International Review of Business Research Papers

Vol.6, No.1 February 2010, Pp. 124-135

A Theoretical Explanation and A Dynamical Model For Regulation For The 2008-2009 Banking And Financial Institutions Crisis.

Laure Jehlen[1],

Our paper offers a new and explanatory dynamical insight on the recent financial crisis. The model developed in our (Jehlen 2009a, 2009b) papers widens the 1973 BSM model. It is applied in this paper to corporate finance to enlighten the mechanisms that led to banking and financial institutions distress. This paper contributes to Firm value theory, by assessing the impact of regulation on stakeholders' considerations and capital structure decisions. Furthermore, in continuation of (Jehlen 2009f) it pinpoints the current inadequacy of the Modigliani Miller fundamental theorems in respect of total assets representation of the firm. Additionally, it identifies several determinants of the avalanche effect disturbing the markets and the economy so far, allowing therefore some regulation schemes.

Field of research : risk and regulation modeling, and financial theory

1.0 Introduction

The experts estimate today at 4,000 billion dollars the losses, for the sole financial institutions, consequential to the crisis and the bankruptcy of the OPVCM fund Madoff. As much as the totality of capital assigned to Hedge Funds and Private Equity Funds together, or in Sovereign Funds. Sovereign Funds manage 3200 billion dollars; 1500 billion dollars are distributed between 11 000 funds for Hedge Funds, and 1 600 billion dollars are managed by Private Equity Funds, (Le Cercle des Economistes, 2008). Banks, insurances, pension funds and assets management companies, and their customers, represent 53,000 billion dollars of managed assets according to the International Monetary Fund in 2007. Cohen 2009, explains according to Friedman, that the main scale factor of the crisis of the 1930s holds in the fact that the monetary authorities let banks go bankrupt. One counted 29,000 banks before the crisis, there will remain 12,000 banks in 1933. All in all, the money and the credit felt of more than a third pulling the economy in the deflation. In 2009, by the means of the national plans of support for banks, for financial institutions, for

[1] Member of the Research Center CEREG. Paris-Dauphine University, DRM, F-75016 Paris, France. CNRS, UMR 7088, F-75016 Paris, France. Associate Professor in Finance, ISG, Paris. Email: laure.jehlen@gmail.com

companies and the international interventions of sovereign funds (Russia towards Iceland, China towards United Kingdom,…), we effectively escaped from the nightmare scenario. But the determinants need to be explained and measures must be taken to preserve the world economic equilibrium.

2.0 Literature Review

In the preceding decade banking and currency crisis literature focused on identifying events that determine banking crisis beginning (e.g. bank runs and nationalization of banks). Like Lindgren and al. (1996), Kaminsky and Reinhart (1999) or Glick and Hutchinson (1999) most previous papers focus more on the study of ratios comparisons at the period of the beginning of a bank crisis, (ratio of non performing assets to total assets greater than 2% of GDP, cost of the rescue amounting at least 2% of GDP). We depart from the general Trade Off Theory (TOT), represented by Leary and Roberts (2004), Welch (2004), Baker and Wurgler (2002), or Strabulaev (2004), we are not aiming at studying dynamic adjustments to a target capital structure in consideration of adjustment costs. The first MM (Modigliani Miller) theorem, states that in the absence of taxes, of transaction costs, of bankruptcy costs, and if financial markets are perfect, there is no link between the financial structure of a company and its value.

Too much standardization of the models can present a risk. The similarity of the models and of the parameters can lead operators to implement the same hedging strategies at the same moment, that can destabilize the markets. Errors of modeling are declared at the origin of the various following, arisen cases of losses: In 1995: Pechiney, Metalgesellshaft, County Orange, Barings, Seita, Procter & Gamble, Gibson & Greetings; in 1997: Tokyo-Mitsubishi Bank, Deutsche Morgan Grenfell; In 1998: LTCM: the dynamic hedging was put in trouble by the choice of a too strong percentage of " junk bonds " and the illiquidity of these securities. In summer, 2007: the problem is not resolved: the crisis of the real-estate from the USA due to "subprime lenders" testifies of it. The banks who had bought these products underwent the absence of liquidity and the default. Besides, their measures, classic, of mortgage evaluation of portfolios, did not take in consideration the 17 successive increases of interest rate. Continuous time market and corporate default risk models all derive from Brownian motion expressions of the underlying asset dynamics, ranging from the Bachelier's Arithmetic Brownian Motion equation and the Black and Scholes Geometric Brownian Motion equation to the Double Exponential Jump Diffusion Equation of Kou (2004). There exists a bulky literature going over existing models. Campbell (2000) and Sundaresan (2000) provide an extended review on this question.

3.0 Methodology

3.1 Financial Theory Analysis And Securitization

The first MM theorem (1958) is based on an argument of arbitration: two assets of the same characteristics have the same return. The intuition of Modigliani and Miller was the following: It is the amount of the future profits and not the distribution of

these between shareholders and creditors that determines the value of the company. Miller liked giving the following metaphor: " Let us imagine the profit of the company as a cake, the number of parts or their respective sizes determine not at all its thickness. " Our analysis 2009f demonstrates that the use of securitization *does change the size of the cake* and that this is the reason why Modigliani Miller firm value theory does no more apply in the current context.

3.2 The Mathematical Model

The theoretical work that we led in market finance in LJ (2009a), is broaden in this paper to corporate finance, to enlighten the 2009 financial crisis. Our papers 2009a, 2009b uncover that Black Scholes and Merton's originally solving of the BSM 1973 PDE is based on a one-dimensional-normal-equation-of-heat-solving frame. It emphasizes the common points between financial mathematical theory originated in Bachelier (1900) and Black and Scholes (1973) and Merton (1973), and the Brownian motion (particle motion) studied by Einstein's (1905). The link between market finance and corporate finance has been establish and pioneered by Merton's (1974) continuous time model for firm valuation. Thus Merton can be considered as the originator of the real options. Our model can be adapted to the modeling of a specific economic sector and even a national economy taken as a whole with its monetary actors.

The **Table 1** below compares the features of our model for different systems .

FEATURES	**SYSTEMS**	
	Market Place Model	Economic sector or national Economy
Random variable Random moving elements	Asset prices	Banking and Financial Institutions Financial Flows
Level η	Evolution of market place capitalization	Evolution of State financial capacity and Gross National Income
Size	Part of each security in the total capitalization of the marketplace	Part of each Bank reserve requirement in the total State reserve
t	Time of measure	Time of measure
z value	Monetary (euros)	Monetary (euros)
Position X(x,t,z)	Position X(size, time, value)	Position X(size, time, value)

Hence, we can alleviate that the investment operated by the final investor in a subprime, a CDS or an ABS, is a Put option. In case of reverse market or insolvability, the value of the asset on which the option is written declines due to the lack of liquidity and nonexistence of counterpart buying the option, subsequently, the crash intervenes. Therefore, the current financial crisis situation ensues from the liquidity shortage and from the unlimited risk taken by the final investors. Their position was equivalent to the position of a put option seller in declining markets, or to the position of the investors in non liquid LCTM's junk bonds in 1998.

We illustrate how and why banking and financial institutions largely adopted securitization and defeasance strategies. We make clear how it degenerated in a huge development and use of finance structured products. Hence, we pinpoint how the regulation implementations (exposed in the Graph 1 in section 4.1. below), through settlements, standards and rules great pressure, ensued in the current financial crisis. A crisis that will need even more regulation in the future to cope with. The aspects of learning from the financial theory for helping in regulation schemes are investigated.

4. Findings

4.1 Financial Theory Analysis, Securitization And MM Inadequacy

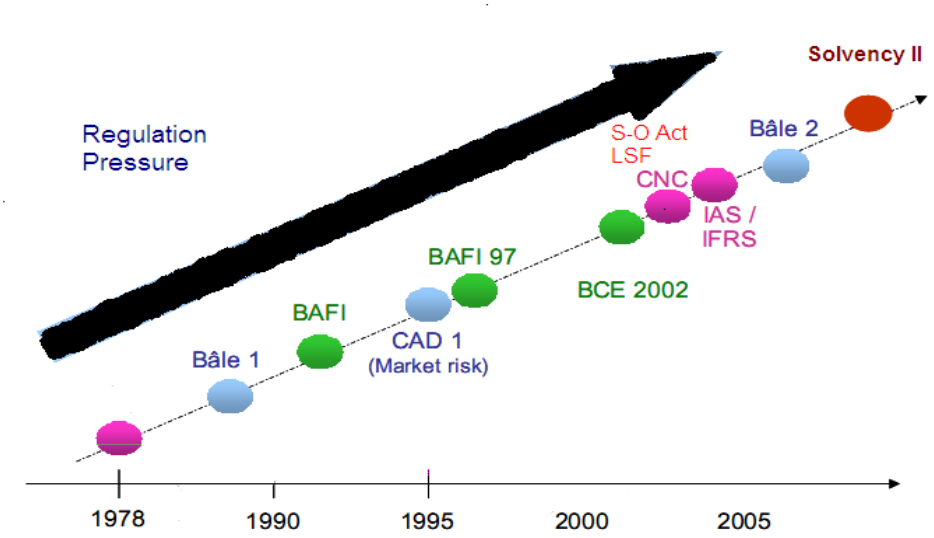
Banking and financial institutions concern about securitization diverges from companies' concern. From an empirical point of view, we consider two main banking and financial institutions capital structure policies: The first one aims at maintaining a target capital structure to control the financial information delivered to rating agencies' sagacity and fulfill the capital reserves requirements. The second rationale for banking and financial institutions in bull market periods is to sustain the growth by a strong degree of investment generally financed through debt. The underlying motivation conveys that money is above all a means of economic competition and what makes the difference is to be able to grab opportunities of growth.

Given that companies have two sources of external financing: stockholders' equity (issues of stock) and the debt (banking loan or bond issue), MM answered by "no" the following question : does the choice between these two modes of financing influence the value of the company, does the financial structure matter? Banks in addition have a third source of external financing that is the deposits made by their customers. It can not be considered as borrowings, but if all customers decide to get their money back, the bank will occur severe difficulties as USB did since 2007.

Our interest concerning Modigliani and Miller (1958), (1961) is basically focused on its link with the two different kinds of regulation pressures existing. The first type, is materialized through International Accounting Standards IAS/IFRS standardization, it concerns companies as well as banking and financial institutions and is primarily

intended to regulate and to standardize their financial statements disclosures. The second type of regulation pressure consists in capital reserves requirements for banks and financial institutions, it begun through Basel Committee 1988 and its Cook solvability ratio, then Basel II 2004 and its McDonough solvability ratio. The phenomena goes on further as Solvency II, 2009-2012, intends to align regulatory and financial reporting of insurance companies as Phase II of the IFRS insurance contracts standard over the next two years.

The **Graph 1** below illustrates the great addition of regulation and accounting standardization pressure since the early nineties.



Source Jehlen (2009f)

The first implementation of «in defeasance substance ", occurred in 1982, in the USA, by the companies Exxon and Xerox. Marsh, (1982), pioneered the first academic study about large investments financing through special vehicle means. Since then more and more companies and banking and financial institutions do use and abuse of securitization. For banks especially this is due to the fact that capital reserves requirements through Basel Committee 1988, European Directive and Basel II 2004, have a negative effect on the equity multiplier ratio (assets over equity ratio). Therefore, regulation requirements make banks more and more interested in securitization mechanisms through special purpose vehicles as to lower the amount of risky assets in their balance sheets. Securitization is a marvelous tool that helps them to manage their level of capital reserves without lowering their return on Equity (ROE) ratio. If one considers the fifteen years period ranging from 1994 to 2007, the ROE records for American, European and French banks turn out to demonstrate that even European and French banks got contaminated from 2000 on and lost their prudence, to even overpass American figures, in 2007, despite the preceeding burst of the dotcom bubble. See Table 2 below.

The figures shown in the **Table 2** below are really meaningful:

Banks nationality	ROE in 1994	ROE in 2000	ROE in 2003	ROE in 2007
US	15.5%	19%	15.5%	14.5%
EU	8.5%	14%	11%	17%
F	5.5%	11%	8.5%	15%

Source NATIXIS - 2 October 2008

The impacts of securitization mechanisms on the balance sheets and the ratios of banking and financial companies helps them definitely to better perform in ratios as ROE (Return on Equity,) ROA (Return on assets), ROCE (Return on Capital Employed) and other indicators as the EBITDA. The aim of using tools and accounting operations differ for banking and financial institutions in comparison with companies. When the banking or financial institutions operate securitization it is principally to avoid the fulfillment of capital requirements.

The use of internal models by banks is accepted by the Basel Committee since 1988, under respect for required criteria which are the constitution of provisions and of a level of stockholders' equity intended to cover the non expected losses. Regulation pressure through capital requirements ensued in capital reserves level target strategies for banks in a way quite similar of the target strategy conducted by companies to manage and control their leverage ratio. If the strategy is comparable, the purpose is different, in the case of the banks the principal reason lies in avoiding to allocate huge amounts of money to capital reserves that would prevent them from utilizing this cash for profitable operations. Therefore their strategy is directly acting on their competitiveness, through their equity multiplier ratio and ROE ratio. It contributes to invest these liquidities in risky financial products expecting highly returns. Surprisingly it is considered through ratios and indicators by rating agencies as a positive signal to the market. Therefore their strategy is directly acting on their stock value, and their competitiveness, directly linked to their return on equity ratio.

Since Modigliani-Miller (1958), many papers in financial literature dealt with the structure of the capital. But the securitization act on the balance sheets and therefore impacts the theory which has to be adapted : in actual fact, when comparing two completely similar firms in their structure, if one of the two uses securitization, they value will differ. Therefore the operations of securitization have a real incidence on the value. The securitization of assets is a game of cash and transfers of funds between accounts. It allows masking the structural deficits of cash or the high level of risky operations. The Modigliani Miller 1958 theorem does not apply to compare two

banking and financial institutions with initial same total of balance sheet if one of these two operates securitization. Effectively, it directly improves ROE, ROA, ROCE ratios and even RAROC and the EBITDA. In addition, as assets are subtracted from the balance sheet, the «size of the cake" becomes finally different. Consequently, the two comparable banking and financial institutions will have different market values. Even more, their markets values following rating agencies' point of view will reflect contradictory values with their economic reality: The bank that operates securitization will have a better rating, superior to that of its competitor. Nevertheless, the «size of the cake" decreases in the amount of the value of the assets which goes out of the balance sheet. There is a real loss of value bound to the decrease of the holdings.
The study case SG/N/CA: These three banking and financial institutions have different strategies. The third was not much levered, the second, a lot. The second used its excess of debt to invest, to gain market stakes and be more competitive. That strategy acted perfectly until 2008, when N. began occurring cash shortage, The bear market and its illiquidity have put this bank in front of its cash shortage, what inverted the balance of power from now on in favor of CA again, benefiting from disposable funds.

4.2 Dynamical Explanation Through The Mathematical Model 2009a,2009b

We consider for our model the financial flows as parts of a dynamic system. As a consequence of the points developed in the section 4.1., instead of analyzing, remotely, the incidence of a capital increase or a contraction of a new loan, we assess the necessity to consider the intrinsic changes of the assets structure, inferred by the balance sheet modifications. As shown in (Jehlen, 2009a, 2009b), continuous time models for price valuation or price evolution representation and continuous time default risk models all derive from Brownian motion expression of the underlying asset dynamics. The model takes into consideration a whole market place as the middle where packets of assets prices evolve. These packets are the price trajectories of the assets that are listed on the marketplace. Respectively, the model can as well take into consideration a whole national economy as the middle where packets of banking and financial institutions' financial flows evolve. All the securities prices trajectories form the envelope value and volume evolution represented by the following evolution equation $\frac{\partial \Phi}{\partial t} = -a \frac{\partial \Phi}{\partial x} + i\alpha \frac{\partial^2 \Phi}{\partial x^2}$ The rise of the level of the marketplace η is the geometrical sum of the constituents.

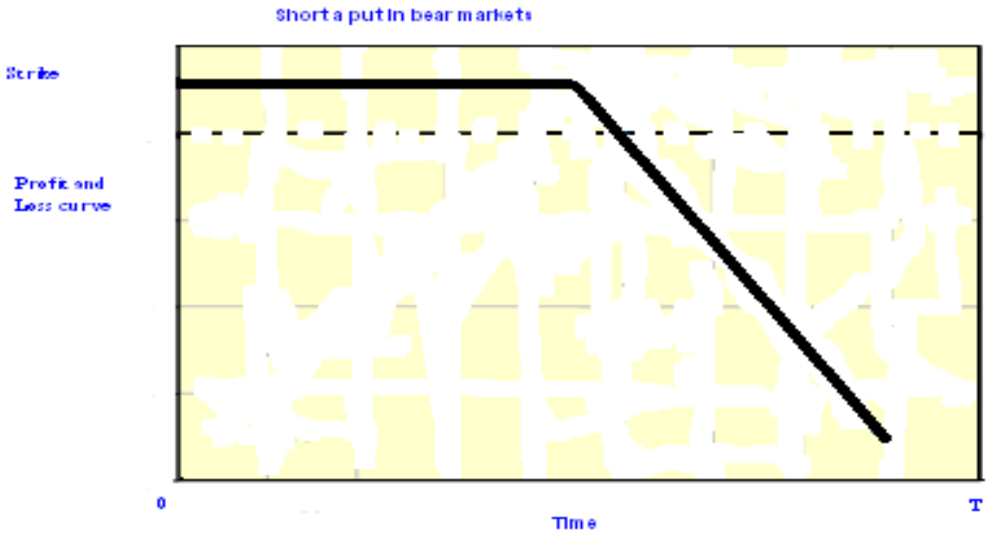
Option valuation models are based on Stochastic Differential Equations since the seminal works of Bachelier, (1900-1913), and rely deeply on the BSM 1973, model. The link between market finance and corporate finance has been pioneered by Merton's structural model. The model reconciles market finance and corporate finance and allows revisiting the existing real options financial theory. As to do so, our model extends the Black and Scholes, Merton, (1973), and Merton (1974), one-dimensional framework to an upper dynamical dimension by introducing a two strengths conjecture (the general diffusion process component and a potential component that is not a jump term), essential for the equilibrium. Incidentally, this potential term does not replace the jump term in the case of extreme events. It

represents the endogenous nonlinearity. One strength acts as a brake, and the other as an accelerator, and both contribute to the equilibrium for the moves of prices.

These two strengths allow the random variable value to oscillate and pass by equilibrium phases. On the one hand, the potential strength depends on the position; it represents the endogenous characteristics of the company or the bank. We mean by endogenous characteristics what makes the firm's value. The potential component introduces the existence of an intrinsic nonlinearity. On the other hand, the diffusion results from the shocks due to the exchanges and economic trades of the operators on the marketplace, respectively on the level of an economic sector, or the level of a whole country.

Hence, we alleviate that the investment operated by the final investor in a subprime, a CDS or an ABS, is a Put option. Worldwide reinsurance in excess became like a worldwide Put on the global economy. In case of reverse market or insolvability (the case of the subprime crisis), the value of the asset on which the option is written declines due to the lack of liquidity and nonexistence of counterpart buying the option, subsequently, the crash intervenes. We have seen in the precedent section that excessive development of securitization does not fit with the Modigliani Miller theorems of firm value. By consequence, it neither fits with the efficient market hypothesis equilibrium. Securitization, like debt has a positive gearing effect on market value, under optimal conditions (bull markets periods, for instance), but under reversal conditions (bear markets), its negative gearing effect combined to overuse and generalization of its usage has severely put in danger the global economy and the financial markets ensuing in the financial crisis 2008-2009.

In bear market securitization turned out to be similar to a global Put option on the financial economy, provoking heavy losses for the financial institutions and credit crunch for firms. See **Graph 2.** Short a put position in bear markets conditions:



At the opposite, detaining a call option would guarantee a limited gain and conversely a limited loss in case of upturn of the market.

5.0 Conclusions

Financial crises are extreme phenomena that accelerate in our current global economy: the possibility of faster frequency of unforeseen events impacts the evaluations and hedging strategies. For instance, when the first warnings of banks occurred in spring 2007, the given explanation was the inadequacy between VaR models and a reality of non constant rates on mortgage loans. .American but also worldwide, Japanese, German, Swiss Norwegian or even English banks, had all invested in structured and reinsurance financial instruments (MBS, Mortgage Backed Securities, CDS, Credit Default Swaps, and CDOs, Collaterized Debt Obligations, ABS Asset Backed Securities and ABC, Asset Backed Commercial paper) based on subprime and second-lien mortgage.

Our paper shows that securitization's trend behavior acts as a positive gearing in a bull market framework. Thus, in a bear and low liquidity market, this gearing becomes negative, accordingly to the functioning of a put option that engenders unlimited losses in a bear and illiquid market amplified by the globalization of the economy. Consequently, this mechanism produced a giant snowball effect and created the current worldwide financial decline spiral. The globalization, the dispersal and the anonymity of the shareholding of the listed banking and financial institutions facilitate this contagion and their vulnerability.

The economic press blamed a lot the *no cash sparing and no confirmed income stream American home owners*. Often reviled too, Hedge Funds, Private Equity Funds, and Mortgage lenders are not the only ones to be blamed. The current paper in continuation of paper Jehlen (2009f) explains that all the chain of the securitization (from the creation of the structured products to their sale and the creation of reinsurance vehicles) played an important role in the current crisis by means of securitization "herd behavior" and massive development of structured investment industry.

6.0 Contributions And Achievable Applications Of The Model :

The features of our model (2009a, 2009b), allows an explanation with regards to valuation of firms in consideration of their debt, for the current financial crisis. It shows that in bear markets, securitization turns out to be similar to a global Put option on the financial economy, provoking heavy losses for the financial institutions and credit crunch for firms as consequences. Global geometric 2D reading of the marketplace time series for study and forecast, may be used to model the evolution, in respect to the time, of the random surface modeled through NLSE evolution equation, and for the comparison of asset prices evolution and the detection of abnormal movements corresponding to big gains or earnings due to speculation. It may be used for the detection of breaking points through the computation and the

calculation of geometric rupture points. They correspond to the inflection point when the positive gearing translates in negative gearing, then the potential component begins acting as a break and no more as an accelerator on prices. Thus, concerning market place regulation policies, the model shows the way to implement a tool to watch markets and financial transactions. The work of the financial analysts and the rating agencies could also benefit from recommendations of common sense for financial disclosures, such as asking for ratios to be published at the same time in book value and in market value, for less shadow accounting and for more transparency.

7.0 References

Anderson, R.W., Sundaresan S. 1996, “Design and valuation of debt contracts”, *Review of Financial Studies,* 9.1, pp.37-68.

Bachelier L. 1900, *Théorie de la spéculation. Théorie mathématique du jeu,* Editions Jacques Gabay, 148 pages, 1995.

Bahaji H. 2006, Cahier de recherche n°2006-01, “IAS 39 et comptabilité de couverture en juste valeur: simulation aléatoire de son impact sur les exigences en fonds propres des banques”, p 3.

Baker,M., Wurgler, J., 2002, “Market timing and capital structure”, *Journal of Finance*, vol. 57, no1, pp1-32.

Black F., Scholes M. 1973, “The pricing of options and corporate liabilities”, *Journal of Political Economy*, 81, pp. 637-54.

Bernard V.I., Merton R.C., Palepu K.G.1995, “Market-to-market accounting for banks and thrifts: Lessons from Danish experience”, *Journal of Accounting Research*, vol 33, no1, pp1-32.

Brennan M.J., Kraus A., 1987, “Efficient financing under asymmetric information”, *Journal of Finance*, vol 42, no5, pp.1225-1243.

Campbell J. Y., 2000, “Asset Pricing at the Millennium”, *Journal of Finance,* vol 55, no4, January 7-9, , pp 1515-1567. Book on line, 600 pages, 2000.

Chang X., Dasgupta S., 2006, “Dynamical capital structure choice”, online Discussion Paper, pp.1-5.

Christensen P.O., Flor C.R., Lando D., Miltersen K.R. 2002, “Dynamical capital structure with callable debt and debt renegotiations”, Working Paper.

Cohen E., 2009, *Quotidien économique Le Monde*, January 5th.

De Angelo, H., Masulis, R. 1980, “Optimal capital structure under corporate and personal taxation”, *Journal of Financial Economics*, 8, pp. 3-29.

Einstein A., 1905, Über die von der molekularkinetischen Theorie der Wärme geforderte Bewegung von in ruhenden Flüssigkeiten suspendierten Teilchen, *Annalen der Physik*, 4, Folge, vol XVII, pp.549-560.

Fédération française bancaire. Paris 12 mai 2004, Ratio de solvabilité, normes IAS : Les principales conséquences.

Fischer, E.O., Heinkel R., Zechner J., 1989, "Dynamic capital structure choice: Theory and Tests", *Journal of Finance*, 44-1, pp19-40.

Gebhard G., Reichard R., Wittenbrink C., 2002, "Accounting for financial instruments in the banking industry", Johan Wolfgang Goethe-Universität Frankfurt am Main, Working *Paper Series ; Finance and accounting* , no95, November 2002.

Glick and Hutchinson, 1999, "Banking and currency crises: How common are twins?", Mimeo, IMF.

Harris, M., Raviv, A.1991, "The theory of capital structure", *Journal of Finance*, 46, pp.297-355.

Jehlen L., 2009a. "Modeling of the financial flows", ACDD April 1-3 2009, Working Paper, 50 pages.

Jehlen L. 2009b, "A new nonlinear model on financial price modeling" *Proceedings of the Forecasting Financial Markets Conference 2009*, Luxembourg, May 27-29, 25 pages.

Jehlen L. 2009f, "From Modigliani-Miller to the 2008-2009 financial crisis: an overall study", *Proceedings of the FCCCE Conference 2009*, 19p.

Jensen M.C., Meckling W.H.,1976, "Theory of the firm, managerial behavior, agency costs and ownership structure", *Journal of Financial Economics,* vol 3, no4, pp.305-360.

Kaminsky G., Lizondo S., Reinhard C.1999, "The twin crises. The causes of banking and balance-of-payments problems.", *American Economic Review*, 89-3, pp. 473-500.

Kou SG., WANG H., 2004, "Option Pricing under a Double Exponential Jump Diffusion Model", *Management Science*, vol 50, no9.

Leary M., Roberts, M.R., 2004, "Financial slack and tests of the Pecking Order's Financial Hierarchy", Working paper, Duke University.

Lindgren J.C., Garcia G., Saal M.I. 1996, "Bank soundness and macroeconomic policy"; IMF.

Le Cercle des Economistes. 2008, *La guerre des capitalismes aura lieu*, Editions Perrin, 261 pages, p.126.

Protter P., Mac Cauley J. L. 2004, *Dynamics of Markets: Econophysics and Finance,* Cambridge University Press, 209 pages.

Protter P. 2008, “The financial meltdown”, *Matapli87*, pp. 61-62.

Mella-Barral,P., Perraudin W.R.N. 1997, “Strategic debt service”, *Journal of Finance*, 52-2, pp. 531-556.

Merton R.C. 1973b,. “Theory of rational option pricing”, *Bell Journal of Economics and Management Sciences,* pp. 141-183.

Merton R.C**.** 1974, “On the pricing of corporate debt : The risk structure of interest rates”, *The Journal of Finance*, vol. 29, no2, New York, pp. 449-470.

Modigliani F., Miller M.H. 1958. “The cost of capital, corporate finance and the theory of investment”, *American Economic Review*, 48(3), pp. 261-297.

Myers S.C., Majluf N.S. 1984. “Corporate financing and investment decisions when firms have information that investors do not have”. *Journal of Financial Economics*, 13, pp187-221.

Samuelson P., Merton R.C. 1969, “A complete model of warrant pricing that maximizes utility”, *Industrial Management Review*, 10, pp.17-46.

Strabulaev, I. 2004, “Do tests of capital structure theory mean what they say?”, Working paper, London Business School.

Welch,I. 2004, “Capital structure and stock returns”, *Journal of Political Economy* Vol. 112, no1, pt. 1, pp. 106-31.

Sundaresan S.M. 2000, “Continuous-time methods in finance: A review and an assessment”, *Journal of Finance*, vol. 55, no4, pp. 1569-1622.