing liquidity is:

$$\frac{\partial b_0}{\partial F_{LOLR-Dep}} = -\frac{\lambda(1-\rho)}{R-1} + \frac{b_0 + \rho L + z}{c_1} + \frac{g_1}{\lambda pc_1} > \frac{\partial b_0}{\partial F_{LOLR}} > 0$$

So, a deposit insurance in the presence of a LOLR with moral hazard helps to recover the effectiveness of regulation to induce banks the appropriate levels of liquidity in order to attenuate the negative effects of moral hazard induced by the existence of the LOLR.