"Taking Diversity into Account" : Financial Institutions Diversity and Accounting Regulation

Gaëtan Le Quang

October 2016

Abstract : The Global Financial Crisis and what has followed point out at least two major failures of the financial system : its inability to contain liquidity risk and its inability to fund long-term investments. We think that these two problems come from the setting up of rules and practices that tend to homogenize market participants incentives and behaviors. Fair value accounting is one elements of this set of practices and rules. If the rationale behind fair value accounting (roughly enhancing transparency in order to limit unreported losses and manipulations) can justify its use in the case of short-term financial institutions that constantly face the risk of a sudden liquidity need, it is totally irrelevant when it comes to long-term financial institutions that will not face liquidity needs before ten or twenty years. In this perspective, we develop a model that shows that an accounting regulation that takes financial instititutions diversity into account offers better results both in terms of liquidity and in terms of efficiency than a regulation that ignores this diversity.

1 Introduction

The Global Financial Crisis and what has followed point out at least two major failures of the financial system : its inability to contain liquidity risk and its inability to fund long-term investments. Concerning the question of liquidity, Brunnermeier and Pederson [7] describe what they called "liquidity spirals" which consist in the interaction of funding liquidity, namely the ease with which a financial institution can obtain funding, and market liquidity, namely the ease with which an asset can be traded. The general idea is that, in times of crisis, a financial institution can be confronted to a sudden liquidity need, for instance because some of its short-term creditors did not roll over their debts. To find liquidity, this institution can be forced to sell assets which can lead to a depreciation of asset prices. This depreciation will in turn put other financial institutions in search of liquidity which will depress furthermore asset prices. This fall of asset prices has two consequences in terms of liquidity : it has a direct negative effect on market liquidity but also a negative impact on funding liquidity in so far as it leads to a depreciation of the value of collateral used, for instance, in repurchase agreements which leads to an increase of haricuts associated to these contracts. This kind of mechanism is particularly strong in the case of highly leverage institutions such as banks. Indeed, as Adrian and Shin [1] point out, banks manage their balance sheets in such a way that their leverages are strongly procyclical : in time of boom, banking leverage tends to increase whereas it quickly decreases in time of bust.

Basically the main issue concerning liquidity is that in times of crisis all market participants want to sell their assets at the same time. Following Persaud [18] this is mainly due to the setting up of rules and practices that incentive all financial institutions to behave the same way. Precisely, the wide use of Value-at-Risk models, that strongly rely on short-term volatility, to manage risk and the progressive adoption of mark-to-market accounting rules, specifically fair value accounting rules as defined in 2006 in SFAS 157 or in 2011 in IFRS 13, give all market participants incentives to focus on short-term assets exhibiting low liquidity risk, which is one way, obviously not the only, to explain the inability of the financial system to fund long-term investments. Yet, some financial institutions, such as a young pension fund or a life insurer, have the natural ability, because of the maturity of their liabilities, to manage liquidity risk and can consequently handle long-term assets exhibiting high liquidity risk. The problem is that both the european directive Solvency 2, which basically extend capital requirements to insurers and pension funds, and the use of fair value accounting force insurers and pension funds to manage their balance sheets considering short-term volatility which can eventually prevent them from holding long-term assets. Consequently, we believe that both liquidity risk and long-term investments funding are two issues that could be adressed the same way : by taking market diversity into account. This paper focuses on the case of accounting and intends to show that an accounting regulation that takes financial institutions diversity into account offers better results both in terms of liquidity and in terms of efficiency than an accounting regulation that ignores this diversity.

Since the Global Financial Crisis, accounting issues, and particularly those related to fair value accounting, have gained ground in the economic field. Yet, those issues are not new and date back at least to the 1930s according to Laux and Leuz [14]. In particular, since the 1970s, the idea that financial reporting has to be as transparent as possible has progressively taken shape through the development of fair value accounting. Indeed, in the case of the United States, Heaton *et al.* [13] show that, from the 1970s, both an extension and a precision of fair value accounting rules have been observed as shown in the next table (Table 1). In the case of Europe, the adoption, in 2005, of the International Financial Reporting Standards (IFRS) by the European Union and the interactions between capital requirements in both Basel 3 and Solvency 2 and the IFRS give fair value accounting a central position in the financial sector. Yet, if fair value accounting does have some advantages (for instance it gives less room to manipulation than historical cost accounting as pointed out by Laux and Leuz [14]) it seems to have some noxious effects when it comes to financial stability. In particular, Bignon *et al.* [5] show that fair value accounting strongly enhances assets prices volatility, Plantin *et al.* [20] point out that fair value accounting is a bad option for institutions that manage long-term, illiquid and senior assets and Plantin and Tirole [21] show that, in the case of laissez-faire, market participants tend to overuse mark-to-market accounting which has deleterious effets in terms of liquidity.

Some empirical works have tried to estimate the impact of fair value accounting on the quality of the information displays by financial reports . For instance, Bernard *et al.* [4] compare danish banks, which are subjected to fair value accounting rules, to american banks, which are subjected to historical cost accounting rules over the studied period, namely 1976 to 1989. Using time series econometrics, they show that fair value accounting offers a more relevant information than historical cost accounting but induces an increased volatility. Barth *et al.* [3] also show that, for a sample of 136 american banks, fair value accounting increases the relevance of financial information. Studying the impact of fair value accounting rules (SFAS 107) on american banks' financial reporting over the period 1992-1993, both Eccher *et al.* [11] and Nelson [17] can't find any significative result concerning the superiority in terms of information quality of fair value accounting over historical cost accounting. Using a large sample of american firms over the period 1998-2010, Blankespoor *et al.* [6] show that fair value accounting increases the quality of the information carried by banks' leverage ratio in terms of credit risk. Concerning Europe, Capkun *et al.* [9], using a sample of 1722 european firms, show that IFRS offer a better financial information than local accounting rules. Concerning the use of fair value accounting rules by insurers, Ellul *et al.* [12] show that, in the case of U.S. insurance industry, insurers facing mark-to-market accounting tend to be more prudent in their portfolio allocations.

SFAS 107 (1991) requires "all entities to disclose the fair value of financial instruments, both assets and liabilities recognized and not recognized in the statement of financial position, for which it is practicable to estimate fair value".
SFAS 115 (1993) presents the distinction between *held-to-maturity securities* which are reported at amortized cost, *trading securities* which are reported at fair value and *available-for-sale securities* which are "reported at fair value, with unrealized gains and losses excluded from earnings and reported in a separate component of shareholders'equity."
SFAS 157 (2006) offers a proper definition of fair value that makes a distinction between three levels :
-*level 1* : there exists a market price so the fair value is equal to this price. This level is referred to as *mark-to-market.*
-*level 2* : there is no market price but it is possible to extract one from inputs observed in the market. This level is referred to as *mark-to-matrix.*
-*level 3* : there is no market price and it is not possible to infer one from inputs observed in the market. In this case, each firm determines a fair value based on unobservable inputs. This level is referred to as *mark-to-model.*
SFAS 159 (2007) extends the use of fair value accounting to a larger set of assets.

Table 1: Main Statements on the Financial Account Standards between 1990 and 2007

The main purpose of this paper is to show that accounting regulation has to take market diversity into account : if fair value accounting appears as a good option for some financial institutions, this is not the case for all financial institutions. In particular, we intend to show that institutions that are naturally, because of what they do, turned toward long-term issues (such as a young pension fund or a life insurer) should not have to focus on short-term volatility whereas institutions exhibiting shorter term preference do have to take this volatility into consideration.

We resort to a theoretical framework that is very close to the one developed by Plantin *et al.* [20]. In this respect, we make great use of the global game technique that was first introduced by Carlsson and Van Damme [8] and has been then continuously improved mainly by Morris and Shin (see for instance [15] and [16]). In particular, as our main purpose is to study the impact of market participants diversity on financial stability and on economic efficiency, we resort to a special kind of global game, namely a game with heterogeneous players. Such a framework was for instance developed by Corsetti *et al.* [10] and Bannier [2] to study the impact of a large trader on the probability of success of a speculative attack on a currency. In both cases, when players' actions are asymetric, the only way to find the *ex ante* unique equilibrium is to consider the limiting case where the noise associated with the signal that is granted to each player vanishes.

The model is presented in the next section and our main results are presented in section 3. Section 4 concludes.

2 Model

We present here the general framework of our model. As mentioned above, the framework is very close to the one developed by Plantin *et al.* [20] albeit we allow heterogeneity amongst financial institutions (FIs). Precisely, we take two types of FIs into account : "short-term" institutions (in proportion $1-k$) and "long-term" institutions (in proportion k). Implicitly, we suppose that the difference between these institutions lies in their liabilities' structure which translated into a difference in terms of time preference (the below-defined parameter ρ). More precisely, we make the assumption that "long-term" FIs have a funding structure that relies strongly on long-term instruments (as a young pension fund or a life insurer for instance) whereas "short-term" FIs rely much more on short-term or very-short term instruments (as is the case for a bank). Consequently, "short-term" FIs can possibly face short-term liquidity needs and prefer short-term assets with low liquidity risk. On the contrary, "long-term" FIs do not normally bother to care about liquidity risk given the very nature of their liabilities. Yet, we consider that because of the use of the same kind of risk management models and the necessity to fulfill similar capital requirements[1], all FIs hold the same portfolio.

There are 3 dates : $t = 0, 1, 2$. As has been just mentioned, all FIs hold a similar portfolio that yields v at an uncertain date : it yields in $t = 1$ with a probability $1 - d$ and it yields in $t = 2$ with a probability d. Each FI can eather hold its portfolio until it pays or sells it to a special purpose vehicle between $t = 0$ and $t = 1$. We make the assumption that the portfolio is made of an asset that is not traded in an active market (such as loans or securitized loans). In consequence, there does not exist a market price for this asset and FIs need to resort to an intern model to price their portfolio :

$$p(v) = \delta v - \gamma s \tag{1}$$

where δ is a positive constant smaller than 1 that captures asset specificity (meaning the ability of an asset to have value not just for its owner but for every firm),γ is a positive constant that captures market liquidity (the larger γ is, the least the market liquid is), s is the number of FIs that have sold their portfolio. We suppose that if a FI wants to sell its portfolio, it faces a price $p = \delta v - \frac{\gamma}{2}s$ (i.e. the position of a FI in the sellers' line follows a uniform law on $[0, s]$). If a FI does not sell its portfolio, it records its earnings on its balance sheet according to the accounting rule that has been chosen. Each FI seeks to maximise its $t = 1$ value.

[1]Even if capital requirements are not designed the same way in Basel 3 and in Solvency 2 the very logic underlying these regulations is the same : estimating the risk associated to assets using a model mainly focused on short-term volatility and elaborating capital requirement accordingly. For further comments on Solvency 2 see Persaud ([18] and more specifically [19]).

2.1 Same Regulation for All Financial Institutions

We suppose here that all FIs resort to the same accounting rule, namely fair value accounting. As previously mentioned, each FI can eather sell its portfolio or hold it to maturity.

A "long-term" FI (hereafter FI_{LT}) holds its portfolio to maturity if its expected value (i.e. $(1-d)v + d(\delta v - \gamma s)$) is larger than its estimated market price (i.e. $\delta v - \frac{\gamma s}{2}$) :

$$(1-d)v + d(\delta v - \gamma s) > \delta v - \frac{\gamma s}{2} \leftrightarrow (1-d)(1-\delta)v > \gamma s(d - \frac{1}{2}) \tag{2}$$

If $d \leqslant \frac{1}{2}$, (2) is always satisfied so we focus on situations where $d > \frac{1}{2}$ (**hyp. 1**).

Similarly a "short-term" FI (hereafter FI_{ST}) holds its portfolio to maturity if its expected value (i.e. $(1-d)v + \rho d(\delta v - \gamma s)$) is larger than its estimated market price (i.e. $\delta v - \frac{\gamma s}{2}$) :

$$(1-d)v + \rho d(\delta v - \gamma s) > \delta v - \frac{\gamma s}{2} \leftrightarrow (1 - d - \delta + \rho d\delta)v > \gamma s(\rho d - \frac{1}{2}) \tag{3}$$

As mentioned above, the parameter ρ captures the difference in time preference beteween FIs_{ST} and FIs_{LT}. Since FIs_{ST} have strong short-term preference, we suppose that $\rho < 1-d$ which can be re-written as follows $\rho < \frac{1}{2}$ (**hyp. 2**). We also make the assumption that : $\delta > \frac{1-d}{1-\rho d}$ (**hyp. 3**). For two reasons :

- if $(1 - d - \delta + \rho d\delta) > 0$, (3) is always satisfied because of **hyp. 2** and the problem gets trivial.
- this assumption means, economically speaking, that the asset is not too specific (which is a condition for the asset to be tradable).

2.1.1 Multiple Equilibria

If $v > \frac{\gamma(d-\frac{1}{2})}{(1-d)(1-\delta)}$, then a FI_{LT} holds its portfolio to maturity no matter what others do.

Conversely, if $v < 0$, all FIs_{LT} sell their portfolio.

If $v \in [0, \frac{\gamma(d-\frac{1}{2})}{(1-d)(1-\delta)}]$, there are two equilibria : one where all FIs_{LT} sell their portfolio and one where they all hold it. In this case, the impossibility to select *ex ante* the equilibrium that will be reached *ex post* is the consequence of the strategic complementarities that exist between players. The same goes for FIs_{ST}.

2.1.2 The Global Game

In order to overcome the multiple equilibria problem, we use the global game technique as notably developed by Morris and Shin (see for instance [15] or [16]). The idea is that FIs do not observe the true value of v but instead a noisy signal of it. This assumption offers at least two advantages : it makes it possible to find the *ex ante* unique equilibrium and it releases the strong assumption according to which v is common knowledge. We suppose that each FI receives a private signal of v such that : $x_i = v + \varepsilon_i \eta$ where $\varepsilon_i \hookrightarrow U([-\frac{1}{2}, \frac{1}{2}])$ and $\eta > 0$. If i and j are two different FIs : $\text{E}(\varepsilon_i \varepsilon_j)$=0 (i.e. ε_i and ε_j are independent). The distribution of x_i is common knowledge but its final value is not.

We define $v^*_{LT} = \gamma s(v^*_{LT})\frac{d-\frac{1}{2}}{(1-d)(1-\delta)}$ the threshold value of v for FIs$_{LT}$, meaning the value of v from which a FI$_{LT}$ decides to hold its portfolio to maturity rather than selling it. $s(v^*_{LT})$ is the proportion of FIs that sell their portfolios when $v = v^*_{LT}$. We suppose that each FI resorts to a threshold strategy, meaning that a FI$_{LT}$ "i" sells its portfolio when $x_i < x^*_{LT}$ and a FI$_{ST}$ "j" sells its portfolio when $x_j < x^*_{ST}$.

Consequently we got

$$\begin{aligned} s(v^*_{LT}) &= kp(x_i < x^*_{LT}|v^*_{LT}) + (1-k)p(x_j < x^*_{ST}|v^*_{LT}) \\ &= kp(\frac{x_i - v^*_{LT}}{\eta} < \frac{x^*_{LT} - v^*_{LT}}{\eta}) + (1-k)p(\frac{x_j - v^*_{LT}}{\eta} < \frac{x^*_{ST} - v^*_{LT}}{\eta}) \end{aligned} \tag{4}$$

We have $p(\frac{x_i-v^*_{LT}}{\eta} < \frac{x^*_{LT}-v^*_{LT}}{\eta}) = \frac{1}{2}$ because x_i is centered on v so when $v = v^*_{LT}$, the probability of observing a signal below x^*_{LT} is the same that the probability of observing a signal above x^*_{LT}.

In addition, $p(\frac{x_j-v^*_{LT}}{\eta} < \frac{x^*_{ST}-v^*_{LT}}{\eta}) = \begin{cases} 1 & \text{if } \frac{x^*_{ST}-v^*_{LT}}{\eta} \geqslant \frac{1}{2} \\ \frac{x^*_{ST}-v^*_{LT}}{\eta} + \frac{1}{2} & \text{if } -\frac{1}{2} < \frac{x^*_{ST}-v^*_{LT}}{\eta} < \frac{1}{2} \\ 0 & \text{if } \frac{x^*_{ST}-v^*_{LT}}{\eta} \leqslant -\frac{1}{2} \end{cases}$

We focus on situations where $-\frac{1}{2} < \frac{x^*_{ST}-v^*_{LT}}{\eta} < \frac{1}{2}$, so we have

$$s(v^*_{LT}) = \frac{k}{2} + (1-k)(\frac{x^*_{ST} - v^*_{LT}}{\eta} + \frac{1}{2}) \tag{5}$$

In conclusion

$$v^*_{LT} = \gamma[\frac{k}{2} + (1-k)(\frac{x^*_{ST} - v^*_{LT}}{\eta} + \frac{1}{2})]\frac{d-\frac{1}{2}}{(1-d)(1-\delta)} \tag{6}$$

Similarly we got the threshold value of v for FIs$_{ST}$:

$$v^*_{ST} = \gamma[\frac{1-k}{2} + k(\frac{x^*_{LT} - v^*_{ST}}{\eta} + \frac{1}{2})]\frac{\rho d-\frac{1}{2}}{1-d-\delta+\delta\rho d} \tag{7}$$

The previous two equations can be rewritten as follows

$$x^*_{LT} = (1 + \frac{\eta(1-d-\delta+\rho d\delta)}{k\gamma(\rho d - \frac{1}{2})})v^*_{ST} - \frac{\eta}{2k} \tag{8}$$

and

$$x^*_{ST} = (1 + \frac{\eta(1-d)(1-\delta)}{\gamma(1-k)(d - \frac{1}{2})})v^*_{LT} - \frac{\eta}{2(1-k)} \tag{9}$$

As such, the system cannot be solved properly. So we focus on the limiting case where $\eta \to 0$. Doing so, we follow the same strategy as the one followed by Corsetti *et al.* [10] and Bannier [2]. In this case we have $x^*_{LT} \to v^*_{LT}$ and $x^*_{ST} \to v^*_{ST}$.

Consequently we have the following system

$$v^*_{LT} = (1 + \frac{\eta(1-d-\delta+\rho d\delta)}{k\gamma(\rho d - \frac{1}{2})})v^*_{ST} - \frac{\eta}{2k} \tag{10}$$

and

$$v^*_{ST} = (1 + \frac{\eta(1-d)(1-\delta)}{\gamma(1-k)(d-\frac{1}{2})})v^*_{LT} - \frac{\eta}{2(1-k)} \tag{11}$$

which can be easily solved (See proof in Appendix **5.1**).

Finally, in the limiting case where $\eta \to 0$:

$$v^*_{ST} = v^*_{LT} = v^* = \frac{\gamma(\rho d - \frac{1}{2})(d-\frac{1}{2})}{2[(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d) + k(1-d)(1-\delta)(\rho d - \frac{1}{2})]} \tag{12}$$

So, when $v < v^*$, all FIs decide to sell their portfolio whereas when $v > v^*$, they all decide to hold it to maturity [2].

2.2 Taking Diversity into Account

We suppose here that all FIs do not resort to the same accounting rule. Depending on its nature, a FI either resorts to fair value accounting or to historical cost accounting. Precisely, we suppose that FIs_{LT} resort to historical cost accounting whereas FIs_{ST} resort to fair value accounting.

A FI_{ST} holds its portfolio to maturity if its expected value (i.e. $(1-d)v + \rho d(\delta v - \gamma s)$) is larger than its estimated market price (i.e. $\delta v - \frac{\gamma s}{2}$) :

$$(1-d-\delta+\rho d\delta)v > \gamma s(\rho d - \frac{1}{2}) \tag{13}$$

A FI_{LT} holds its portfolio to maturity if its expected value (i.e. $(1-d)v + dv_0$) is larger than its estimated market price (i.e. $\delta v - \frac{\gamma s}{2}$) :

$$\frac{\gamma s}{2} + dv_0 > (d+\delta-1)v \tag{14}$$

No matter what other FIs do, a FI_{LT} decides to hold its portfolio to maturity if $v < \frac{dv_0}{d+\delta-1}$ and to sell it if $v > \frac{\frac{\gamma}{2}+dv_0}{d+\delta-1}$. When $v \in [\frac{dv_0}{d+\delta-1}; \frac{\frac{\gamma}{2}+dv_0}{d+\delta-1}]$, a FI_{LT} sells its portfolio with a probability $\frac{2}{\gamma}[(d+\delta-1)v - dv_0]$. Consequently we have

$$s_{LT}(v) = \begin{cases} 0 \text{ if } v < \frac{dv_0}{d+\delta-1} \\ \frac{2}{\gamma}((d+\delta-1)v - dv_0) \text{ if } \frac{dv_0}{d+\delta-1} \leqslant v \leqslant \frac{\frac{\gamma}{2}dv_0}{d+\delta-1} \\ 1 \text{ if } \frac{\frac{\gamma}{2}dv_0}{d+\delta-1} < v \end{cases}$$

As previously, we make the assumption that FIs do not observe the true value of v but instead are granted a noisy signal such as a FI indexed i receives a signal $x_i = v + \eta\varepsilon_i$ where $\varepsilon_i \hookrightarrow U([-\frac{1}{2}, \frac{1}{2}])$ and $\eta > 0$. This assumption does not modify what has just been said concerning FI_{LT} as shown in Plantin *et. al* [20].

We have

$$v^*_{ST} = \gamma s(v^*_{ST})\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} = \gamma[\frac{1-k}{2} + ks_{LT}(v^*_{ST})]\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} \tag{15}$$

When the market is not too illiquid and the asset not too specific we have $\gamma\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} < \frac{dv_0}{d+\delta-1}$ (See proof in Appendix **5.2**) and, since $\gamma(\frac{1-k}{2} + ks_{LT}(v^*_{ST}))\frac{\rho d-\frac{1}{2}}{1-d-\delta+\rho\delta d} \leqslant \gamma\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d}$,

[2] When $\rho = 1$, meaning in the case of homogeneous agents studied by Plantin *et al* [20], we got $v^* = \frac{\gamma(d-\frac{1}{2})}{2(1-d)(1-\delta)}$ which is the threshold found by Plantin *et al.* [20].

we got $v^*_{ST} < \frac{dv_0}{d+\delta-1}$, so $s_{LT}(v^*_{ST}) = 0$.

Finally we got

$$v^*_{ST} = \gamma(\frac{1-k}{2})\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} \tag{16}$$

So, when $v < v^*_{ST}$, all FIs$_{ST}$ sell their portfolio whereas all FIs$_{LT}$ hold it to maturity and $s(v) = 1-k$. When $v^*_{ST} < v < \frac{dv_0}{d+\delta-1}$, all FIs hold their portfolio to maturity and, consequently, $s(v) = 0$. When $\frac{dv_0}{d+\delta-1} \leqslant v \leqslant \frac{\frac{\gamma}{2}+dv_0}{d+\delta-1}$, $\frac{2k}{\gamma}[(d+\delta-1)v - dv_0]$ FIs$_{LT}$ sell their portfolio and all FIs$_{ST}$ hold it to maturity so $s(v) = \frac{2k}{\gamma}[(d+\delta-1)v - dv_0]$. Finally, when $\frac{\frac{\gamma}{2}+dv_0}{d+\delta-1} < v$, all FIs$_{LT}$ sell their portfolio and all FIs$_{ST}$ hold it to maturity so $s(v) = k$.

3 Main Results

3.1 Analytical Results

We now want to compare the two cases. In particular, we are interested in the impact of accounting regulation on both liquidity and efficiency. To do so, we first determine asset price in both cases and then define the loss in terms of efficiency.

3.1.1 Price

Asset price has been defined as follows $p(v) = \delta v - \frac{\gamma}{2}s(v)$. The following two tables summary asset price in all situations :

	$s(v)$	$p(v)$
$v < v^*$	1	$\delta v - \frac{\gamma}{2}$
$v^* < v$	0	δv

Table 2: Asset price in the first case

	$s(v)$	$p(v)$
$v < v^*_{ST}$	$1-k$	$\delta v - \frac{\gamma}{2}(1-k)$
$v^*_{ST} < v < \frac{dv_0}{d+\delta-1}$	0	δv
$\frac{dv_0}{d+\delta-1} < v < \frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}$	$\frac{2k}{\gamma}((d+\delta-1)v - dv_0)$	$\delta v - k[(d+\delta-1)v - dv_0]$
$\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1} < v$	k	$\delta v - \frac{k\gamma}{2}$

Table 3: Asset price in the second case

Directly from the observation of above tables we got the following proposition :

Proposition 1 : *price's fluctuations are less important when we take diversity into account. In particular, the price reaches a smaller minimum in the first case ($\delta v - \frac{\gamma}{2}$) than in the second case ($\delta v - k\frac{\gamma}{2}$ or $\delta v - (1-k)\frac{\gamma}{2}$ depending on the value of k).*

This result has an important implication in terms of liquidity : in the second case, since all FIs do not want to sell at the same time, asset price does not fall all of the sudden. The Global Financial Crisis pointed out that sudden asset prices' fall plays a major part in the transmission of the crisis through the financial sector. Indeed, asset prices' fall lies in the center of the liquidity spirals described above. In consequence, taking diversity into account is a good option for liquidity and consequently for financial stability.

3.1.2 Efficiency Loss

We define efficiency loss as follows $L(v) = s(v)(v - p(v))$. The difference $v - p(v)$ gives us an idea of the loss due to ineffective sales at the aggregate level. This loss can be interpreted as investments that cannot be funded anymore because of managers' decisions to sell instead of holding their portfolio to maturity. In order to compare the two cases we define the average total efficiency loss as follows $ATL(v) = \frac{1}{M-m}\int_m^M L(v)dv$ where m is the minimum value of v and M the maximum value of v.

Case 1

We have

$$ATL_1(v) = (1-\delta)\frac{v^* - m}{2} + \frac{\gamma}{2} \tag{17}$$

PROPOSITION 2 : $\frac{\partial ATL_1}{\partial k} > 0$ *which means that, in the first case, the loss in terms of efficiency grows when the number of* FIs_{LT} *grows.*

Proof : $\frac{\partial ATL_1}{\partial k} = \frac{1-\delta}{2}\frac{\partial v^*}{\partial k} > 0$ (See Appendix **5.4**).

This result is consistent with the idea that fair value accounting is not a good option for long-term FIs because of their time preference which directly comes from the very nature of what they do. This is something regulation has to take into account in order to solve the above-mentioned two problems : liquidity risk and bad long-term investments funding.

Case 2

We show that (See Proof in Appendix **5.5**)

$$\begin{aligned} ATL_2(v) &= (1-k)(1-\delta)\frac{v^*_{ST} - m}{2} + \frac{\gamma}{2}(1-k)^2 + k[\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) \\ &\quad +2kdv_0(\frac{dv_0}{\gamma} - 1)] + k(1-\delta)\frac{M - \frac{dv_0 + \frac{\gamma}{2}}{d+\delta-1}}{2} + k^2\frac{\gamma}{2} \end{aligned} \tag{18}$$

Comparison of the two cases

PROPOSITION 3 : *we have* $ATL_1(v) > ATL_2(v)$ *when* $M < \frac{2}{1-\delta}[\gamma(1-k) - \frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) - 2kdv_0(\frac{dv_0}{\gamma} - 1)] + \frac{dv_0 + \frac{\gamma}{2}}{d+\delta-1}$ *(sufficient condition). This means that the loss in terms of efficiency is greater in the first case than in the second.*

Proof : See Appendix **5.7**

This result is the main result of our paper. It shows that, when accounting regulation treats financial institutions according to their nature, financial markets can more easily fulfill their goal (namely transferring money from those who have liquidity in excess to those who need liquidity to invest). In this respect, an accounting regulation that discriminates between financial institutions on the based of their time horizon offers better results in terms of economic growth than a regulation that makes no distinction between financial institutions.

3.2 Numerical Application

We now resort to numerical application in order to illustrate our resultats. To do so, we choose parameters values in accordance with Plantin *et al.* [20] when it is possible (meaning when they also use the parameter in question). So we suppose that $d = 0.7$, $\rho = 0.4$, $\delta = 0.75$, $\gamma = 1.5$, $v_0 = 1$ and $k = 0.5$.

The following graph (Figure 1) depicts the loss in terms of efficiency in both cases according to the value of v. We got an illustration of Proposition 3. In particular, we see that when $v \in [0.35; 1.5]$, meaning for all situations between a decrease of the portfolio return of 65% and an increase of this return of 50%, the loss in terms of efficiency is equal to zero in the second case. This interval covers a wider range of realistic situations than $[1.17, +\infty]$ (i.e. the interval where the loss in terms of efficiency is equal to zero in the first case).

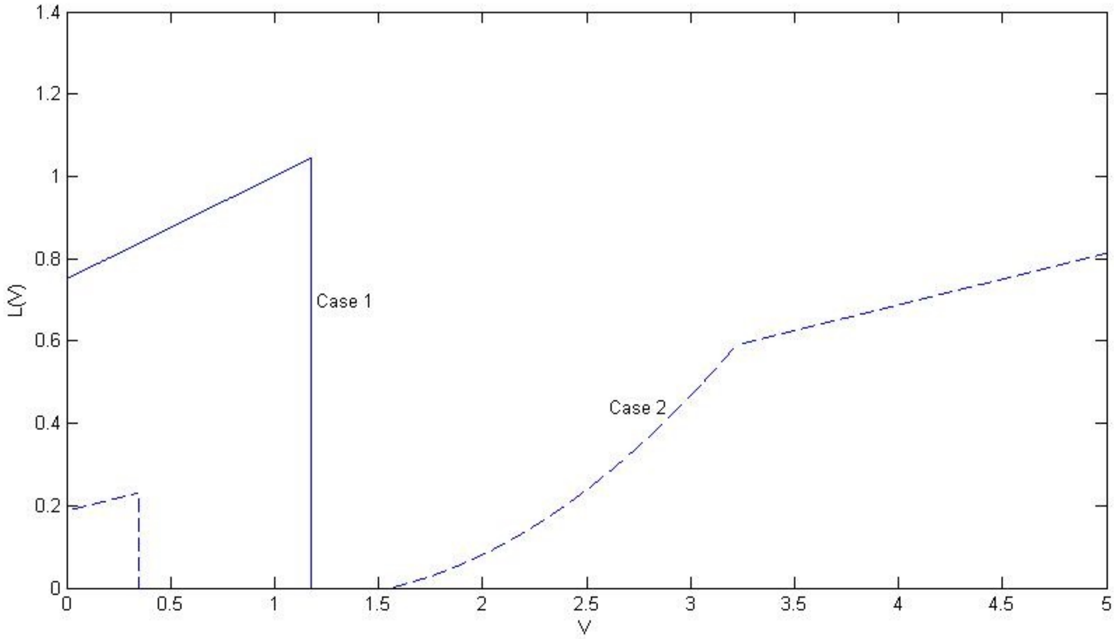

Figure 1: Loss in terms of Efficiency in both cases

4 Conclusion

The Global Financial Crisis has clearly brought out the devastating consequences of the financial system inability to handle liquidity shortages. We think that this inability directly comes from the setting up of rules and practices that tend to homogenize incentives and consequently to homogenize behaviors in financial markets. Besides limiting financial system resilience, this homogenization of behaviors has noxious consequences in terms of long-term investments funding in so far as no one wants to handle the liquidity risk associated with long-term assets.

Fair value accounting is one elements of this set of practices and rules that tends to shorten market participants time horizon. If the rationale behind fair value accounting (roughly enhancing transparency in order to limit unreported losses and manipulations) can justify its use in the case of short-term financial institutions that constantly face the risk of a sudden liquidity need, it is totally irrelevant when it comes to long-term financial institutions that will not face liquidity needs before ten or twenty years.

In this perspective, our model shows that an accounting regulation that takes financial institutions diversity into account offers better results both in terms of liquidity and in terms of efficiency than a regulation that ignores this diversity.

5 Appendix

5.1 Proof that $v^*_{ST} = v^*_{LT} = v^* = \frac{\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2})}{2[(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2})]}$

We define $A = \frac{(1-d-\delta+\rho d\delta)}{k\gamma(\rho d-\frac{1}{2})}$ and $B = \frac{(1-d)(1-\delta)}{\gamma(1-k)(d-\frac{1}{2})}$

We got

$$v^*_{LT} = (1+\eta A)v^*_{ST} - \frac{\eta}{2k}$$

and

$$v^*_{ST} = (1+\eta B)v^*_{LT} - \frac{\eta}{2(1-k)}$$

So
$v^*_{ST} = (1+\eta B)((1+\eta A)v^*_{ST} - \frac{\eta}{2k}) - \frac{\eta}{2(1-k)}$

$v^*_{ST}(1+\eta A+\eta B+\eta^2 AB) - v^*_{ST} = (1+\eta B)\frac{\eta}{2k} + \frac{\eta}{2(1-k)}$

$v^*_{ST} = \frac{(1+\eta B)\frac{\eta}{2k}+\frac{\eta}{2(1-k)}}{\eta A+\eta B+\eta^2 AB} = \frac{(1+\eta B)\frac{1}{2k}+\frac{1}{2(1-k)}}{A+B+\eta AB} \underset{\eta\to 0}{\longrightarrow} \frac{\frac{1}{2k}+\frac{1}{2(1-k)}}{A+B}$

In addition, $v^*_{LT} = (1+\eta A)v^*_{ST} - \frac{\eta}{2k} \underset{\eta\to 0}{\longrightarrow} v^*_{ST} = \frac{\frac{1}{2k}+\frac{1}{2(1-k)}}{A+B}$

Finally, $v^*_{ST} = v^*_{LT} = v^* = \frac{\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2})}{2[(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2})]}$

5.2 Proof that $\gamma\frac{\rho d-\frac{1}{2}}{1-d-\delta+\rho\delta d} < \frac{dv_0}{d+\delta-1}$

$\gamma\frac{\rho d-\frac{1}{2}}{1-d-\delta+\rho\delta d} < \frac{dv_0}{d+\delta-1}$

$\leftrightarrow \gamma(\rho d-\frac{1}{2})(d+\delta-1) > dv_0(1-d-\delta+\rho d\delta)$ because $1-d-\delta+\rho d\delta < 0$ (**hyp. 3**)

$\leftrightarrow \delta\gamma(\rho d-\frac{1}{2}) + (d-1)(\rho d-\frac{1}{2})\gamma > dv_0(1-d) - \delta(1-\rho d)dv_0$

$\leftrightarrow \delta[\gamma(\rho d - \frac{1}{2}) + (1-\rho d)dv_0] > dv_0(1-d) - (d-1)(\rho d - \frac{1}{2})\gamma$

We suppose that $\gamma < \frac{(\rho d - 1)dv_0}{\rho d - \frac{1}{2}}$ meaning that the market is not too illiquid. In this case we got $\gamma(\rho d - \frac{1}{2}) + (1-\rho d)dv_0) > 0$

In consequence we have
$\gamma\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} < \frac{dv_0}{d+\delta-1} \leftrightarrow \delta > \frac{dv_0(1-d)-(d-1)(\rho d-\frac{1}{2})\gamma}{\gamma(\rho d - \frac{1}{2})+(1-\rho d)dv_0}$ if $\gamma < \frac{(\rho d-1)dv_0}{\rho d - \frac{1}{2}}$

In addition, $\frac{dv_0(1-d)-(d-1)(\rho d-\frac{1}{2})\gamma}{\gamma(\rho d - \frac{1}{2})+(1-\rho d)dv_0} < 1$

$\leftrightarrow dv_0(1-d) - (d-1)(\rho d - \frac{1}{2})\gamma - \gamma(\rho d - \frac{1}{2}) - (1-\rho d)dv_0 = dv_0(d(\rho-1)) - (\rho d - \frac{1}{2})\gamma d < 0$

which is true whenever $\gamma < \frac{dv_0(\rho-1)}{\rho d - \frac{1}{2}}$

So, when the market is not too illiquid (i.e. $\gamma < \frac{dv_0(\rho-1)}{\rho d - \frac{1}{2}}$) and the asset not too specific (i.e. $\frac{dv_0(1-d)-(d-1)(\rho d-\frac{1}{2})\gamma}{\gamma(\rho d - \frac{1}{2})+(1-\rho d)dv_0} < \delta$), we got $\gamma\frac{\rho d - \frac{1}{2}}{1-d-\delta+\rho\delta d} < \frac{dv_0}{d+\delta-1}$

5.3 Average Total Loss Function : case 1

$ATL_1(v) = \frac{1}{v^*-m}\int_m^{v^*}[(1-\delta)v + \frac{\gamma}{2}]dv = (1-\delta)\frac{v^*-m}{2} + \frac{\gamma}{2}$

5.4 Proof that $\frac{\partial v^*}{\partial k} > 0$

$\frac{\partial v^*}{\partial k} = \frac{2[(d-\frac{1}{2})(1-d-\delta+\rho\delta d)-(1-d)(1-\delta)(\rho d-\frac{1}{2})]\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2})}{[2((1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2}))]^2}$

$[2((1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2}))]^2 > 0$ so the sign of $\frac{\partial v^*}{\partial k}$ is the same that the sign of $2[(d-\frac{1}{2})(1-d-\delta+\rho\delta d)-(1-d)(1-\delta)(\rho d-\frac{1}{2})]\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2})$

So
$\frac{\partial v^*}{\partial k} > 0$

$\leftrightarrow 2[(d-\frac{1}{2})(1-d-\delta+\rho\delta d)-(1-d)(1-\delta)(\rho d-\frac{1}{2})]\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2}) > 0$

$\leftrightarrow (d-\frac{1}{2})^2(\rho d-\frac{1}{2})(1-d-\delta+\rho\delta d)-(1-d)(1-\delta)(\rho d-\frac{1}{2})^2(d-\frac{1}{2}) > 0$

$\leftrightarrow (d-\frac{1}{2})^2(\rho d-\frac{1}{2})(1-d) - \delta(1-\rho d)(d-\frac{1}{2})^2(\rho d-\frac{1}{2}) > (1-d)(\rho d-\frac{1}{2})^2(d-\frac{1}{2}) - \delta(1-d)(\rho d-\frac{1}{2})^2(d-\frac{1}{2})$

$\leftrightarrow \delta[(1-d)(\rho d-\frac{1}{2})^2(d-\frac{1}{2}) - (1-\rho d)(d-\frac{1}{2})^2(\rho d-\frac{1}{2})] > (1-d)(\rho d-\frac{1}{2})^2(d-\frac{1}{2}) - (d-\frac{1}{2})^2(\rho d-\frac{1}{2})(1-d)$

$\leftrightarrow \delta(\rho d-\frac{1}{2})(d-\frac{1}{2})[(1-d)(\rho d-\frac{1}{2}) - (1-\rho d)(d-\frac{1}{2})] > (\rho d-\frac{1}{2})[d-\frac{1}{2})((1-d)(\rho d-\frac{1}{2}) - (d-\frac{1}{2})(1-d)]$

We know that $(\rho d-\frac{1}{2}) < 0$ and $(d-\frac{1}{2}) > 0$ (**hyp. 1** and **hyp.2**), so $(\rho d-\frac{1}{2})(d-\frac{1}{2})[(1-d)(\rho d-\frac{1}{2}) - (1-\rho d)(d-\frac{1}{2})] > 0$

So
$\frac{\partial v^*}{\partial k} > 0 \leftrightarrow \delta > \frac{(\rho d-\frac{1}{2})(d-\frac{1}{2})[(1-d)(\rho d-\frac{1}{2})-(d-\frac{1}{2})(1-d)]}{(\rho d-\frac{1}{2})(d-\frac{1}{2})[(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})]} = \frac{(1-d)(\rho d-d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})}$

We have
$\frac{(1-d)(\rho d-d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})} = \frac{1-d}{1-\rho d}(\frac{(\rho d-d)(1-\rho d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})})$

$(\rho d-d)(1-\rho d)-(1-d)(\rho d-\frac{1}{2})+(1-\rho d)(d-\frac{1}{2}) = (1-\rho d)(\rho d-\frac{1}{2})-(1-d)(\rho d-\frac{1}{2}) = (\rho d-\frac{1}{2})(d-\rho d) < 0$ because of **hyp. 2**

So
$\frac{(\rho d-d)(1-\rho d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})} < 1$

And
$\frac{(1-d)(\rho d-d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})} = \frac{1-d}{1-\rho d}(\frac{(\rho d-d)(1-\rho d)}{(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})}) < \frac{1-d}{1-\rho d} < \delta$ according to **hyp. 3**

Finally we always have
$\frac{\partial v^*}{\partial k} > 0$

5.5 Average Total Loss Function : case 2

$$ATL_2(v) = \frac{1}{v^*_{ST}-m}\int_m^{v^*_{ST}}(1-k)[v(1-\delta)+\frac{\gamma}{2}(1-k)]dv + \frac{1}{\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}-\frac{dv_0}{d+\delta-1}}\int_{\frac{dv_0}{d+\delta-1}}^{\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}\frac{2k}{\gamma}[(d+\delta-1)v-dv_0][(1-\delta)v+k((d+\delta-1)v-dv_0)]dv + \frac{1}{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}\int_{\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}^{M}k[(1-\delta)v+k\frac{\gamma}{2}]dv$$

$$= (1-k)(1-\delta)\frac{v^*_{ST}-m}{2}+\frac{\gamma}{2}(1-k)^2+\frac{2k}{\gamma}[(d+\delta-1)(1-\delta+k(d+\delta-1))\frac{(\frac{\frac{\gamma}{2}}{d+\delta-1})^2}{3}-kdv_0(d+\delta-1)\frac{\frac{\frac{\gamma}{2}}{d+\delta-1}}{2}-dv_0(1-\delta+k(d+\delta-1))\frac{\frac{\frac{\gamma}{2}}{d+\delta-1}}{2}+d^2v_0^2k]+k(1-\delta)\frac{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}{2}+k^2\frac{\gamma}{2}$$

$$= (1-k)(1-\delta)\frac{v^*_{ST}-m}{2}+\frac{\gamma}{2}(1-k)^2+k[(1-\delta+k(d+\delta-1))\frac{3\gamma}{2(d+\delta-1)}-kdv_0(d+\delta-1)\frac{2}{d+\delta-1}-dv_0(1-\delta+k(d+\delta-1))\frac{2}{d+\delta-1}+\frac{2}{\gamma}d^2v_0^2k]+k(1-\delta)\frac{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}{2}+k^2\frac{\gamma}{2}$$

$$= (1-k)(1-\delta)\frac{v^*_{ST}-m}{2}+\frac{\gamma}{2}(1-k)^2+k[\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)-2kdv_0+\frac{2}{\gamma}d^2v_0^2k]+k(1-\delta)\frac{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}{2}+k^2\frac{\gamma}{2}$$

$$= (1-k)(1-\delta)\frac{v^*_{ST}-m}{2}+\frac{\gamma}{2}(1-k)^2+k[\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)+2kdv_0(\frac{dv_0}{\gamma}-1)]+k(1-\delta)\frac{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}{2}+k^2\frac{\gamma}{2}$$

5.6 Proof that $v^*_{ST} < v^*$

$v^*_{ST} < v^*$

$\leftrightarrow \gamma\frac{1-k}{2}\frac{\rho d-\frac{1}{2}}{1-d-\delta+\rho d\delta} < \frac{\gamma(\rho d-\frac{1}{2})(d-\frac{1}{2})}{2[(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2})]}$

$\leftrightarrow \frac{(1-k)(\rho d-\frac{1}{2})}{1-d-\delta+\rho d\delta} < \frac{(\rho d-\frac{1}{2})(d-\frac{1}{2})}{(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2})}$

$\leftrightarrow (1-k)(\rho d-\frac{1}{2})[(1-k)(d-\frac{1}{2})(1-d-\delta(1-\rho d))+k(1-d)(1-\delta)(\rho d-\frac{1}{2})] < (\rho d-\frac{1}{2})(d-\frac{1}{2})(1-d-\delta(1-\rho d))$

because $1-d-\delta+\rho\delta d<0$ and $(1-k)(d-\frac{1}{2})(1-d-\delta+\rho\delta d)+k(1-d)(1-\delta)(\rho d-\frac{1}{2})<0$

$\leftrightarrow (1-k)^2(d-\frac{1}{2})(1-d-\delta(1-\rho d))+k(1-k)(1-d)(1-\delta)(\rho d-\frac{1}{2}) > (d-\frac{1}{2})(1-d-\delta(1-\rho d))$

because $\frac{1}{\rho d-\frac{1}{2}}<0$

$\leftrightarrow -\delta(1-\rho d)(1-k)^2(d-\frac{1}{2})+(1-d)(1-k)^2(d-\frac{1}{2})-\delta k(1-k)(1-d)(\rho d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2}) > -\delta(1-\rho d)(d-\frac{1}{2})+(d-\frac{1}{2})(1-d)$

$\leftrightarrow (1-d)(1-k)^2(d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2})-(d-\frac{1}{2})(1-d) > \delta[(1-\rho d)(1-k)^2(d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})]$

We got
$(1-\rho d)(1-k)^2(d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})<0$

So
$v^*_{ST}<v^*$

$\leftrightarrow \delta > \frac{(1-d)(1-k)^2(d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2})-(d-\frac{1}{2})(1-d)}{(1-\rho d)(1-k)^2(d-\frac{1}{2})+k(1-k)(1-d)(\rho d-\frac{1}{2})-(1-\rho d)(d-\frac{1}{2})} = \frac{1-d}{1-\rho d}\left(\frac{(d-\frac{1}{2})(k-2)+k(1-k)(\rho d-\frac{1}{2})}{(d-\frac{1}{2})(k-2)+\frac{k(1-k)(\rho d-\frac{1}{2})}{1-\rho d}}\right)$

We have $\frac{k(1-k)(\rho d-\frac{1}{2})}{1-\rho d} > k(1-k)(\rho d-\frac{1}{2})$ so $\frac{(d-\frac{1}{2})(k-2)+k(1-k)(\rho d-\frac{1}{2})}{(d-\frac{1}{2})(k-2)+\frac{k(1-k)(\rho d-\frac{1}{2})}{1-\rho d}}<1$

So $\frac{1-d}{1-\rho d}\left(\frac{(d-\frac{1}{2})(k-2)+k(1-k)(\rho d-\frac{1}{2})}{(d-\frac{1}{2})(k-2)+\frac{k(1-k)(\rho d-\frac{1}{2})}{1-\rho d}}\right) < \frac{1-d}{1-\rho d} < \delta$ according to **hyp. 3**

Finally, we always have $v^*_{ST}<v^*$

5.7 Comparison of the two cases

We now try to find the sign of $ATL_1(v)-ATL_2(v)$. In particular, we are interested in situations where $ATL_1(v)>ATL_2(v)$. Since we have $v^*>v^*_{ST}$, we always have $(1-\delta)\frac{v^*-m}{2} > (1-k)(1-\delta)\frac{v^*_{ST}-m}{2}$ and consequently a sufficient condition for $ATL_1(v)>ATL_2(v)$ is :

$-\gamma(1-k)+\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)+2kdv_0(\frac{dv_0}{\gamma}-1)+(1-\delta)\frac{M-\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}}{2}<0$

$\leftrightarrow M\frac{1-\delta}{2} < \gamma(1-k)-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)-2kdv_0(\frac{dv_0}{\gamma}-1)+(1-\delta)\frac{dv_0+\frac{\gamma}{2}}{2(d+\delta-1)}$

$\leftrightarrow M < \frac{2}{1-\delta}[\gamma(1-k)-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)-2kdv_0(\frac{dv_0}{\gamma}-1)]+\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}$

The previous condition is particularly interesting if we have
$\frac{2}{1-\delta}[\gamma(1-k)-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma-2dv_0)-2kdv_0(\frac{dv_0}{\gamma}-1)]+\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1} > \frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}$

$\leftrightarrow \frac{2}{1-\delta}[\gamma(1-k) - \frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) - 2kdv_0(\frac{dv_0}{\gamma} - 1)] > 0$

$\leftrightarrow \gamma(1-k) - \frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) - 2kdv_0(\frac{dv_0}{\gamma} - 1) > 0$

$\leftrightarrow \gamma[1-k-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}\frac{3}{2}] + 2dv_0[\frac{1-\delta+k(d+\delta-1)}{d+\delta-1} - k\frac{dv_0}{\gamma} + k] > 0$

We have $1-k-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}\frac{3}{2} > 0$

$\leftrightarrow (1-k)(d+\delta-1) - \frac{3}{2}(1-\delta+k(d+\delta-1)) > 0$

$\leftrightarrow \delta[1-k+\frac{3}{2}(1-k)] > (1-d)[1-k+\frac{3}{2}(\frac{1}{1-d}-k)]$

$\leftrightarrow \delta > \frac{(1-d)[1-k+\frac{3}{2}(\frac{1}{1-d}-k)]}{1-k+\frac{3}{2}(1-k)} = \frac{(1-d)[1-k+\frac{3}{2}(\frac{1}{1-d}-k)]}{(1-\rho d)[\frac{1-k+\frac{3}{2}(1-k)]}{1-\rho d}]}$

Since $1-k < \frac{1-k}{1-\rho d}$ and $\frac{3}{2}(\frac{1}{1-d}-k) < \frac{\frac{3}{2}(1-k)}{1-\rho d}$ (because $\frac{3}{2}(\frac{1}{1-d}-k) - \frac{\frac{3}{2}(1-k)}{1-\rho d} = \frac{3}{2}\frac{-\rho d+\rho dk-k\rho d^2-d}{(1-d)(1-\rho d)} < 0$), we got $\frac{(1-d)[1-k+\frac{3}{2}(\frac{1}{1-d}-k)]}{(1-\rho d)[\frac{1-k+\frac{3}{2}(1-k)]}{1-\rho d}]} < \frac{1-d}{1-\rho d}$ so, according to **hyp. 3**, we always got $\delta > \frac{(1-d)[1-k+\frac{3}{2}(\frac{1}{1-d}-k)]}{1-k+\frac{3}{2}(1-k)}$ and consequently $1-k-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}\frac{3}{2} > 0$

We have $\frac{1-\delta+k(d+\delta-1)}{d+\delta-1} - k\frac{dv_0}{\gamma} + k > 0$

$\leftrightarrow \gamma > \frac{k}{\frac{1-\delta}{d+\delta-1}+2k}dv_0$

Finally, when $\gamma > \frac{k}{\frac{1-\delta}{d+\delta-1}+2k}dv_0$, we got $\gamma[1-k-\frac{1-\delta+k(d+\delta-1)}{d+\delta-1}\frac{3}{2}] + 2dv_0[\frac{1-\delta+k(d+\delta-1)}{d+\delta-1} - k\frac{dv_0}{\gamma} + k] > 0$ and consequently :

$\frac{2}{1-\delta}[\gamma(1-k) - \frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) - 2kdv_0(\frac{dv_0}{\gamma} - 1)] + \frac{dv_0+\frac{\gamma}{2}}{d+\delta-1} > \frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}$

In conclusion :
$ATL_1(v) > ATL_2(v)$ when $M < M^* = \frac{2}{1-\delta}[\gamma(1-k) - \frac{1-\delta+k(d+\delta-1)}{d+\delta-1}(\frac{3}{2}\gamma - 2dv_0) - 2kdv_0(\frac{dv_0}{\gamma} - 1)] + \frac{dv_0+\frac{\gamma}{2}}{d+\delta-1}$ (sufficient condition)
In addition $\frac{dv_0+\frac{\gamma}{2}}{d+\delta-1} < M^*$ when $\gamma > \frac{k}{\frac{1-\delta}{d+\delta-1}+2k}dv_0$ (sufficient condition)

References

[1] T. Adrian and H.S. Shin, "Liquidity and Leverage", *Journal of Financial Intermediation*, 2010

[2] C. Bannier, "Big Elephants in Small Ponds : Do Large Traders Make Financial Markets More Agressive ?", *Journal of Monetary Economics*, 2005

[3] M. Barth, W. Beaver and W. Landsman, "Value-Relevance of Banks' Fair Value Disclosures under SFAS 107", *The Accounting Review*, 1996

[4] V. Bernard, R. Merton and K. Papelu, "Mark-to-Market Accounting for Banks and Thrifts: Lessons from the Danish Experience", *Journal of Accounting Research*, 1995

[5] V. Bignon, Y. Biondi and X. Ragot, "An Economic Analysis of Fair Value : Accounting as a Vector of Crisis", *Cournot Center for Economic Studies*, 2009

[6] E. Blankespoor, T. Linsmeier, K. Petroni and C. Shakespeare, "Fair Value Accounting for Financial Instruments: Does It Improve the Association between Bank Leverage and Credit Risk ?", *Accounting Review*, 2013

[7] M. Brunnermeier and L.H. Pederson, "Market Liquidity and Funding Liquidity", *Review of Financial Studies*, 2008

[8] H. Carlsson and E. Van Damme, "Global Games and Equilibrium Selection", *Econometrica*, 1993

[9] V. Capkun, A. Cazavan-Jeny, T. Jeanjean and L. Weiss, "Earnings Management and Value Relevance During the Mandatory Transition from Local Gaaps to IFRS in Europe", *Ssrn.com*, 2008

[10] G. Corsetti, A. Dasgupta, S. Morris and H.S. Shin, "Does One Soros Make a Difference ?", *Review of Economic Studies*, 2004

[11] E. Eccher, K. Ramesh and S. Ramu Thiagarajan, "Fair Value Disclosures by Bank Holding Companies", *Journal of Accounting and Economics*, 1996

[12] A. Ellul, C. Jotikasthira, C. Lundblad and Y. Wang, "Mark-to-Market Accounting and Systemic Risk: Evidence from the Insurance Industry", *Economic Policy*, 2014

[13] J. Heaton, D. Lucas and R. McDonald, "Is Mark-to-Market Accounting Destabilizing ? Accounting and Implications for Policy", *Journal of Monetary Economics*, 2010

[14] C. Laux and C. Leuz, "Did Fair Value Accounting Contribute to the Financial Crisis ?", *Journal of Economic Perspectives*, 2010

[15] S. Morris and H.S. Shin, "Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks", *American Economic Review*, 1998

[16] S. Morris and H.S. Shin, "Global Games: Theory and Applications", *Advances in Economics and Econometrics* (*Proceedings of the Eighth World Congress of the Econometric Society*), edited by M. Dewatripont, L. Hansen and S. Turnovsky, Cambridge University Press, 2003

[17] K. Nelson, "Fair Value Accounting for Commercial Banks: An Empirical Analysis of SFAS 107", *The Accounting Review*, 1996

[18] A. Persaud, *Reinventing Financial Regulation*, Apress, 2015

[19] A. Persaud, "How Not to Regulate Insurance Markets : the Risks and Dangers of Solvency II", *Peterson Institute for International Economics*, 2015

[20] G. Plantin, H. Sapra and H.S. Shin, "Marking-to-Market : Panacea or Pandora's Box ?", *Journal of Accounting Research*, 2008

[21] G. Plantin and J. Tirole, "Marking to Market versus Taking to Market", *Systemic Risk Center discussion paper*, 2015