

MINSKY OPTIONS AND SUBPRIME

Chiara Oldani, PhD

Lecturer of Economics

University of Viterbo “La Tuscia”

Faculty of Political Sciences

coldani@unitus.it, chiara_oldani@yahoo.it

Tel +393479452010

Viterbo, via San Carlo 32

01100 Italy

This draft 21 Febr. 2009

Abstract

The Financial Instability Hypothesis-FIH (Minsky, 1977) explains the endogenous creation of the business cycle by considering how the economic units contribute to the capital development, and the debt impact. The FIH is a powerful model to describe how financial markets become unstable, also in the absence of an exogenous shock. We consider the availability of hedging tools for firms, (i.e. options), which should positively influence their cash and interest payments (i.e. savings). First empirical evidence on the American economy shows that the hypotheses put forward can be satisfied over tranquil periods of financial markets. On the contrary, if markets become unstable, derivatives contribute to instability and the only solution is the one put forward originally by Minsky: the Government intervention.

Keywords: Minsky, Financial Instability Hypothesis, Options, Hedge-hedging, subprime financial crisis, Government intervention.

JEL Numbers: E12, E32, G1.

Introduction

The Minsky model is an interesting alternative to Neo-Classical and New Keynesian models, which are completely unsatisfactory in integrating the real and the financial sides of macro-models. In particular, for both streams of the literature the evolution of the financial system is subject to exogenous shocks, while Minsky supposes also the existence of an endogenous push toward new equilibrium. To manage the natural instability of a dynamic capitalist economy, Minsky emphasized the role for the government to create adequate constraining institutions to stabilize the economy. The financial stability is one of the most relevant duties of the monetary and financial authority (Central Bank and the Government), and financial innovation, like derivatives, changes the way the authority can operate to achieve stability. In the Minskian Financial Instability Hypothesis (FIH), the hedging propensity represents markets' sentiment, but regulation and monitoring are strategic ingredients to guarantee effective stability. We introduce financial derivatives (i.e. options) in a fully articulated Minskian FIH model by means of the hedging they provide to firms. Financial innovation widens the portfolio allocation opportunities, and improves market liquidity. Hedging is a natural feature of the Minskian theory, and is a function of options. The paper is organised as follows: the first section introduces the FIH, the second implements the model to consider the hedging ability provided to economic units. The third discusses the (in)stability that can be carried by derivatives in the macro-economy; the fourth presents some empirical evidences; the fifth depicts the subprime mortgage crisis as an application of the FIH. A concluding paragraph draws policy implications.

1. Financial instability and the macroeconomy

Hyman Minsky (1977) introduced the Financial Instability Hypothesis (FIH) as an alternative interpretation to the Keynesian Theory (1936), in which he considers instability to be endogenous. The key to the theory is the capital development of the economy, rather than the allocation of given resources to alternative uses. Capital development is accompanied by exchanges of present for future money. In the capitalist economy, the past, present and future are linked not only by capital assets and labour force, but also by financial relations. In a simplified economy, aggregate profits in each period equal aggregate

investments. In a slightly more complex system, aggregate profits equal aggregate investment plus the government deficit. So, the FIH is a theory of debt impact on the economic system, and banks are profit-seeking businesses (not simply intermediaries of resources)¹.

Three distinct income-debt relations can be identified for economic units: hedge, speculative and Ponzi finance. Hedges fulfil their payments by their cash flows; governments and corporations with floating debt and banks are hedges. Speculators finance their payments, but cannot repay the principal and need to roll over their liabilities. Ponzi units are unable to pay their obligations (interest and the principal), and need either to borrow or to sell assets; by doing this they tend to lower their overall margin of safety. According to the Minskian interpretation, if hedge finance dominates in the economy, it is more likely to reach a stable equilibrium; if Ponzi and speculative units dominate, the likelihood that the economy deviates from equilibrium increases. The economy has financing regimes, some of which bring stability and others that are unstable. Over periods of prosperity, the economy moves from financial relations bringing stability to those bringing instability. This means that after periods of prosperity, the financial structure tends to move toward Ponzi and speculative structures. If inflationary pressures arise, because of exogenous or endogenous events, speculative units become Ponzi, and Ponzi units can default. The evolution process, from being robust to fragile, is endogenous. The FIH is a system, which does not need any exogenous shock to generate a business cycle, since the cycle is the result of the internal dynamics and of the existing regulation and interventions. The Government has the duty to stabilise the economy, is active in the system and can be of relevant size; the Government is not perfect, similarly to other agents, and can fail.

¹ This means that banks do not only distribute resources, but also look for extra value.

This framework is useful to evaluate the contribution of innovative financial securities, i.e. options, which are employed by markets' participants to hedge in the search of new markets' opportunities. Financial innovation represents a natural evolution of financial markets, and derivatives success over the recent decades, especially with respect to OTC contracts, is explained by their being tailored on customers' needs. We consider derivatives used for the purpose of hedging, i.e. options, and consider their contribution toward stability. Among different types of derivatives contracts, options represent a relevant share of transactions, their pricing mechanism is supposed to be efficient, while the implied volatility of options is monitored and analysed as a proxy of market sentiment².

As a result of the structural changes introduced by derivatives in the global financial system, we believe that the financial stability can be guaranteed only by explicitly considering them in the macro-model; this awareness implies that the FIH should cope with derivatives. They are relevant both in terms of volume of transactions, but also play a role in the monetary theory.

The BIS, in the quarterly review and in the triennial survey, reports the amazing growth derivatives experienced over the last decade; according to last figure available, the notional amount of OTC derivatives reached \$683.7 trillion in June 2008. The gross market value, which "measures the cost of replacing all existing contracts and are thus a better gauge of market risk than notional amounts," reached \$20.4 trillion. This volume of transactions corresponds to around 4 times world GDP (on a yearly basis), but it is relevant to note that refers to trading activity of OTC transactions (i.e. deregulated and less collateralized than exchange traded contracts). Most contracts are interest rate based (US Federal Fund rate

² The implied volatility of S&P500 (VIX) is monitored by the US Federal Reserve Bank since 1999, and considered as a barometer of market sentiment useful for monetary policy analysis

and the European Euribor), and are mostly traded in the US³. Other than their size, which is inflated by nominal values, that is never exchanged between parties, the relevance of financial derivatives is mirrored in the efficient pricing mechanism, the lower bid-ask spread, and the increased liquidity they provide to the underlying market.

At a macroeconomic level the effects of derivatives and options has not been fully investigated and their role, stabilizing or not, is not taken for granted. According to the neo-classical macro-theory financial markets are complete, and derivatives, being replicates of underlying assets, are zero-sum games and thus add nothing new in terms of wealth or risk to the financial and real sectors.

We doubt that derivatives represents a zero sum-game in the financial system, and follow the literature that believes that derivatives have influenced:

- a. the money demand: they affect the speculative motive to hold money, since they are interest rate sensible⁴;
- b. the money circulation: firms and banks substitute liquid disposable (free) reserves with rolled-over derivatives contracts, modifying the multiplication process and its stability⁵;
- c. the credit channel: banks can substitute the central banks funds with liquid rolled-over derivatives contracts, and firms can substitute banking credit with liquid transactions and portfolio strategies⁶.

2. The financial instability hypothesis in the presence of options

Let us consider a closed economy, where price levels and the interest rate are constant; workers do not save ($C_W=W$). There is no issue of new shares (fixed supply), D is debt, r is

³ For more detailed data, see the Derivatives Statistics section in the Bank for International Settlements website (www.bis.org).

⁴ Banca d'Italia, 1995; European Central Bank, 2000; Upper, 2006; Violi, 2000; Vrolijk, 1997.

⁵ Hunter and Marshall, 1999; Vahamäa, 2005.

⁶ Gorton and Rosen, 1996; Hunter and Marshall, 1999.

the (constant) interest rate, P is the flow of profits, and the propensity to save on profits is $0 < s_f < 1$ ⁷. The capitalist propensity to save on dividends and interest received is s_c .

We implement the savings function, and introduce financial innovation, through the hedging possibility given to investors.

Derivatives are efficient instruments thanks to their good pricing mechanism, which should rule out arbitrage. Their volatility is comparable to that of underlying financial securities (Avellaneda and Laurence, 2000). The financial literature has shown that the introduction of derivatives ameliorates the pricing mechanism and then average financial volatility diminishes. The level of volatility is a proxy of market (in)stability; when markets are tranquil, volatility is low and stable, while over periods of stress, volatility increase and is unstable. The expected future volatility computed from option prices provides a measure of the uncertainty that the market attacks to the future developments: “a barometer of markets sentiment” (ECB, 2000 and Federal Reserve, 1999). Option contracts can be used to extract investors’ attitude toward risks (BIS Quarterly Review, 2003); the risk attitude changes over time and the level of investors’ effective risk aversion changes with financial market dynamics.

We proxy the hedging in the Minskian FIH with a variable that is considered to be the “barometer of markets’ sentiment”; the behavior of the two variables, over tranquil periods of time, is very similar⁸. When volatility is low, hedging of firms is stable and relatively low; when volatility increases, hedging becomes more relevant (risks and interest payments increase) and firms need to modify their portfolios to match the modified risk-return path.

⁷ Notation used is that of Charles (2004).

⁸ Over periods of shocks the behavior of many financial variables becomes unpredictable, and the intervention by the government is necessary to stabilize.

Hedging is an important feature of derivatives, according to users' survey, and we incorporate it directly in the FIH; the possibility to hedge has nominal positive effects on firm's debt. Formally, it positively influences the firm saving.

The saving function can be expressed as:

$$S = s_f[P + (\theta - r)D] + s_c[(1 - s_f)(P - rD) + rD] \quad (1)$$

The savings (S) by firms depends on the propensity to save on profits (s_f), profits (P), debt (D), the propensity to save on dividends and interest received (s_c), and two parameters: r and θ . The interest rate paid by firms on their debt, r , is supposed to be constant. Options are employed by firms to hedge their debt and enter the saving function by means of a hedging parameter (θ). The hedging parameter we introduce, θ , is supposed to be constant (not time dependent). We suppose that $0 < \theta < 1$. The fact that $\theta > 0$ means that the hedging strategy is effective, and can contribute to reduce the payments by firm⁹.

An important condition for not introducing explicitly moral hazard is that debt, in the presence of hedging, should exhibit always a positive costs; this means that:

$$\theta < r \quad (2)$$

If this condition is violated, it is possible for firms to raise debt at no costs, i.e. arbitrage and moral hazard, which violate the stability conditions of the model. In period of turbulence (i.e. when volatility of financial markets change abruptly) it can happen that hedging strategy is ineffective, and the payment is aggravated (i.e. $\theta < 0$).

The literature has referred to derivatives as securities, which contribute to complete financial markets thanks to their microeconomic properties¹⁰. Since the markets are efficient and agents are rational, the availability of hedging securities completes the investment opportunities, and ameliorates the allocation process. Options, the most traded

⁹ If $\theta < 0$ or $\theta > 1$ it is not hedging but speculation.

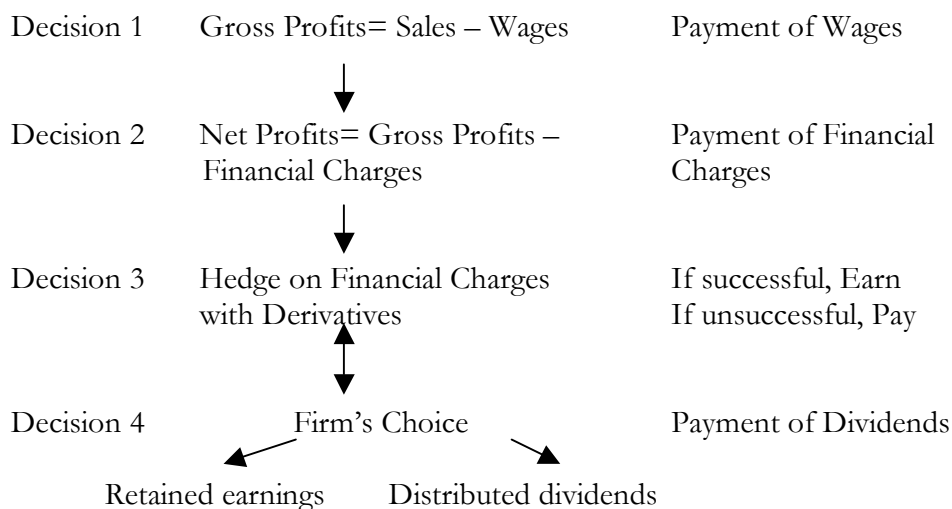
¹⁰ See Ang and Cheng (2005), and Hung-Gai and Leung (1993) among the others.

and liquid financial derivatives contract, make no exception (Cohen, 1999; Conrad, 1998; among the others).

Options enter the saving function through firms' debt. I investigate the role and effects of derivatives, as hedging tools. Firms, governments, and financial operators use derivatives to hedge and only if they are risk lovers, to speculate (Ponzi units).

Table 1, which is a modification of Charles table (2004), shows the chronology of firms' decision regarding their payments; after labour costs are taken off, financial charges are paid, and then the decision to hedge produces its effects. If hedging reduces the burden of financial charges, its effect is that of increased profits, which can be either distributed to shareholders or not (decision 4); this last decision is independent from the decision to hedge, but both are not independent from tax rules. As a matter of facts, tax timing options can induce firms to employ extensively hedging tools thus influencing decision 3, while unfair tax rules can induce firms not to distribute dividends to shareholders, but push for an increase in shares' price. Because of these forces, the arrow which links decision 3 to 4 is bidirectional.

Table 1 Chronology of Firm's Decision with Derivatives



The difference with the Charles (2004) elegant analysis of the FIH is the possibility to hedge financial costs; it is a financial practice aiming at smoothing the interest rate payments, and it is computed as a way to diminish the cost of debt (if the strategy is successful). Hedge units can be successful in their hedging strategy (i.e. $\theta > 0$ and $< r$) or not, depending on financial markets performance and on their portfolio strategies.

With a constant hedging (θ) the solution to the Minskian model is that shown by Charles (2004) since the new parameter (the hedging parameter) enters the equilibrium conditions, but not the final equation. The non-linear form of the model is still unsolved; the introduction of a new parameter introduces further conditions for non-negative debt, but the representation by Charles (2004) is valid.

The debt dynamic is given by:

$$dD/dt = I - s_f[P + (\theta - r)D] \quad (3)$$

I is the investment, which is financed either by new issued debt (dD/dt) or by retained earnings. The equilibrium condition on the goods markets, which is the net cash flow, is given by:

$$s_f[\pi + (\theta - r)d] = s_f \frac{g - s_c r d}{s_F} \quad (4)$$

where $\pi = P/K$ is the profit rate, $g = I/K$ is the rate accumulation; $d = D/K$ is the debt to capital ratio, $0 < s_f < 1$ and $1 > s_F = s_f + s_c(1 - s_b) > s_b$, $s_c > 0$. The rate of accumulation evolves according to the law:

$$\dot{g} = \delta(g^d - g) \quad (5)$$

This is the difference between the desired (g^d) and the effective (g) levels. The desired level depends on the net profits, $g^d = \gamma s_f[\pi + (\theta - r)d] + b$, where γ is a positive coefficient, which links the net cash flow to the investments decision, and b is a positive parameter.

The non-linear system of differential equations described above has no closed form solution, and the phase diagram helps describing their behaviour.

Following Charles (2004), the isoclines¹¹ are:

$$\begin{aligned} d(\dot{g} = 0) &= [\gamma s_f \pi + \gamma s_f b - g] / [\gamma s_f (\theta - r)] \\ d(\dot{d} = 0) &= (s_F - s_f)g / (s_F g - s_f s_c r) \end{aligned} \quad (6)$$

which describe the system's behaviour after some predefined values are given to the parameters (e.g. values of r compatible with a non negative debt). I form no special hypothesis on the relationship between the parameters (γ, s_F, s_c, s_f, r), but the one expressed in the functions. The phase diagram describes the behaviour of this non-linear system between g and d .

If the hedging coefficient increases ($\theta \rightarrow 1$) the shape of the curve changes, depending on the value of the (new) equilibrium condition¹². In particular, if θ increases, the left hand side of (4) increases, inducing either an increase in the numerator of the right hand side, or a decrease in the denominator, or a combination of the two. The variation of θ can correspond to a variation in one or more of the other four parameters and/or to variables. A relevant issue to address is to what extent a shock affects the model and how much of derivatives' investments reflect in the hedging coefficient, θ ; inefficient financial markets provide very poor opportunity for hedging ($\theta=0$), while perfect financial market can provide good, but not full hedging¹³. The creation of derivatives' market is, according to the literature, a sign of increasing efficiency and completeness¹⁴ of financial markets; this

¹¹ Since the system is non linear, isoclines are useful tools to describe its dynamic; they are computed imposing the differential term to zero, then obtaining the slope of the curves, but not their exact positions. We can have a rough idea of the behaviour of the curves, but cannot obtain equilibrium points.

¹² The equilibrium depends on 5 parameters ($r, \theta, s_c, s_f, \gamma$) and two variables (d, g).

¹³ Having full hedging ($\theta=1$) means that no matter how risky is the investment, an insurance is always provided on the capital, but this gives raise to herding behaviour.

¹⁴ See Violi (2000); Vrolijk (1997); Upper (2006).

means that financial systems with derivatives are characterised by a hedging parameter that is absent in markets without derivatives.

According to the theory, instability (caused by a shock) reflects high variation in prices (or quantities). When the system moves toward instability, it is probable that the hedging ability of financial operators weakens, because of model risk acting at the detriment of the efficiency of hedging strategies, which usually relies on past-observed values. This means that regardless of operators portfolio rebalancing, the hedge is ineffective ($\theta \rightarrow 0$).

We consider the effects of the hedging (θ) in the model, keeping it time-invariant; in particular, we are interested in how it influences the investment dynamics ($d(\dot{g}=0)$).

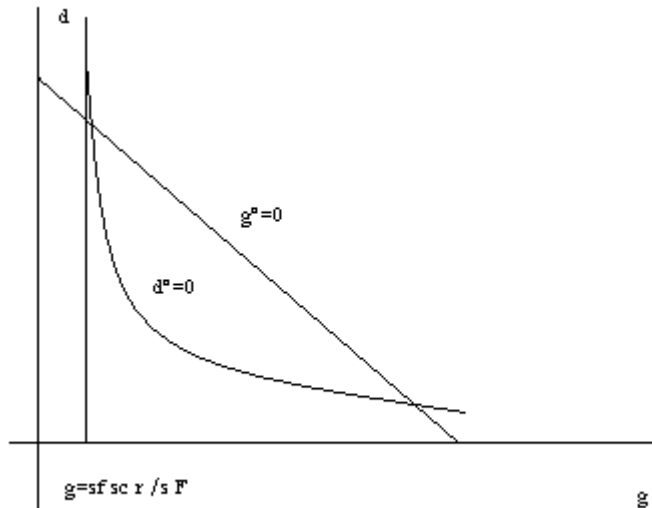
During periods of tranquillity, $(\theta-r)<0$ the isoclines, $d(\dot{g}=0)$, can have positive or negative slope, depending on $(\gamma s_f \pi + \gamma s_f b - g)$ being positive or negative. If it is positive, the slope of isoclines is negative (fig. 1).

Over periods of growth the Minskian economy improves its performance and the equilibrium condition (4) is assured by the positive cash flow. By ameliorating at any period of time, the economy increases its appetite for risk, which translates first into an higher debt accumulation, and secondly the hedging preference (θ) tends to increase (i.e. new risks need to be hedged, and/or higher appetite for risk needs wider hedging).

If the isoclines have a positive slope, the system is unstable, since the investment is accelerating at an increasing speed (i.e. bubble)¹⁵. The presence of bubbles is coherent with Minskian original interpretation and should be solved by the Government intervention. To safeguard the economy and its stability, the role of public authorities is crucial; the rule of law, the possibility to influence the adjustment process and its speed are key features in the reaction to bubbles.

¹⁵ An empirical evaluation of key parameters is presented in the following paragraph, and cannot rule out bubbles.

Fig.1 Isoclines of the Minsky Model of the Accumulation of Debt



Source: Charles, 2004.

3. Options: Bringing (In)Stability?

The Minsky model is useful to assess the impact of innovative financial securities, which influence the debt accumulation process and the achievement of a stable equilibrium. With this respect, a relevant issue is the (in)stability due to hedging.

Innovation plays a special part in the process of growth of the capitalist economy; it contributes to push forward growth, profits and investments endogenously, in periods of tranquillity and stability. On the basis of previously explained stylised elements about options (i.e. lower bid ask spread, good pricing efficiency), we argue that the variability of θ should not be too different from the one recorded in the stock exchange, or on other traditional financial markets (bonds, or others) in the absence of adverse shocks.

Exchange-traded derivatives have been steadily increasing over the last decades, and are becoming more efficient and attractive, even for medium and small-size (non professional)

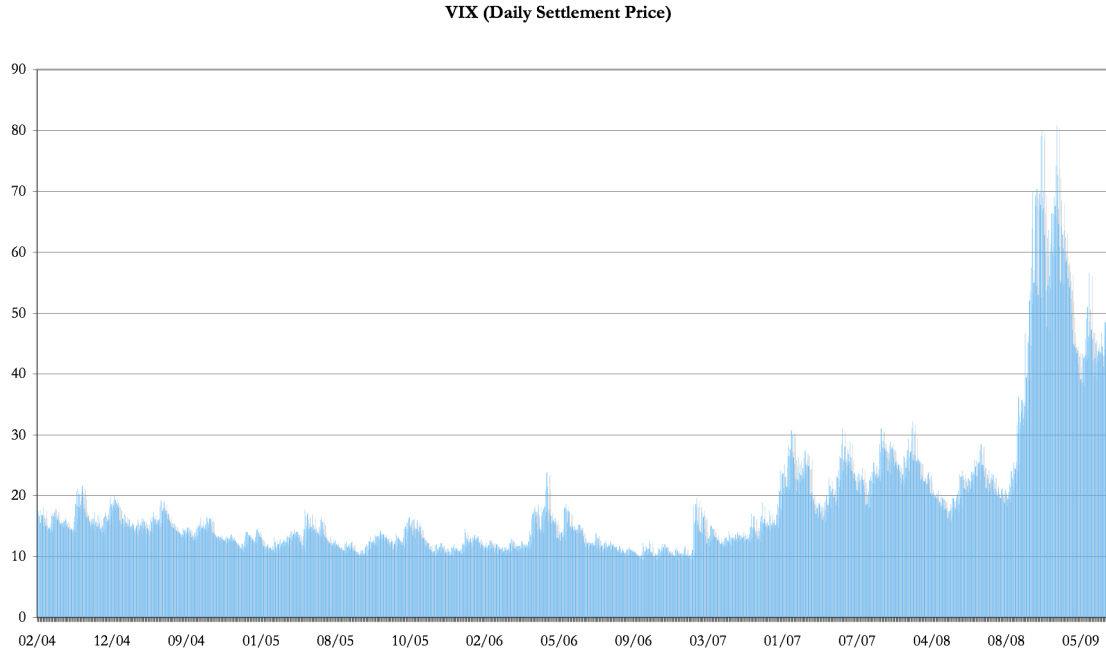
investors. The investment in these securities has also finally entered the balance sheets of banks and (non financial) firms. The application of IAS n. 39 contributes to represent in a more comprehensive way the effective exposure of the firm, since all financial securities in portfolio are marked to market in the balance sheet (Shin 2004).

If volatility increases and the economy is hit by a shock (e.g. due to inflation) financial innovations can contribute to amplify the negative effects, like the “evaporation” of Ponzi units, since highly leveraged and off balance sheet items can increase the final exposure, fuelled by the volatility¹⁶. The presence of sophisticated financial instruments ameliorates the hedging ability of agents in a stylised Minsky model where financial instability is not ruled out. Comprehensive regulation and control are necessary for the innovation not to be a source of danger for the capitalist economy.

Paul Volcker (1993), chairman of the study group on derivatives at the Group of Thirty, stated that they “by their own nature do not introduce risks of a fundamental different kind than those already present. Systemic risks are not aggravated”.

However, the 2007-9 subprime global crisis testifies that financial derivatives (especially credit default contracts) have been employed not only to hedge, but also to speculate by non-financial firms, circumventing existing prudential rules, and avoiding regulation.

¹⁶ Ponzi units are very likely to apply financial strategies, which, in case of initial loss, double all the positions betting on subsequent gain. This type of strategy is explained by the overconfidence that characterizes (irrational) investors, and has been detected in a number of cases (e.g. Barings Bank, Societ  General, and the Orange County).



4. Minskian FIH in the US

We consider the US economy over a tranquil period for financial markets: 1980-2005. We split the period in two sub-periods: over the first (1980-2005) hedging is not present, and the model is as specified by Charles (2004). Over the second sub-period (1990-2005) options are traded and priced, the implied volatility can be computed (the hedging parameter, θ). Table 2 shows average values of parameters of the Minskyan FIH basing on US quarterly data over two periods. Statistical data come from Thomson Financial, International Financial Statistics of the IMF, the St. Louis Federal Reserve database FRED, and the Chicago Board Options Exchange. Data are provided in US\$ billion at current prices, except the implied volatility and the interest rate. Debt (D) is considered as the claims to the private sector; I is the fixed investments; K is the capital stock; r is the Federal Fund effective rate; P is the profits before tax (to limit the tax distortion) and Π is the net dividends payments. We choose the implied volatility on the most relevant American stock

index, the S&P500¹⁷, which is computed since 1993 and is a relevant barometer of investors' sentiment and market volatility.

During the longer period (1980-2005) average values are smaller than over the shorter period (1990-2005); this evidence is as expected because over the 80s there has been a severe slowdown of the American economy.

Over the period when hedging was possible (1990-2005), the propensity to save on profits by firms (s_f) is around 0.122, which is less than one but greater than zero, as the theory predicts. However, this number is heavily affected by the fact that saving refers to the entire private sector, while profits are only corporate ones. We suspect that if saving refers to corporations only (maybe a smaller figure), the propensity should increase as a result.

An interesting issue is the scale of two relevant variables in the model, the interest rate and the implied volatility, which are present in most equations of the FIH (eqs. 1, 2, 3). The interest rate is expressed in percentage, while the implied volatility as computed by the CBOE, is a positive pure number. To avoid arbitrage and keep Minsky idea intact, we should avoid that $\theta > r$ (otherwise the debt and savings dynamic become explosive, simply because of the possibility to hedge). To meet this internal consistence condition we divide the implied volatility by 1000. The period under observation is characterised by tranquil financial markets, as a result the hedging parameter is low, together with the interest rate. The complete set of parameters of the FIH confirms that it can describe the US financial system; no other country provides complete statistics (especially on savings and capital), and then the comparison is not possible at the present. Over the period 2005-08 there has been a structural break in financial markets stability, which is discussed in depth in the following paragraph.

¹⁷ The CBOE Volatility Index® (VIX®) is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices.

5. Minskian FIH and the Subprime crisis

The sub-prime crisis of 2007-09, not yet ended when writing, has been produced by excessive risk taking allowed by the US Federal Reserve Bank¹⁸, the cheap money and credit by the European and American central banks over the period 2002-06, the asymmetric regulation (i.e. small capital requirement on hedge funds and no collateral requirements on OTC securities, like Credit Default Options - CDOs) and the ineffective monitoring in the credit market. Credit rating agencies have been unable to properly assess the creditworthiness and indirectly allowed the spread of risks in the global financial system, in the absence of any compensation system. The global financial system fell into a credit crunch as a result. The crunch hit the real sector, via investments and loans. The outcome has been an increase in risks, systemic and not, the depression of investments, resulting in a global slowdown, which is very difficult to manage by fiscal and monetary authorities. These effects added to inflationary pressures produced by energy and commodity prices, which are slowing down in 2009. It is worth noting that inflationary pressures originate in the commodity sector, where central banks can do nothing, and where most (oil dependent) Western governments cannot act anyhow.

Most analyses of roots of the crisis admitted that:

1. Credit derivatives contracts played a substantial role in the shifting of credit risks out of banks' and into non-financial institutions balance sheets;
2. Un-transparent credit practices let accumulate excessive risks by un-hedged investors, regardless of their size (households as much as firms);
3. OTC transactions under wide deregulation broke the basis of the Originate To Distribute model, and severely damaged the confidence of the global credit system.

¹⁸ Ed Gramlich, a member of the Federal Reserve Board, underlined in 2004 the risks and challenges due to the spread of subprime mortgages lending, but his position was not prominent on the board.

The role of derivatives in this crisis has been to complicate the transmission mechanism of impulses and shocks; they made the (already weak) regulation and monitoring completely inappropriate and ineffective, finally destroying Volcker's optimism about financial innovation. Derivatives' leverage effect further fuelled the volatility of financial markets, and amplified its instability (Krugman, 2007; Greenspan, 2007; Bernanke 2007).

According to the Minskian FIH, over the subprime crisis it is likely that ($\theta > r$), i.e. volatility far exceeded its normal level, and hedging strategies become ineffective, pushing for further selling and losses. During year 2008, the US average interest rate (Fed Fund) has been 0.0176, while the VIX has a (rescaled) average value of 0.0327.

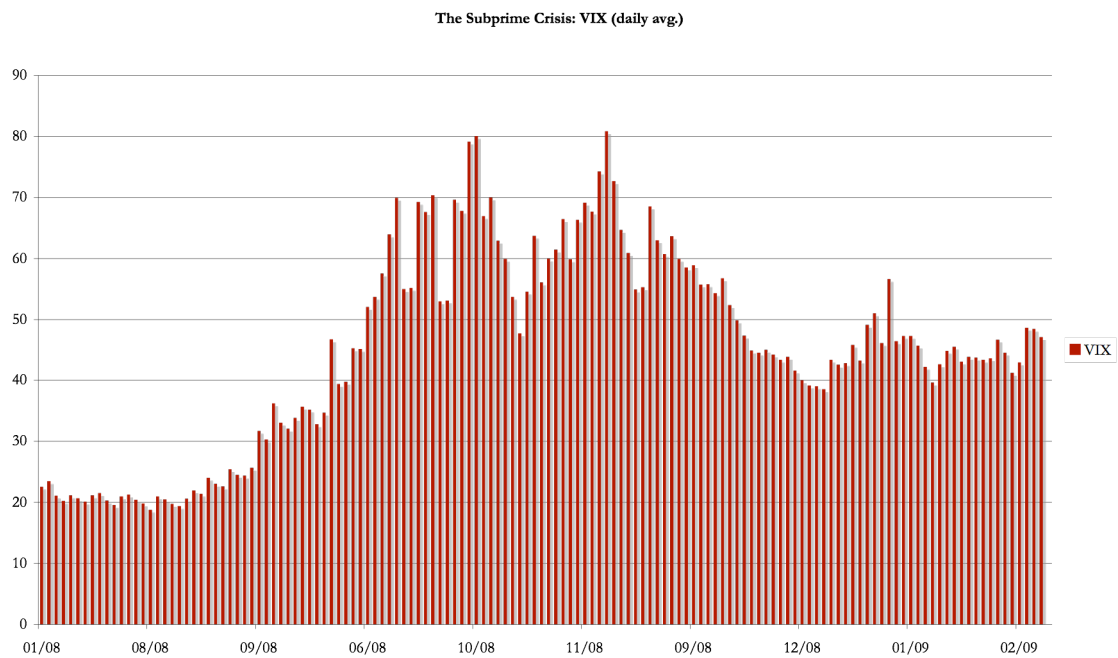
The violation of the consistence condition altered the saving ability by firms (S), as shown in the eq. 1 repeated below for convenience, where dividends and profits (P) become negative, firms need to raise funds by increasing their debt (D) or capital. The possibility to increase debt (D) is heavily limited by the lack of confidence, and the public intervention to finance firms (D, S) is the only way out.

$$S = s_f[P + (\theta - r)D] + s_c[(1 - s_f)(P - rD) + rD] \quad (1)$$

On the banking side, the cost of credit (r) becomes uncertain (i.e. the credit rating does not reflect any more the creditworthiness of firms) and the inter-bank credit system dries up.

The proof of such instabilities is that over the crisis the "barometer of financial markets", the VIX" reached its maximum value ever registered¹⁹, and the spread over Credit Default Swaps increased to its maximum level.

¹⁹ The average value of VIX during the worst part of the sub-prime crisis (Aug.2008-February 2009) is 45, while in the previous period it reached only 22.



The policy response to stabilize the markets is subject to heavy trade off. If the central bank fights against inflation and raises interest rates, it exacerbates the negative effects of the credit crunch, and does not support growth. The financial stability could be achieved at a very high price for growth and employment. If the central bank decreases interest rates, inflationary pressures reduce its credibility and accountability, but there might be room left for recovery. Fiscal policy can sustain the economy by means of public spending; the debt resulting will be paid by means of higher taxes in the future, and the wealth effect in the long run will not be positive.

The subprime crisis underlines the fact that financial stability can be influenced by easier credit conditions, while most is due to regulation and institutional control and supervision. As a matter of facts, the solution put forward by the Minskian approach (1977), the massive government stabilization, has been proposed as a way out to the crisis at the G20. According to the November 2008 G20 final statement, to smooth the turbulence and restore market confidence, original asymmetries of regulation and monitoring in the credit sector have to be eliminated, real income stabilised via public spending, and employment

safeguarded. The result of the statement would be that member countries deeply revise the governance and financial rules, which is very expensive for financial intermediaries, especially those unregulated, such as hedge and sovereign wealth funds (mostly located in the US and the UK). This choice has been confirmed in February 2009 by most countries, that adopted massive rescue plans to sustain the economy, credit and industry, and in some cases nationalized troubled banks (e.g. Northern Rock in the UK, and Citybank in the USA). The Minskian “Big Government” and “Big Bank” substantiate in the coordinate intervention by the G20 at the domestic level, but can fail if the rules of the game, which permitted the crisis, do not change. In that case, is a pure waste of money.

Table 2 Minsky Financial Instability Hypothesis with Derivatives

Average value basing on US data

<i>Period</i>	D	S	I	sf (S/P)	sc (S/D)	r (%)	g=(I/K)	π =(P/K)	θ (value)	θ (rescaled)	d=(D/K)	Π (dividends)	P (profits)
1980-2005	11.153,37	1.225,36	1.223,56	0,11	7,432500	6,888350	0,000180	0,000020	n.a.	n.a.	0,001371	283,86	142,03
1990-2005	14.890,26	1.477,50	1.517,84	0,12	8,824300	4,510781	0,000190	0,000023	19,599365	0,019600	0,001637	381,90	186,06

Legenda

D= claims to the private sector (IFS, IMF); S= gross savings of private sector (Thomson Financial); θ VIX (CBOE);

I= fixed investments (Thomson Financial); K= capital stock (Thomson Financial); Π = net dividends payments (Thomson Financial);

r= federal fund effective rate (US FRED); P= profits before tax (Thomson Financial).

Values are in US\$ billion except the Federal Fund interest rate (%) and the implied volatility (θ).

6. Conclusion

We introduce financial securities (exchange-traded options) with hedging characteristics in the Financial Instability Hypothesis (FIH). Operators use derivatives to hedge, options enter the firm's saving function, and can influence the equilibrium condition in the goods' market. Resources increase because of hedging, thanks to the endogenous business cycle created by the FIH.

Empirical data on the US confirms the coherence of the Minskian functions, and that during periods of tranquillity derivatives can positively influence savings by decreasing firms' financing costs.

But when turbulence hits the markets, volatility increases, parameters stop being constant and hedging strategies can become ineffective, aggravating financial payments by firms, which need to sell assets, increase debt or raise new capital (and this aggravates the downturn in the financial sector). The leverage effect of options produces a sudden aggravation of losses, which can have very negative effects on the debt accumulation process and the investment decision. This means that in the presence of massive use of options (also by hedge units), financial fragility is more pronounced, and regulation should aim at maintaining a sounder financial environment. Similarly to previous interpretations of the FIH, the cycle is endogenous, and the economic system can come back to equilibrium by means of proper regulation, which evolves following markets and operators, and stronger institutions.

Options employed for hedging contribute positively to financial stability; the limit case ($\theta < r$), when hedging is ineffective, translates into an unstable dynamic, similar to other sources of crisis previously investigated in the literature (such as bank or currency crisis, and financial market's turbulence).

The subprime crisis of 2007-09 is, unfortunately, a concrete example of how weak regulation and insufficient control and monitoring first translate into turbulence and financial distress, and then negatively influence growth and development. As predicted by Minsky, a way out can be the massive public intervention together with proper regulation, transparent accounting rules, and effective incentives toward best business practice: the Big Government and the Big Bank.

Further researches in the future would shed the light over the contribution of OTC derivatives (i.e. opaque contracts) to instability, and the measurement of the hedging parameter (θ) for other economies or with other relevant indices.

References

- ANG J., Y.CHENG (2005) Financial Innovation and Market Efficiency: the case of Single Stock Futures, *Journal of Applied Finance*, Spring-Summer, pp. 38-51.
- AVELLANEDA M., P. LAURENCE (2000) *Quantitative Modelling of Derivatives Securities*, Chapman & Hall RC, London.
- BANK FOR INTERNATIONAL SETTLEMENTS (2007) *New Development in Clearing and Settlement Arrangements of OTC Derivatives*, Committee on Payment and Settlement System, Basle.
- BANK FOR INTERNATIONAL SETTLEMENTS (2005) *Triennial Central Bank Survey on Foreign Exchange and Derivatives Market Activity (2001-2004)*, Basle.
- BANK FOR INTERNATIONAL SETTLEMENTS, *Quarterly Review*, various issues, Basle.
- BENIGNO P., M. WOODFORD (2003) *Optimal Monetary and Fiscal Policy: A Linear Quadratic Approach*, NBER Working Papers 9905, National Bureau of Economic Research.

- BERNANKE B. S. (2007) *The subprime mortgage market*, speech at the Federal Reserve Bank of Chicago's 43rd Annual Conference on Bank Structure and Competition, Chicago, Illinois, May 17.
- BLACK, F., SCHOLES, M. (1973), The Pricing of Options and Corporate Liabilities, *Journal of Political Economy*, 81, 637-654.
- CHARLES S. (2004) *A Note on Some Minskyan Models of Financial Instability*, Working paper, University of. Paris 8, n° 13, March.
- COHEN, B., *Derivatives, Volatility and Price Discovery*, International Finance, 2(2), 167-202 (1999).
- CONRAD, J., *The Effect of Option Introduction*, The Journal of Finance XLIV(2), June, 487-98 (1998).
- ESTRELLA A. (2001) *Financial Innovation and the Money Transmission Mechanism*, Working Paper, Federal Reserve Bank of New York, New York.
- EUROPEAN CENTRAL BANK (2000) *The Information Content of Interest Rates and Their Derivatives in Monetary Policy*, Monthly Bulletin, May, pp. 37-56
- FEDERAL RESERVE BANK OF ST. LOUIS (1999). *A barometer of financial market uncertainty*, Monetary Trends.
- G20 (2008) *Declaration of the Summit on Financial Markets and the World Economy*, November 15, Washington DC.
- GREENSPAN A. (2000) *Over-The-Counter Derivatives*, Testimony of Chairman of Federal Reserve Before the Committee on Agriculture, Nutrition and Forestry, United States Senate, February 10.
- GREENSPAN A. (2005) *Reflections on Central Banking*, Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 26.
- GREENSPAN A. (2007) *The age of turbulence*, Penguin Press, New York.

- HUNG-GAY F., W. K. LEUNG (1993) The Pricing Relationship Of Eurodollar Futures And Eurodollar Deposit Rates, *Journal of Futures Markets*, 13(2), pp. 115-126.
- KRUGMAN, P. (2007) *Catastrophe Foretold*, Washington Post, October 26, 2007.
- MERTON, R. (1973), Theory of Rational Option Pricing, *Bell Journal of Economics and Management Science*, 4(1), 141-183.
- MINSKY H. P. (1977) The Financial Instability Hypothesis: an Interpretation of Keynes and Alternative to Standard Theory, *Challenge*, March-April, p. 20-27.
- OLDANI C. (2008) *Governing Global Derivatives: Challenges and Risks*, Ashgate Publisher.
- PAGE S. (2004) Innovations in Risk, *Canadian Investment Review*; Winter, Vol. 17 Issue 4, pR25.
- TSE J. (2001) Minsky's Financial Instability Hypothesis, *Oeconomicus*, Vol. IV, Winter, p.77-81.
- UPPER (2006) *Derivatives activity and monetary policy*, BIS Quarterly Review, Sept.
- VIOLI R. (2000), *Mercati derivati, controllo monetario e stabilità finanziaria*, Il Mulino, Bologna.
- VOLKER P. (1993) *Report on Practices and Principles*, Group of Thirty.
- VROLIJK C. (1997) *Implications of derivatives for monetary policy*, IMF Working Paper n. 121, Washington D.C..
- WOODFORD M. (2003), *Interest and Prices, Foundation of a Theory of Monetary Policy*, Princeton University Press, Princeton.