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The Economic Consequences of Fair Value Accounting

Mingzhe Yuan and Huifeng Liu

Abstract

Two fatal intrinsic flaws of fair-value accounting are found and mathematically proved by this paper. One flaw concerns its non-complete existence, that is, the required fair value may not exist under certain conditions. One direct consequence of the flaw is that a huge fair value trap may be created by fair-value accounting when the fair value does not exist. Another flaw of fair-value accounting is its self-expansion, that is, the fair-value accounting acts as a share price bubble maker based upon the normal net incomes from the operations of listed firms. The bubble may then expand much larger than the original incomes.

For a single firm, it is possible to sell out its assets at their “fair value,” but it is usually impossible for all firms to sell out their assets at the same market price within a short period of time. From the standpoint of the whole market, fair-value accounting acts then like a numbers game, while its book values lose any connections with cash flows.

All these flaws of fair-value accounting can bring risks to investors in financial markets, and finally provoke financial crises.

KEYWORDS: fair value, marked-to-market, financial crisis, bubble, self-expansion

JEL Classification Codes: M41, E60, G01, G18, G28, G38

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Introduction

Only two years later after the issuance of FASB's (Financial Accounting Standards Board) Accounting Standards No. 157--- "Fair Value Measurements", a serious financial crisis occurred, first in USA, then spread all over the world. On 2 October 2008, the US Parliament adopted the Paulson plan, which conferred the Stock Exchange Commission (SEC) the power to suspend the application of fair value for reasons of "public interest" and consistent with the "protection of investors".¹ The Paulson plan called for a study of the economic consequences of fair value accounting. On 2 April 2009, in response to criticisms blaming fair value accounting for the deepening of the crisis,² FASB authorized financial intermediaries to measure certain financial assets not at their market value but at a value estimated through financial evaluation models. In January 2009, a report by the "Group of Thirty" (G30) condemned fair value accounting for its role in creating systemic risks, low resilience and financial instability.

In spite of the fierce criticism, both accounting regulators (IASB and FASB) have no intention of changing their move towards fair value accounting. The accounting model has not been revised; it has merely been subject to a few marginal adjustments, whilst keeping in line with the previous approach.

SFAS 157 establishes a fair value hierarchy that prioritizes the inputs to valuation techniques that are used to measure fair value. A firm has to use Level 1 inputs (unadjusted quoted prices in active markets) on the assumption that a quoted price in an active market provides the most reliable evidence of fair value. It shall be used whenever available, except when it is available but not readily accessible, or when it might not represent fair value at the measurement date. If observable prices are not available, the firm can value its assets based on Level 2 inputs (observable inputs other than quoted prices included in Level 1). Level 2 inputs are

¹ Emergency Economic Stabilization Act of 2008, 3 October 2008, Sec. 132. Authority to suspend mark-to-market accounting.

² Cf. "Banks Get Leeway in Valuing Their Assets", The New York Times, 3 April 2009.

inputs such as (i) quoted prices for similar (but not identical) assets or liabilities in both active and inactive markets, and (ii) inputs other than quoted prices such as interest rates and yield curves, credit risks, default risks, and other inputs that can be derived principally from observable market data by correlation or other means (market-corroborated inputs). A Level 2 input must be substantially observable for the full term of the asset or liability. Finally, to the extent that observable Level 2 inputs are not available (for example, situations in which there is little market activity for the asset or liability at measurement date), Level 3 inputs can be applied. These are the firm's own assumptions about how other market participants would price the asset or liability. To ensure that there is information that will enable financial statement users to assess the quality of inputs used to estimate these fair value measurements, the standard requires firms to disclose information (separately for each major category of assets and liabilities), both quantitative information that shows how the fair value measurements are segregated based on the valuation inputs, and qualitative information that specifies the valuation techniques used to measure fair value.

A great amount of literature has pointed out the shortcomings of fair value accounting. Ijiri (2005) argues that if an efficient market for these assets does not exist, the firm's valuations should rely upon explicit modeling, and of course this second method introduces a lot of discretionary power and uncertainty.

Dichev (2008) believes that "mark-to-market" type accounting rules are difficult to apply when there are no reliable estimates of market values, and thus in practice firms have to resort to "mark-to-model" accounting instead. The weakness of the "mark-to-model" approach is that it involves the potential for large estimation errors and outright manipulation. For example, after Enron fell, "mark-to-model" accounting became notorious because it was extensively used to manage earnings.

As recent bankruptcies have shown, the fair value accounting model has proved to be conducive to the appropriation of potential profits and the concealment of losses by artful insiders and executive managers to the detriment of the other stakeholders. This disproves the key argument in favor of fair value accounting, that it is objective and makes accounting

manipulation impossible. In practice, fair value gives at each instant a seemingly relevant liquidation value, but obscures the value creation process by mixing present profit with unrealized capital gains and losses (Kothari et al. 2009; Biondi 2011).

Boyer (2007) challenges the notion that the reform of accounting principles in accordance with fair value would provide better information, and that more transparency would reinforce the resilience of the economy. He argues that fair value introduces an accounting accelerator on top of the already present and typical financial accelerator. It extends to the entire economic system, the source of financial fragility typical of the 1990s. If fair value accounting is applied to banks, an extra volatility may be created unless a new wave of innovations introduces countervailing forces.

Bignon et al. (2009) indicate that the value of each asset for a firm is always greater than its resale value due to specificities and complementarities of assets. When valuation models are used, small changes in the assumptions can lead to large variations in the results. The principle of fair value may introduce the problem of financial volatility into accounting and tends to reduce the investment capacity of firms. The financial crisis that began in the summer of 2007 confirms the intrinsic flaws of the fair value accounting model. It failed to prevent the crisis, but rather deepened it.

A profound misunderstanding about the place and role of accounting in the firm may be caused by the adoption of fair value accounting models. Accounting has been transformed from an instrument of management and control into a tool of marked-to-market financial valuation, generating a short-termist attitude towards the economy of the firms to be accounted for (Orléan, 1999; Aglietta and Rebérioux, 2004).

Laux and Leuz (2009) do not think that fair value accounting is responsible for the crisis, but its measurement system that reports asset values has economic effects. A return to historical cost accounting is unlikely to be a remedy to the problems with fair value accounting.

Benston (2008) and Ryan (2008) analyze the dual character of fair value accounting on the financial crisis and find that while fair value accounting improves the transparency and timeliness of the accounting information, it also produces some negative effects on it. For example, fair

value accounting may provide irrelevant or misleading information for long-term holding assets (especially for held to maturity asset). The market price taken as the base of fair value may be distorted because of the non-efficiency of market or the irrationality of investors, and the valuation models used in fair value accounting may be unreliable.

Persaud (2008) and Plantin etc. (2008a) pointed out that, during the boom of the market, fair value accounting increases the book values of assets, and enables the bank industry to increase financial leverage. The inevitable result is the decline of capacity of withstanding risks and the aggravation of the financial crisis.

Foreshadowed by Bignon et al. (2004), financial crisis models proposed by Allen and Carletti (2008) and Plantin, etc. (2008b) show that “contagion effect” in the capital markets can be triggered by fair value accounting, that is to say, if one bank sells a financial asset at a price less than its value, all other banks holding the same financial assets will suffer loss, and lead to a decrease of book value. However, Ramanna and Watts (2007) argue that, although FAS 157 puts over-reliance on quotations in active markets, accounting standards may be used as a tool to manipulate profits if enterprise management’s measurements based on valuation models are not strictly limited. They also provide empirical evidence to show that business operators do not want to reduce the book values of assets when the value is impaired actually.

The financial crisis made us understand that fair value accounting is far from perfection. However, there are still some people who cherish unrealistic fancies about fair value accounting and ignore the possible serious economic consequences caused by it. They try to ascribe these consequences to accounting standards users and market circumstances, but never think that the fair value accounting itself is wrong. In this paper, we find two shocking results that fair value has conceptual flaws and can create bubbles in capital markets. The fatal intrinsic flaws of fair-value accounting are derived from utility functions and matrix theory. The paper provides a new perspective to the study of fair value accounting.

Just as a commodity is of utility for a consumer, an asset is of utility for a firm. If a firm wants to survive, it must “consume” assets to generate income and cash flows. The utility functions of assets can be constructed in

the same manner as utility functions of commodities. The well known “accounting entity assumption” implies that an accounting entity is a special unit which has its own objective and will maximize the utility of its assets for realizing the objective. For any asset, both sellers and buyers want to maximize their utility of assets in the transaction of the asset. For a given price, they will decide an optimal trading quantity. Therefore, for any firm, it has an optimal buying quantity function or an optimal selling quantity function. A fair trading price should be decided by all agents’ optimal buying quantity functions and optimal selling quantity functions. An equilibrium model, in line with the Walrasian equilibrium model, can be built to determine the equilibrium price. Of course, the equilibrium price must be the fair value of these assets. However the problem is that, when the equilibrium price is not existent, the fair value could be not existent. It is proved in this paper that, if the total supply of the asset is larger than equilibrium trading volume, the fair value for the asset does not exist.

In the real life, it is common for an asset to be supplied exceeding the equilibrium trading volume. In this case, there is no logic to measure the asset by “fair value” according to the result about fair value existence. In practice, many firms may not want to sell out all their assets, like financial assets and real estates, but continue to hold them for better profit. A direct result of the decision is that the current market price could be maintained in a level higher than the clearing price at which all existing assets could be sold out. If the market price is taken as a reliable evidence of the fair value and the assets are measured based on “mark to market accounting”, a large “income from changes in fair value” may be recognized. It can be regarded as a “fair value trap” because it cannot be changed into cash flow in the present circumstances in the near future.

Furthermore, for securities, the fair value accounting may become a bubble maker, instead of an instantaneous reflector of active markets. When firm F experiences profit growth, its securities’ price will rise. All other firms which hold firm F’s securities will also earn an (unrealized) income because of the increase of the securities values based on the fair value accounting. Similarly, their securities’ prices will also increase. What is the exact consequence of firms’ ordinary earnings if the securities are measured by fair value accounting? We prove that fair value accounting may create a

bubble several times larger than the earnings obtained by the listed firms in their usual operating activities. As long as the profit go on increasing year by year, the bubbles will be expanded gradually but when growth stops or reverses, a financial crisis will occur.

In the next section, existence of fair value is analyzed based on the utility functions of assets and the conceptual flaws of fair value are proved mathematically. A fair value self-expansion model is built up based on matrix theory and the function of creating value bubbles for fair value accounting is proved in Section 2. Section 3 introduces some empirical evidence in the existing literature for the fair value bubble model. Section 4 tries to apply those models to the current financial crisis. The last section concludes by summarizing the main results in the paper.

1. Existence of fair values

1.1. Conditions for fair value based on utility functions

SFAS 157 defines fair value as “the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date”. An orderly transaction assumes that the participants have sufficient time to market the asset. Hence, fair values should not be estimated as in a forced liquidation or distress sale.

IAS 39 specifies the principles for recognizing and measuring financial instruments for firms that report their financial statements under IFRS. IAS 39 defines fair value slightly differently from SFAS 157. Fair value is defined as “the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm’s length transaction”.

There are some subtle language differences between the fair value definitions in SFAS 157 and that in IAS 39. The SFAS 157’s definition is explicitly based on the concept of an “exit price,” whereas the IAS 39’s definition is based neither on “exit price,” nor “entry price.” SFAS 157 uses the “market participants” view whereas the IAS 39’s definition uses the concept of “willing buyer and seller.”

Definitions of fair value in other countries are of no essential difference with those of SFAS 157 and IAS 39. All the definitions are set up depending upon the “orderly transaction”, but the criterions of an orderly transaction are not defined in details.

In order to strictly describe “orderly transaction”, utility functions of assets of a firm are introduced into the study of fair value accounting in this paper. The well known “accounting entity assumption” implies that a firm as an accounting entity is a special unit which has its own objective and will maximize the utility of its assets for realizing the objective. The basic method of realizing its objective is to “consume” assets, just like a natural person consumes commodities for pursuing its own purposes. The utility of an asset can also be simply regarded as the contribution to the firm’s value.

Fair value in fact is an economic concept about the price formation in an ideal market environment. Just like Leon Walras constructs the general equilibrium theory based on the utility functions of consumers, we also seek to prove the existence of fair value based on utility functions of firms.

Suppose there are N kinds of possible assets, now we want to measure the last kind of asset, or asset N for convenience. For a particular seller (or a firm), at the balance sheet date, it has a asset utility function of $u = U_s(x_1, x_2, \dots, x_N, m)$, where u denotes the total utility of assets if the firm continues to use or to possess them in the current state; $x_1, x_2, \dots, x_N$ denote the numbers of non-monetary assets; and m denotes monetary asset. Utility functions are supposed to be monotone increasing as the assets increase in the following discussion. That is to say, if the number of any assets increases, then, the total utility increases strictly.

Let $s_1, s_2, \dots, s_N, m_s$ be the non-monetary assets and monetary asset respectively before the transaction. Suppose q units of asset N are sold at price p . After the transaction, the seller’s total utility is changed by

$$f_s(p, q) = U_s(s_1, s_2, \dots, s_N - q, m_s + pq) - U_s(s_1, s_2, \dots, s_N, m_s) \quad (1)$$

Similarly, for a particular buyer (or a firm), at the balance sheet date, it has an asset utility function of $u = U_B(x_1, x_2, \dots, x_N, m)$. Let $b_1, b_2, \dots, b_N, m_b$ be the non-monetary assets and monetary assets respectively before the transaction. Suppose q units of asset N are purchased at price p . After the transaction, the buyer's total utility is changed by

$$f_B(p, q) = U_B(b_1, b_2, \dots, b_N + q, m_b - pq) - U_B(b_1, b_2, \dots, b_N, m_b) \quad (2)$$

For convenience, we measure the utility by currency units, or we suppose the currency units equate to the utility units. One reason of utilizing this notion of cardinal utility is that the utility of assets can be measured as the contribution of assets to the firm's value.

Fair Value Conditions: For a specific number of asset N, denoted by q ($q > 0$), the exchange price P is a fair value if and only if the following conditions are satisfied:

(1) Condition for total utility: $f_S(P, q) \geq 0$, $f_B(P, q) \geq 0$;

(2) Condition for marginal utility: $\left. \frac{\partial U_S}{\partial x_N} \right|_{x_N=q} \leq P$, $P \leq \left. \frac{\partial U_B}{\partial x_N} \right|_{x_N=q}$;

(3) Condition for transactions: For any price higher than P , the seller could not sell out all q units of the assets; for any price lower than P , the buyer could not buy all q units of the assets.

The first condition for total utility means that the exchange should not reduce the total utility of either side. The second condition for marginal utility means that the last units of the assets exchanged should not cause any loss in utility for both sides. The third condition for transactions indicates that the fair value is optimal price for both sides. It is obvious that all the conditions are necessary requirements of "knowledgeable, willing parties" in transactions.

1.2. Fair value existence theorem

For a given price p , in order to maximize the utility of assets, sellers must determine the optimal selling quantity q by the following model (called optimal selling quantity model):

$$\begin{aligned} \max_{0 \leq q} \quad & f_s(p, q) \\ \text{s.t.} \quad & f_s(p, q) \geq 0 \end{aligned}$$

Suppose $\tilde{q}$ is a non-zero optimal solution in the optimal selling quantity model. Note that the necessary condition for the optimal solution is

$$\frac{\partial f_s(p, q)}{\partial q} = 0$$

Then, the non-zero optimal solution must satisfy:

$$\left. \frac{\partial U_s}{\partial x_N} \right|_{x_N = \tilde{q}} = p$$

The corresponding relation between price and optimal selling quantity, determined by the above optimal selling quantity model, is called as the seller's optimal selling quantity function. When there is more than one seller in the market, the market's optimal selling quantity function can be established by summing up the optimal selling quantity functions of all sellers in the market. Obviously, the optimal selling quantity function will increase as the price increases. In a coordinate system with price as vertical axis and trading volume as horizontal axis, the curve of optimal selling quantity function can be called as the optimal selling curve.

Similarly, for a given price p , in order to maximize the utility of assets, buyers must determine the optimal buying quantity q by the following model (called optimal buying quantity model):

$$\begin{aligned} \max_{0 \leq q} \quad & f_B(p, q) \\ \text{s.t.} \quad & f_B(p, q) \geq 0 \end{aligned}$$

Suppose $\bar{q}$ is a non-zero optimal solution in the optimal buying quantity model. Note that the necessary condition for the optimal solution is

$$\frac{\partial f_B(p, q)}{\partial q} = 0$$

Then, the non-zero optimal solution must satisfy:

$$\left. \frac{\partial U_B}{\partial x_N} \right|_{x_N = \bar{q}} = p$$

The corresponding relation between price and optimal buying quantity, determined by the above optimal buying quantity model, is called as the buyer's optimal buying quantity function. When there is more than one buyer in the market, the market's optimal buying quantity function can be established by summing up the optimal buying quantity functions of all buyers in the market. Obviously, the optimal buying quantity function will increase as the price increases. In the coordinate system with price as vertical axis and trading volume as horizontal axis, the curve of optimal buying quantity function can be called as the optimal buying curve.

If the intersection point of the optimal selling quantity curve and the optimal buying quantity curve exists, the corresponding trading volume is called as the market equilibrium volume, and the corresponding price is called as the market equilibrium price.

Fair value existence theorem:

Suppose that the total supply of asset N is Q ($Q > 0$) at the balance sheet date. Let $q = S(p)$ be the market optimal selling quantity function, $q = B(p)$ be the market optimal buying quantity function in a competitive market environment, $p = P_s(q)$ be the inverse function of $q = S(p)$, and $p = P_b(q)$ be the inverse function of $q = B(p)$. Suppose the intersection point of the optimal selling quantity curve and the optimal buying quantity curve exists. The equilibrium trading volume is denoted by $\bar{q}$, and the equilibrium price is denoted by $\bar{p}$, then

(1) If $Q \leq \bar{q}$, then, the fair value of asset N for the exchange volume Q is $P_b(Q)$;

(2) If $Q > \bar{q}$, then, the fair value of asset N for the exchange volume Q does not exist.

Proof:

(1) Suppose $Q \leq \bar{q}$, now we want to prove that $P_b(Q)$ satisfies all conditions of fair value for the exchange volume Q .

According to the definition of the optimal buying quantity curve, in the market, there are one or more buyers who are willing to buy Q units of asset N at the price of $P_b(Q)$. After the exchange, they

satisfy $f_b(q, p) \geq 0$ and $\frac{\partial U_b}{\partial x_N} = P_b(Q)$, according to the optimal buying quantity model.

According to the definition of the optimal selling quantity curve, in the market, there are one or more sellers who are willing to sell Q units of asset N at

the price of $P_S(Q)$. After the exchange, they satisfy $f_s(q, p) \geq 0$ and $\frac{\partial U_s}{\partial x_N} = P_S(Q)$,

according to the optimal selling quantity model.

Because $Q \leq \bar{q}$, and the optimal buying quantity function is a monotone decreasing function and the optimal selling quantity function is a monotone increasing function, we have $P_S(Q) \leq P_B(Q)$ (Figure1),

then $\frac{\partial U_s}{\partial x_N} = P_S(Q) \leq P_B(Q)$.

Figure1

Because $\frac{\partial U_B}{\partial x_N} = P_B(Q)$, the buyers would not buy Q units of asset N if the

price is higher than $P_B(Q)$. That is to say, if sellers raise the price above $P_B(Q)$, it is impossible to sell out all Q units of the asset N.

On the other hand, having known the optimal buying quantity curve, the sellers will sell Q units of asset N at price $P_B(Q)$ because they want to maximize their profit. That means that the buyers can not purchase Q units of asset N at a price lower than $P_B(Q)$.

So, $P_B(Q)$ satisfies all conditions of fair values. The fair value of exchanging Q units of asset N in the market must be $P_B(Q)$.

(2) Suppose $Q > \bar{q}$.

According to the definition of the optimal buying quantity curve, there are one or more buyers in the market who are willing to buy Q units of asset N at the price of $P_B(Q)$. After the exchange, their marginal utility

satisfies $\left. \frac{\partial U_B}{\partial x_N} \right|_{x_N=Q} = P_B(Q)$ according to the optimal buying quantity model.

Therefore, if the price is higher than $P_B(Q)$, they do not want to buy the last one of Q units of asset N , or they are not willing to buy all Q units.

According to the definition of the optimal selling quantity curve, there are one or more sellers in the market who are willing to sell Q units of asset N at the price of $P_S(Q)$. After the exchange, their marginal utility satisfies

$\left. \frac{\partial U_S}{\partial x_N} \right|_{x_N=Q} = P_S(Q)$ according to the optimal selling quantity model. Therefore, if

the price is lower than $P_S(Q)$, they do not want to sell the last one of Q units of asset N , or they are not willing to sell all Q units.

Because $Q > \bar{q}$, and the optimal buying quantity function is a monotone decreasing function and the optimal selling quantity function is a monotone increasing function, then $P_S(Q) > P_B(Q)$. Therefore, we have $\left. \frac{\partial U_S}{\partial x_N} \right|_{x_N=Q} > \left. \frac{\partial U_B}{\partial x_N} \right|_{x_N=Q}$.

That is to say, the price P satisfying condition (2) (i.e. $\left. \frac{\partial U_S}{\partial x_N} \right|_{x_N=q} \leq P$,

$P \leq \left. \frac{\partial U_B}{\partial x_N} \right|_{x_N=q}$) does not exist. Q.D.E.

The market may still be active even if the fair value does not exist, and for a single firm it is possible to sell out its assets at the current market price. But when all those assets from all firms arrive in the market, “at the measurement date”, it is almost impossible to sell out them at the current market price. In the real life, some assets may be held by firms longer than one period, for example, more than one year. Those assets can bring profit for firms through the manner of only holding them for a period of time. Such assets include securities, bonds, real estates etc. The part exceeding the firm’s optimal holding volume will be sent to the market for sale and will affect the market price. If all assets are sent to the market simultaneously in some special case at the measurement date, the market price must decline.

Unfortunately, when all those assets are measured at a fair value, the latter assumes that all those assets can be sold out at the current market price in a normal accounting period. When the real supply (Q) of the assets is larger than the equilibrium supply, the price of selling out all Q units of the assets is $P_B(Q)$,

lower than the current market price p_m . A large “income from changes in fair value” may be recognized when fair value accounting is used for all of this kind of assets. But only a part of it, or $P_B(Q)$, can be changed into cash flows. The part that cannot be changed into cash flows is not only unrealized, but also unrealizable. It constitutes then a “trap” for the market. It may be called a “fair value trap”. We can calculate the fair value trap as follows:

$$T = [p_m - P_B(Q)]Q \quad (3)$$

Where, p_m is the current market price and $P_B(Q)$ is the expected price when all available asset N arrive in the market simultaneously.

Of course, a fair value trap is a static measure of over-valuation relative to the clearing price. But the existence of fair value traps will send a misleading signal or information on fundamental value to the market participants, and may then provoke bubbles.

1.3. “Fair value trap” for financial assets

According to current accounting standards about financial assets, both “trading financial assets” and “financial assets available for sale” should be measured by their fair values. Why do firms keep on holding financial assets available for sale but make ready to sell trading financial assets? The reason must be that the utility of holding financial assets available for sale continuously is larger than that of selling them out in the current period. Therefore, only trading financial assets are exchanged in the market and the market price is formed based on the supply of the trading financial assets. We can conclude that, for financial assets, the fair value trap always exists due to the existence of “financial assets available for sale”.

If the total supply of trading financial assets Q_T and the total supply of financial assets available for sale is Q_A , then, the fair value trap can be estimated by the following model:

$$T = [p_m - P_B(Q_T + Q_A)](Q_T + Q_A) \quad (4)$$

For example, suppose $Q_T = Q_A$, $P_B(Q_T + Q_A) = \frac{2}{3} p_m$, we have $T = \left[p_m - \frac{2}{3} p_m \right] (Q_A + Q_A) = \frac{1}{3} p_m Q_A$. The equation indicates that while we have a market with $p_m Q_T$ securities traded in it, a third of the value of

financial assets available for sale, or $p_m Q_A$, is unrealizable for cash flow at the current price.

Fair value traps will be expanded due to the following reasons:

(1) Increase of the total supply of financial assets, which means an increase of $(Q_T + Q_A)$ and a decrease of $P_B(Q_T + Q_A)$;

(2) Speculation and irrationality of market participants, which leads to an increase of p_m ;

(3) Penetration of value bubbles from the real estates market or other commodities markets, which implies an increase of p_m .

If the fair value trap becomes large enough so as no investors want to hold the asset any longer, the asset price p_m surely begins to decline.

From the historical experience of economic development world wide, the bursting of bubbles in real estate market are the most likely trigger for a slump of the price of related financial assets. Moreover, the pro-cyclical effect of fair value accounting will exacerbate the market panic, and finally financial crisis outbreaks. When p_m decreases to $P_B(Q_T + Q_A)$, then $T=0$, and the fair value trap collapses completely.

Prior literature has found the actual affection of fair value accounting on financial market, such as the “contagion effect” (Bignon et al. 2004; Allen and Carletti, 2008; Plantin, etc. 2008b), but the underlying reasons behind the fair value concepts has been ignored. The fair value existence theorem indicates that serious economic consequences are derived from the inherent flaws of fair value concept. From this point of view, fair value should be redefined or removed from the basis of accounting measurements.

Though the empirical evidence needed for supporting the existence of fair value trap for financial assets is not provided in this paper, the current financial crisis is just a living case giving a good picture of

evolution of a financial asset fair value trap. Details about the application of the fair value trap are given in the third section of the paper.

2. Fair value accounting as “bubble maker”

2.1. Fair value self-expansion model

The securities market is supposed to be efficient in the following discussion, that is, the current market price is expected to reflect the fundamental value of the firm over time. If the securities held by a listed firm are measured by fair value, they are called “fair securities”. Fair securities should be equity securities in general because the values of fair securities are supposed to change following the change of the firm value.

Let k_{ij} be the proportion of fair securities issued by firm i and held by firm j

and let A be the matrix of k_{ij} :

$$A = \begin{pmatrix} k_{11} & k_{12} & \cdots & k_{1n} \\ k_{21} & k_{22} & \cdots & k_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ k_{n1} & k_{n2} & \cdots & k_{nn} \end{pmatrix} = (b_1 \quad b_2 \quad \cdots \quad b_n) \quad (5)$$

Where, $k_{ii} = 0$, $k_{ij} \geq 0$ ($i=1, 2, \dots, n$; $j=1, 2, \dots, n$) .

If $k_{ij} = 0$ for all j ($j=1, 2, \dots, n$) , that is, securities issued by firm i are

all held by no-listed firms, then delete firm i from the matrix. Matrix A can be called a fair securities related matrix and the firms in A can be called an related firm. Let

$$E = (1 \quad 1 \quad \cdots \quad 1)^T \quad \text{and} \quad AE = \left(\sum_{j=1}^n k_{1j} \quad \sum_{j=1}^n k_{2j} \quad \cdots \quad \sum_{j=1}^n k_{nj} \right)^T = b_1 + b_2 + \cdots + b_n$$

where AE represents the sum of proportions of securities held by other listed firms. If all securities of a firm are held by other listed firms, then we have $\sum_{j=1}^n k_{ij} = 1$ for the firm. In practices, it is true for almost all listed firms that their securities are held by no-listed firms or private shareholders after the public exchanges. Therefore, it is rational for us to assume that $\sum_{j=1}^n k_{ij} < 1$.

Let $F_0 = (\Delta x_1 \ \Delta x_2 \ \cdots \ \Delta x_n)$, denoting the changes of net assets measured in fair values (deficit is negative), caused by operating activities of listed firms. F_0 is called the initial changes vector of fair values. Because the securities market is efficient, the total prices of those firms' securities would change by $F_0 = (\Delta x_1 \ \Delta x_2 \ \cdots \ \Delta x_n)$. Then the values of those securities held by firm 1, 2, $\cdots$, n will increase respectively by

$$\left(\sum_{j=1}^n \Delta x_j k_{j1}, \sum_{j=1}^n \Delta x_j k_{j2}, \cdots, \sum_{j=1}^n \Delta x_j k_{jn} \right)$$

Or re-expressed as

$$F_1 = (F_0 b_1, F_0 b_2, \cdots, F_0 b_n)$$

The total value is

$$F_0 b_1 + F_0 b_2 + \cdots + F_0 b_n = F_0 AE$$

According to the fair value accounting standards, their securities assets should be re-valuated, and $F_1 = (F_0b_1, F_0b_2, \dots, F_0b_n)$ should be recognized as earnings and recorded as unrealized “changes in fair values”.

Because those listed firms have recognized and recorded the earnings, namely $F_0 = (\Delta x_1 \quad \Delta x_2 \quad \dots \quad \Delta x_n)$, the listed firms in the market as a whole add book values by F_0AE , with no corresponding cash flows occurred at all. Therefore, the value F_0AE represents an accounting bubble in the securities market.

Similarly, as the book values of those associated firms increase by $F_1 = (F_0b_1 \quad F_0b_2 \quad \dots \quad F_0b_n) = F_0A$, their stock prices should also increase in the efficient market. The value changes of securities caused by $F_1 = (F_0b_1 \quad F_0b_2 \quad \dots \quad F_0b_n) = F_0A$ will be $F_2 = (F_1b_1, F_1b_2, \dots, F_1b_n)$, and the total value increased could be calculated as $F_1b_1 + F_1b_2 + \dots + F_1b_n = F_1AE$.

The value changes of fair securities, namely $F_2 = (F_1b_1, F_1b_2, \dots, F_1b_n)$, will continue to lead to another round of value change of fair securities. The next rounds of changes can be calculated in the same manner. The m-th round of value changes of securities assets of listed firms is

$$F_m = (F_{m-1}b_1 \quad F_{m-1}b_2 \quad \dots \quad F_{m-1}b_n) = F_{m-1}A$$

The total value is

$$F_{m-1}b_1 + F_{m-1}b_2 + \dots + F_{m-1}b_n = F_{m-1}AE$$

Now summing up all added values (or bubbles) created by measuring securities' values according to fair value accounting, we have

$$\sigma(F_0) = F_0AE + F_1AE + \cdots + F_mAE + \cdots = \left(\lim_{m \rightarrow +\infty} \sum_{i=0}^m F_i \right) AE \quad (6)$$

Letting $H_m = \sum_{i=0}^m F_i$, we have

$$\begin{aligned} H_m &= \sum_{i=0}^m F_i = F_0 + (F_0A + F_1A + \cdots + F_{m-1}A) = F_0 + H_{m-1}A = F_0 + (F_0 + H_{m-2}A)A \\ &= F_0 + F_0A + H_{m-2}A^2 = \cdots = F_0 + F_0A + F_0A^2 + \cdots + F_0A^{m-1} \end{aligned}$$

Therefore,

$$\sigma(F_0) = \left(\lim_{m \rightarrow +\infty} H_m \right) AE = F_0 (I + A + A^2 + \cdots) AE$$

where I is an unit matrix.

Let $\lambda_1, \lambda_2, \dots, \lambda_p$ be the all eigenvalues of A , and denote the maximum of the absolute values by $\rho(A) = \max \{ |\lambda_1|, |\lambda_2|, \dots, |\lambda_p| \}$, called the spectral radius of A .

According to the matrix theory theorems about spectral radius, we have $\rho(A) \leq \max \left\{ \sum_{j=1}^n k_{1j}, \sum_{j=1}^n k_{2j}, \dots, \sum_{j=1}^n k_{nj} \right\} = c$, where c represents the maximum percentage of the fair securities, called the sum norm of rows.

Because parts of associated firms' securities are supposed to be held by no-listed firms or natural persons, then we have $\sum_{j=1}^n k_{ij} < 1$ ($i=1,2,\dots,n$).

Therefore, the spectral radius satisfies $\rho(A) \leq c < 1$. According to the

convergence theorem of matrix series in matrix theory, when the spectral radius $\rho(A)$ is less than 1, $\sum_{m=0}^{\infty} A^m$ is convergent.

Because $\rho(A)$ is less than 1, $I - A$ must be a non-singular matrix, and $\lim_{m \rightarrow \infty} A^m = 0$. Letting $S_k = \sum_{m=0}^k A^m$, we have

$$(I - A)S_k = \sum_{m=0}^k A^m - A \sum_{m=0}^k A^m = I - A^{k+1}$$

Multiplying both sides of the equation by $(I - A)^{-1}$, we obtain

$$S_k = (I - A)^{-1} - (I - A)^{-1} A^{k+1}$$

Suppose both sides of the equation tend to infinity, we have

$$\sum_{m=0}^{\infty} A^m = (I - A)^{-1}$$

Using the above relation, we can re-express the total bubbles $\sigma(F_0)$ as

$$\sigma(F_0) = F_0 (I + A + A^2 + \dots) AE = F_0 (I - A)^{-1} AE \quad (7)$$

We can name the above model a *self-expansion model of fair value*. The model indicates that when the listed firms earn a profit of F_0 measured by fair value, the fair values of securities held by all listed firms increase

by $F_0(I-A)^{-1}AE$ beside F_0 according to the fair value accounting. Though F_0 is possible to bring about a cash flow, $F_0(I-A)^{-1}AE$ is not related to any cash flow from the point of view of the whole market. Therefore, the fair value accounting creates a bubble of $F_0(I-A)^{-1}AE$ in the market. Let $B = (I-A)^{-1}AE$. It represents a self-expansion multiple and may be called a fair value multiplier.

The self-expansion model describes the economic consequence of fair value accounting based on the whole market. For a specific listed firm, the model is not applicable. When needed, the firm can sell out its securities and change them into cash flow in the market. That is why investors still want to buy the securities even if they are aware of the bubble. The existence of bubbles seems contrary to the efficiency of the market. In fact, the market is efficient for every investor, but not efficient for all investors as a whole or for the whole society. Among others, Posner (2009) does not think that the utility maximizing behavior of individuals is the main cause of the financial crisis because personal motivation always exists even long before the financial crisis. He points out that it is the systemic risk generated during the aggregation of all self-serving decision-makings that caused the financial crisis. Therefore, individuals or specific firms' self-serving decision-makings should not be condemned, and to curb the systemic risk is beyond the abilities of them. Only the regulatory authorities and governments have the ability to prevent the crisis.

It can be easily proved that historical cost accounting will not yield any double-counting bubbles. Detailed proof is given in the appendix.

2.2. The impact of fair value multiplier on accounting income

Let $K = I - A$. Because $A \geq 0$ and $\rho(A) < 1$, K must be a nonsingular Minkowski matrix, or a nonsingular M matrix. According to matrix theorems, we have $|K| > 0$. It is well known that $K^{-1} = \frac{K^*}{|K|}$, where K^* is an

adjoint matrix of K . So we have $K^* \geq 0$.

Suppose an invertible matrix T exists so as $A = TJT^{-1}$, where J is a Jordan criteria Matrix. Then, we have

$$|K| = |I - A| = |I - TJT^{-1}| = |T(I - J)T^{-1}| = |I - J|$$

The self-expansion multiple can be re-expressed as

$$B = (I - A)^{-1} AE = \frac{K^*}{|K|} AE = \frac{K^*}{|I - J|} AE \quad (8)$$

It can be concluded that the more close the spectral radius $\rho(A)$ approaches to 1, the more close $|I - J|$ approaches to zero, and the larger the self-expansion multiple. The larger the spectral radius of a securities market, the greater the fluctuations of securities values. The smaller the spectral radius of a securities market, the more stable the market. If we want to reduce the spectral radius, a very efficient way is to cut down the largest fair securities proportion among all listed firms.

Suppose all listed firms have the same fair securities proportion, denoted by s , then we have $AE = sE$.

Multiplying both sides of $(I - A)^{-1}(I - A) = I$ by E , we obtain

$$(I - A)^{-1}(E - AE) = E$$

Or, equivalently,

$$(I - A)^{-1} (E - sE) = E$$

The equation can be re-expressed as

$$(I - A)^{-1} E = \frac{1}{1-s} E$$

So, the self-expansion multiple can be transformed as

$$B = (I - A)^{-1} AE = s(I - A)^{-1} E = \frac{s}{1-s} E \quad (9)$$

The corresponding relations between the self-expansion multiple (B) and fair securities proportion (s) are shown in Table 1.

Table 1 Corresponding relations between the self-expansion multiple (B) and fair securities proportion (s)

s	5%	10%	20%	30%	40%	50%	60%
B	0.05E	0.11 E	0.25 E	0.43 E	0.67 E	1.00 E	1.5 E
s	70%	80%	90%	95%	99%	100%	
B	2.33 E	4.00 E	9.00 E	19 E	99 E	∞	

If little securities (s=5%) are hold by other listed firms, bubble is also very small (0.05E). When s=50%, fair value accounting will create a bubble as large as the operating income. As s increases from 50% to 100%, the bubble increases sharply. If most of issued securities (for example, s=0.6) of listed firm is held by other listed firms and is measured by fair value accounting, then it will create a bubble larger than (1.5E) the earnings obtained by the listed firms in their operating activities. As the listed firms obtain profit year by year, the bubbles will be heaped up gradually.

However, the bubbles will not expand forever. When it is burst by some strong external force, it will be shattered and a financial crisis will happen.

The self-expansion multiple will increase as the fair securities proportion (s) increases. The cross-holding securities are the source of bubbles under fair value accounting. The government supervisors should restrict the cross-holding securities proportion by listed firms if the abrogation of fair value accounting is impossible for political reasons. If the fair securities proportion of a listed firm's increases to a very high degree, it should be delisted compulsively.

2.3. The impact of fair value multiplier on accounting equity

Suppose that the correlation matrix of the "fair securities" (that are, securities accounted for at fair values) is composed of n listed firms. The following symbols are used to denote:

$(s_1 \ s_2 \ \cdots \ s_n)^T$: Vector of fair securities;

$(x_1 \ x_2 \ \cdots \ x_n)^T$: Vector of other assets (including goodwill);

$(l_1 \ l_2 \ \cdots \ l_n)^T$: Vector of liabilities;

$(f_1 \ f_2 \ \cdots \ f_n)^T$: Vector of equities related to fair securities;

$(u_1 \ u_2 \ \cdots \ u_n)^T$: Vector of equities related to non fair securities.

According to fair value accounting, the accounting equations for all associated firms in the correlation matrix can be changed into the following form:

$$\begin{pmatrix} s_1 \\ s_2 \\ \vdots \\ s_n \end{pmatrix} + \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix} = \begin{pmatrix} l_1 \\ l_2 \\ \vdots \\ l_n \end{pmatrix} + \begin{pmatrix} f_1 \\ f_2 \\ \vdots \\ f_n \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{pmatrix} \quad (10)$$

Summing up all elements in every vector, we obtain

$$\sum_{j=1}^n s_j + \sum_{j=1}^n x_j = \sum_{j=1}^n l_j + \sum_{j=1}^n f_j + \sum_{j=1}^n u_j \quad (11)$$

Now suppose the earnings obtained in the operating activities for all associated firms is $(\Delta x_1 \ \Delta x_2 \ \cdots \ \Delta x_n)^T$, and correspondingly the values of fair securities increase by $(\Delta f_1 \ \Delta f_2 \ \cdots \ \Delta f_n)^T$, and the values of non fair securities increase by $(\Delta u_1 \ \Delta u_2 \ \cdots \ \Delta u_n)^T$. Due to the increase of book values of equities, the values of fair securities held by other listed firms will also change by $(\Delta s_1 \ \Delta s_2 \ \cdots \ \Delta s_n)^T$. Then the accounting equations become

$$\begin{pmatrix} s_1 \\ s_2 \\ \vdots \\ s_n \end{pmatrix} + \begin{pmatrix} \Delta s_1 \\ \Delta s_2 \\ \vdots \\ \Delta s_n \end{pmatrix} + \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix} + \begin{pmatrix} \Delta x_1 \\ \Delta x_2 \\ \vdots \\ \Delta x_n \end{pmatrix} = \begin{pmatrix} l_1 \\ l_2 \\ \vdots \\ l_n \end{pmatrix} + \begin{pmatrix} f_1 \\ f_2 \\ \vdots \\ f_n \end{pmatrix} + \begin{pmatrix} \Delta f_1 \\ \Delta f_2 \\ \vdots \\ \Delta f_n \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{pmatrix} + \begin{pmatrix} \Delta u_1 \\ \Delta u_2 \\ \vdots \\ \Delta u_n \end{pmatrix} \quad (12)$$

Summing the elements in the above vectors, we have

$$\sum_{j=1}^n s_j + \sum_{j=1}^n \Delta s_j + \sum_{j=1}^n x_j + \sum_{j=1}^n \Delta x_j = \sum_{j=1}^n l_j + \sum_{j=1}^n f_j + \sum_{j=1}^n \Delta f_j + \sum_{j=1}^n u_j + \sum_{j=1}^n \Delta u_j$$

Because $\sum_{j=1}^n s_j + \sum_{j=1}^n x_j = \sum_{j=1}^n l_j + \sum_{j=1}^n f_j + \sum_{j=1}^n u_j$, then we obtain

$$\sum_{j=1}^n \Delta s_j + \sum_{j=1}^n \Delta x_j = \sum_{j=1}^n \Delta f_j + \sum_{j=1}^n \Delta u_j \quad (13)$$

According to the fair value self-expansion model, total values of fair securities added by fair value accounting is

$$\sum_{j=1}^n \Delta s_j = F_0 (I - A)^{-1} AE$$

where $F_0 = (\Delta x_1 \quad \Delta x_2 \quad \cdots \quad \Delta x_n)$.

Suppose $F_0 = E^T$ (i.e. every listed firm obtains one unit of earnings in the operating activities) and $AE = sE$ (i.e. the proportions of fair securities for every firms are same, and equal to a constant s). According to the above conclusions, we have

$$\sum_{j=1}^n \Delta s_j = E^T (I - A)^{-1} AE = \frac{s}{1-s} n \quad (14)$$

Therefore, the total value of all equities added by the fair value accounting is

$$\sum_{j=1}^n \Delta f_j + \sum_{j=1}^n \Delta u_j = \sum_{j=1}^n \Delta s_j + \sum_{j=1}^n \Delta x_j = \frac{s}{1-s} n + n = \frac{1}{1-s} n \quad (15)$$

A paradox can be derived from equation (15):

Fair value measurement paradox:

While all the associated firms generate earnings for 1 unit (for example, one billion), the total equities increase by 2.5 units (that is $s=0.6$, and $\frac{1}{1-s} = 2.5$). Is it reasonable that one unit of earnings generate 2.5 units of equities?

3. Empirical evidence supporting fair value self-expansion model

3.1. Impact on securities prices of accounting information

No direct empirical evidence for the above models in this paper is provided because of various limitations. However, we can gain support for those models from empirical results in the existing literature. First, we need to verify that the stock prices would be affected by changes of income in the listed firms' financial reports in an efficient capital market. Many empirical studies provide evidence that the changes of stock prices are relevant to the changes of accounting income.

Ball and Brown (1968) contribute the first literature about the relationship between stock prices and accounting information. They select a sample of 261 NYSE-listed firms with earnings across the period 1957-1965. They divide firms into good news firms and bad news firms based upon whether current year's earnings are larger or less than the expected earnings. Then, they track the stock price performance of the good news firms relative to the bad news firms across the 18 month period starting 12 months before the current year earnings are announced. To facilitate comparison across firms, they examine stock returns (change in stock price during a period scaled by beginning of period stock prices) rather than stock prices. Also, to control for market-wide movements in stock prices, they examine abnormal returns rather than raw returns (roughly speaking, abnormal returns are the difference between the raw stock return and the average market return). Much to the surprise of many doubters, they discover that stock returns of good news firms increase over the period, and the stock returns of bad news firms decline. In particular, if an investor has bought good news (sold bad news) firms' securities at the start of the accounting period, the investor would have outperformed the overall market by 6 (9) percent. Thus, they show that the unexpected earnings have information content in the sense that they "reflect" the economic events that drive investors' decisions during the accounting period.

Beaver, Clarke and Wright (1979) discover that the magnitude of unexpected earnings was related to the magnitude of the stock price response. They focus on market-adjusted stock returns so as to facilitate across-firm comparisons and to control for market-wide movements in stock prices.

Amir (1993), based on the data of U.S. capital markets, investigates the correlation degree between the financial reports of foreign firms listed in USA prepared according to their national accounting standards and the financial reports adjusted according to the American accounting standards. The results show that the correlation indeed exists.

Francis and Schipper (1999) use annual data in their test and provide evidence that the value relevance of earnings is decreasing over time. But Landsman and Maydew (2002) use quarterly data to test the value relevance of earnings, focusing on different market statistics (abnormal volume and return volatility, instead of abnormal returns), and offer a dissenting opinion.

There are lots of prior studies that provide empirical evidence that the capital market would be fooled by the change in the accounting numbers caused by alternative accounting methods with no cash flow consequences. Teoh, Welch and Wong (1998a) provide evidence that there exists an abnormal accrual which makes the income increase in the financial statements of listed firms applying for a seasoned equity offer. Teoh, Welch and Wong (1998b) and Teoh, Wong and Rao (1998) find the same phenomenon exists for firms before IPO. Dechow (1996) and Sloan (1996) find that the abnormal stock returns of listed firms are significantly reduced after their earnings managements become known.

3.2. Impact on securities prices of fair value changes

In 1991, the Financial Accounting Standards Board (FASB) issued SFAS 107, requiring all companies to disclose the fair values of financial assets and liabilities in the financial statements or annotations. In 1994, SFAS 119 requires the disclosure of the fair value of derivative financial instruments. This statement was superseded by SFAS 133 (issued in June 1998) that requires firms to disclose their financial assets and liabilities measured at fair value in financial statements. As a result, a large number of studies

related to the fair value of financial instruments began to focus on the bank industry. The following empirical studies provide evidence that stock prices will increase when issuing firms report added values of its trading financial assets according to the fair value accounting.

Bernard etc. (1995) study the value relevance of fair values based on the bank data of Denmark, and find that there is no significant evidence to support that the management manipulates the fair values in its financial reports. More information is contained in the mark to market accounting reports than historical cost reports, and the mark to market information is more powerful to explain the value of the firm. The fluctuation of stock returns increases significantly after the mark to market accounting is adopted.

Nelson (1996) tests the correlation between the values of equities of 200 largest banks in United States and the fair value information disclosed according to the SFAS107. He find that investments in securities are relative to values of equities, but loans, deposits, long term liabilities and financial instruments outside statements are not. But Eccher, Ramesh and Thiagarajan (1996) argue that not only investments in securities, but also other financial assets like loans, long term liabilities and financial instruments outside statements are value-related and the fair value accounting provide a comprehensive information source for investors.

Barth, Beaver and Landsman (1996) investigate 136 banks of USA from 1992 to 1993 to test the value relevance of fair value information disclosed according to SFAS107. They find that investments in securities, loans, long term liabilities are all value relevant but the deposits and financial instruments out-balance-sheet are not.

Khurana and Kim (2003) investigate the banks from 1995-1998, and find that fair values are more value relevant than historical costs for both trading financial assets and available for sale financial assets because of the existence of efficient markets. But loans and deposits are not value relevant. For the small banks or private banks, historical costs are more useful than fair values. They argue that the more efficient the capital market, the more value relevant the fair values measured based on the market.

4. Application to the financial crisis

4.1. Financial assets and the current financial crisis

Since 2000, due to the stimulus by the low interest rate policy of American Federal Reserve committee, U.S. mortgage companies started to increase loans to low-income families (subprime loans). Although subprime loans are of high-risk (defaults more easily happen for low-income families), the high interest rate of subprime loans is attractive for mortgage companies. Meanwhile, the house prices are rising. If low-income families do not default, the mortgage company can get higher interest income; even if low-income families default, as long as mortgage companies repossess the house and auction it, they will not lose any money. Since 2001, subprime mortgage loans in all American home mortgage loans increased from about 2% in 1999 to nearly 15% in 2006. Subprime loans are packaged into standardized Mortgage-Backed Securities (MBS) and Collateralized Debt Obligation (CDO) by investment banks and sell them to more investors. The proportion of MBS using subprime loans as underlying assets in total MBS increased rapidly from 3% in 2001 to 13% in 2006³.

Since 2004, American Federal Reserve committee began to raise benchmark interest rates, default rates of subprime loans continued to rise, causing a slump of subordinated bonds. In early 2008, debentures of two largest U.S. mortgage companies Fannie Mae and Freddie Mac, supported by government, began to be massive sell-off. Share price of Bear Stearns who issued subordinated bonds plummeted, and ultimately the firm declared bankruptcy. According to the model (9), listed firms holding large number of subordinated bonds will incur lose larger many times than the devaluation of subordinated bonds. In August of 2008, Columbia Bank and Trust Company closed down, becoming the ninth of bankrupt banks. In September of 2008, Lehman Brothers, with asset values of more than 600 billion of U.S. dollars, went bankruptcy. Merrill Lynch, Larger than Lehman Brothers, is acquired by Bank of America. Fannie Mae and Freddie Mac were taken over

³ Report (2008) by The Mortgage Banker Association.

by Federal Housing Finance Board. In October, a panic crash spread in the global stock market, and the financial crisis broke out.

4.2. Impact of real estates market on financial assets

If the expected price of real estate is expected to rise in next few years, investments in real estate will be profitable under conditions of low loan interest rates and low initial payments. High profits will attract more investors to buy lands and build houses, and in turn, the increased demands will lead to higher expected price of real estate.

For further explanations, we use the following symbols:

dp = proportion of initial payment to total investment;

P_t = the current price of houses;

$dp \times P_t$ = initial payment;

R_{t+1} = expected rent for the house;

C_{t+1} = expected total expenditure on the house (management fees, maintenance fees, insurance, taxes, etc.);

l = loan interest rate;

$(1 - dp) \times P_t \times l$ = interest of one year for the house;

$R_{t+1} - C_{t+1} - (1 - dp) \times P_t \times l$ = expected net rent income;

$u = \frac{R_{t+1} - C_{t+1}}{P_t}$ = expected net rent income rate;

dep = depreciation rate of houses;

P_{t+1} = expected new house prices after one year;

$(1 - dep) \times P_{t+1}$ = expected price after one year for a new house bought now;

$(1 - dp) \times P_t$ = liability after one year for the loan on the house;

$(1 - dep) \times P_{t+1} - (1 - dp) \times P_t$ = expected net value for the investment in the house after one year;

r = required rate of return (or the discount rate) for the investment on the house.

The present value of the house can be calculated as follows:

$$\begin{aligned}
 NPV_t &= \frac{R_{t+1} - C_{t+1} - (1 - dp) \times P_t \times l}{1 + r} + \frac{(1 - dep) \times P_{t+1} - (1 - dp) \times P_t}{1 + r} - dp \times P_t \\
 &= \frac{u \times P_t - (1 - dp) \times P_t \times l}{1 + r} + \frac{(1 - dep)(1 + g) \times P_t - (1 - dp) \times P_t}{1 + r} - dp \times P_t \\
 &= \frac{u - (1 - dp) \times l - dep + (1 - dep) \times g + dp}{1 + r} \times P_t - dp \times P_t \quad (16)
 \end{aligned}$$

The present value of the house is calculated by summing up the present value of expected net rent income (the first term in the right side of the first equation) and the present value of expected value of the investment on the house (the second term in the right side of the first equation), and subtracting the initial payment (the third term in the right side of the first equation).

Let $NPV_t = 0$, or

$$\frac{u - (1 - dp) \times l - dep + (1 - dep) \times g + dp}{1 + r} \times P_t - dp \times P_t = 0$$

From the above equation, we can derive r , or the internal rate of return of the investment as

$$IRR = \frac{u - (1 - dp) \times l - dep + (1 - dep) \times g}{dp} \quad (17)$$

Based on the related data from the current Chinese real estates market, we can estimate those variables as follows:

Yearly depreciation rate (dep) = (1- estimated residual value ratio) /estimated useful life = (1-5%)/40 = 0.02375

Growth rate of house price increase (g) = 20%, according to the increasing speeds in recent years.

Net rental rates (u) = 2.5%, according to the rental ratio1:400.

Initial payment ratio dp=30% and loan rate l =4.16%, according to the current mortgage policies of Chinese banks.

Then, the internal rate of return of the investment on houses is

$$\begin{aligned} IRR &= \frac{u - (1 - dp) \times l - dep + (1 - dep) \times g}{dp} \\ &= \frac{2.5\% - (1 - 30\%) \times 4.16\% - 0.02375 + (1 - 0.02375) \times 24\%}{30\%} \\ &= 52.14\% \end{aligned}$$

How shocking the return rate is. We can conclude that the internal rate of return is directly affected by the growth rates of house prices. In particular, when the house price keep unchanged, or $g=0$, then $IRR=0.6\%$ remaining other conditions unchanged, and when $g=-10\%$, then $IRR=-32.1\%$.

If the house prices have increased quickly for a long time, high return on houses will attract larger investment in real estates and create larger investment real estates. As the supply of houses much exceeds the consumer demands for houses, a large fair value trap will be formed according to the fair value existence theorem.

4.3. Break of bubbles in capital market

From the point of view of economic history, financial crisis are often associated with the break of value bubble in real estate.

As discussed above, if we buy a house on loan, we can obtain an internal rate of return as high as 52.14% in the current market. However, when the house price keep unchanged, or $g=0$, then $IRR=0.6\%$ remaining other conditions unchanged, and when $g=-10\%$, then $IRR=-32.1\%$. The simple calculation tells us that if the house price can not maintain a high growth, investors will obtain little profit or make a loss from the investment. Then they will transfer their money to other industries, which will in turn accelerate the downslide of the house price. Some investors with insufficient cash flows may be unable to repay the loan and have to go bankrupt. As the numbers of bankrupt firms increase, banks with large loans on house investments will incur huge losses.

Suppose listed firm i incurs a loss of l_i because it possesses securities of banks which suffer losses in the loan on houses or debentures based on loans on houses, like Mortgage-Backed Securities (MBS) and Collateralized Debt Obligations (CDO). The prices of securities of firm i will also decrease in an efficient capital market. Similarly, as in discuss of self-expansion model, we use k_{ij} to denote the proportion of fair securities of firm i held by firm j , and construct the fair securities related matrix as follows:

$$A = \begin{pmatrix} k_{11} & k_{12} & \cdots & k_{1n} \\ k_{21} & k_{22} & \cdots & k_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ k_{n1} & k_{n2} & \cdots & k_{nn} \end{pmatrix} = (b_1 \quad b_2 \quad \cdots \quad b_n) \quad (18)$$

Where, $k_{ii} = 0$, $k_{ij} \geq 0$ ($i=1, 2, \dots, n$; $j=1, 2, \dots, n$). If $k_{ij} = 0$ for all j ($j=1, 2, \dots, n$), then delete firm i .

Let $L = (l_1, l_2, \dots, l_n)$ be the loss vector of listed firms in the related matrix. If firm i included in the matrix does not incur any losses in the fall of house prices,

then put $l_i=0$. According to the fair value self-expansion model, the total loss of those listed firms will increased by

$$\sigma(L) = L(I + A + A^2 + \dots)AE = L(I - A)^{-1}AE \quad (19)$$

The above model means that all listed firms in the matrix will lose $LE + L(I - A)^{-1}AE$ because of the decline of house price. Suppose all listed firms in the matrix have a same fair securities proportion of 60%, then we can calculate the total added lose is $\sigma(L) = 2.5LE$. The added lose is incurred by fair value accounting.

Some firms may not be able to bear the loss and have to declare bankrupt. As more and more firms run into financial troubles, investors in capital market may lost their confidence and clear their securities. Then a serious financial crisis may come soon.

Conclusions

Two fatal intrinsic flaws of fair value accounting are found in this paper: (1) non-complete existence, that is, the available fair value may not exist under certain conditions. When the fair value is not existent, there always exist a fair value trap which is a potential trouble for capital markets; (2) self-expansion, that is, the fair value accounting is also a bubble maker, and the normal net income may cause a huge bubble under fair value accounting. All the flaws would lead to fair value traps, and finally provoke bubbles and eventually crashes. This argues for the major role of fair value accounting during the financial crisis of 2007.

For a single firm, it may be possible to sell all its assets at “fair value”, but it is usually impossible for all firms to sell their assets in a market at the measurement date. From the standpoint of whole market, fair value accounting becomes a numbers game considering that its book values lose the internal relations with cash flows. The intrinsic flaws of fair value

accounting imply that it cannot be taken as a proper basis of accounting recognition and measurement.

Though lots of evidences for the relationship between accounting information (including fair value information) and stock prices or stock returns have been provided by much existing literature, further empirical study are expected to verify the existence of fair value trap and the economic consequences of self-expansion model.

Appendix

One of the referees of this paper uses the following example to illustrate double counting could also arise from historical cost accounting when we have cross-holding.

Consider two firms, firm A and firm B. Both firms start with \$100 cash and \$100 equity, and both firms have a return on asset of 20%. Compare two scenarios. In scenario 1, firms do not have cross listing. As a result, the total equity of the two firms at the end of the period is $200 + 200 * 20\% = 240$.

In scenario 2, suppose firm A invests 40% of its cash with firm B. At the beginning of the period, firm A has \$60 cash and \$40 investment. Firm B has \$140 cash and \$140 equity. At the end of the period, the total equity for Firm B is $140 * (1 + 20\%) = \$168$. For firm A, it earns $60 * 20\% = 12$ from its non-investment asset and recognizes its share of the profit in firm B ($140 * 20\% * 40 / 140 = \8) based on equity method. Thus, Firm A's equity is $100 + 12 + 8 = \$120$. The total equity of the two firms are \$288, higher than 240 in the first scenario.

The comment is no doubt correct if all equity investments are measured based on "equity method". The equity method has the same effect as fair value accounting in that the incomes acquired by invested firm are recorded by both investment firm and invested firm. The equity method is not included in the self-expansion model of fair value because the paper focuses on flaws of fair value accounting.

However, historical cost accounting does not yield any double-counting bubbles if only "cost method" is used in measuring equity investment. When a firm obtains a net income, under cost method, its stocks held by other listed firms will not be re-measured and remain the book values unchanged as before, though

the market price of those stocks may increase. If those stocks are sold, the seller will realize an income and obtain related cash flow, while the buyer does not generate income from the transaction (no earnings are obtained). Book values of stocks do not reflect increased market values of those stocks. Therefore, no bubbles will be led by historical cost accounting.

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