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On the fundamentals of winning virtuous strategies creation toward leveraged buyout transactions implementation during private equity investment in conditions of resonant absorption of discrete information in diffusion - type financial system with induced nonlinearities

Dimitri O. Ledenyov and Viktor O. Ledenyov

Abstract – The authors perform an original research on the fundamentals of winning virtuous strategies creation toward the leveraged buyout transactions implementation during the private equity investment in the conditions of the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities in particular, and at the influences by the Schumpeterian creative disruption processes in the free market economy in general. Going from the academic literature, we make a comprehensive review on the various aspects of modern financial engineering approaches to make the private equity investments and design the leveraged buyout and venture capital firms, funds and transactions in the finances. We highlight a private equity's important role in the Schumpeterian creative destruction processes in the free market economy, discussing the leverage buyout transactions process and the accurate characterization of the leverage buyout transactions properties at the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities. We formulate the Ledenyov theory on the winning virtuous strategies creation toward the leveraged buyout transactions implementation during the private equity investment in the conditions of the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities.

JEL Codes: G3, G11, G13, G20, G23, G24, G30, G32, G34, G34, G39, J2, J33, J44, L2 .

PACS numbers: 89.65.Gh, 89.65.-s, 89.75.Fb .

Keywords: winning virtuous strategies creation, corporate finance, corporate governance, private equity financing, leveraged buyout (LBO) firms/funds/transactions, venture capital (VC) firms/funds/transactions, management buyouts, direct/reverse leveraged buyouts (D/RLBOs), bootstrap acquisitions, mergers and acquisitions, "quick flips" business deals, capital structure, leverage risks, post-buyout company business operation efficiency over time, return on equity (ROE), return on investment (ROI), employment/productivity/innovation effects, ownership change, socially responsible investment, probability theory, information absorption theory, econophysics, econometrics, nonlinearities, meaning of money, leveraged finance, financial institutions, financial and economic systems.

Introduction

The ***science of financial engineering*** had been thoughtfully used to design and implement the *first financial transactions* in the *financial markets* in *Joseph Penso de la Vega (1668, 1996).* The *science of financial engineering* had been also applied to evaluate the *associated financial risks* during the *first financial transactions completion* in the *financial markets,* using a number of *conceptual mathematical tools and theories*, in *Bernoulli (1738, 1954), Bagehot (1873, 1897).*

In the *XVIII* and *XIX* centuries, the increasing application of the *science of financial engineering* led to a strong necessity to further develop the ***science of financial mathematics*** in *De Laplace (1812)*, *Bunyakovsky (1846), Chebyshev (1846, 1867, 1891)*, *Markov (1890, 1899, 1900, 1906, 1907, 1908, 1910, 1911, 1912, 1913), Fisher (1892).* The main purpose of *financial mathematics* is to formulate the *theories* and derive the *mathematical equations* to estimate the *changing values of financial variables* in the *financial markets* in *Bagehot (1873, 1897)* over the *time*, *frequency*, *scale* domains, applying the ***probability theory***, ***statistics theory****, and most recently,* **signals spectral analysis theory** *in De Laplace (1812)*, *Bunyakovsky (1846)*, *Chebyshev (1846, 1867, 1891)*, *Markov (1890, 1899, 1900, 1906, 1907, 1908, 1910, 1911, 1912, 1913)*, *Kolmogorov (1938, 1985, 1986)*, *Wiener (1949)*, *Brush (1968, 1977)*, *Shiryaev (1995), Ledenyov (2004)* in the frames of the ***science of econometrics*** in *Schumpeter (1906, 1933), Bowley (1924)*, *Fogel (1964)*, *Box, Jenkins (1970)*, *Grangel, Newbold (1977)*, *Van Horne (1984)*, *Taylor S (1986), Tong (1986, 1990)*, *Judge, Hill, Griffiths, Lee, Lutkepol (1988)*, *Hardle (1990)*, *Grangel, Teräsvirta (1993)*, *Pesaran, Potter (1993)*, *Banerjee, Dolado, Galbraith, Hendry (1993)*, *Hamilton (1994)*, *Karatzas, Shreve (1995)*, *Campbell, Lo, MacKinlay (1997)*, *Rogers, Talay (1997)*, *Hayashi (2000)*, *Durbin, Koopman (2000, 2002, 2012), Ilinski (2001), Greene (2003)*, *Koop (2003)*, *Davidson, MacKinnon (2004), Campbell, Lo, MacKinlay (1996).*

In the beginning of *XX* century, the *sophisticated high-level mathematical techniques* have been mainly applied to evaluate the *financial risks* and predict the *returns-on-investments* in the *finances.* For instance, *Bachelier (1900)* contributed to a scientific progress, developing his original research ideas to estimate the *valuable financial papers prices evolution* with the help of the *probability theory* in the *mathematics,* using the *knowledge base* on the *probability theory* in the *mathematics* in *De Laplace (1812)*, *Bunyakovsky (1846), Chebyshev (1846, 1867, 1891)*, *Markov (1890, 1899, 1900).*

At the end of *XIX* century, *Hirsch (1896), Australian philosopher* formulated the ***scientific notion of money***: "*That which is accepted freely, throughout the community, in final*

discharge of all debts, or in exchange for all commodities, without any intention on the part of the acceptor to consume it, or use it for any other purpose than in his turn to tender it in discharge of debts or in exchange for commodities." *Hirsch (1896)* emphasized that the ***money are used as a medium of exchange*** and listed *the* ***following functions of money***:

1. "To enable the exchanges to be made independently of the double coincidence of wants and possessions;
2. To enable the exchange of commodities of different value without any division of these commodities themselves;
3. To serve as a common denominator for the value of existing commodities;
4. To serve as a measure for obligations to be discharged in the future."

Presently, taking to an account the *contemporary research findings* in *Dodd (2014a, b)*, the *authors* think the *initial scientific notion* on the ***meaning of money*** in *Hirsch (1896)* can be successfully complemented by the *authors' general proposition* that the ***money is not an adorable physical object (the metal coin or the paper money) or a virtual object (the bitcoin), but it represents a financial process, taking place in the so called exchange medium, which can be dynamically characterized by the changing values of financial variables in the financial markets over the time, frequency, scale domains***. In the course of research on the *theory of financial speculations* in *Bachelier (1900),* it was understood that a possible characterization of the *complex financial systems* within the *financial markets* can be done much more accurately, considering the *existing theoretical models* in the *physics,* namely in the *condensed matter physics*: the *model on the Brownian motion of molecules at the heat transfer process in the solids* in *Bunyakovsky (1825)* as well as the *Brownian movement of small particles suspended in a stationary liquid demanded by the molecular-kinetic theory of heat* in *Einstein (1905, 1956), Einstein, Smolukhovsky (1936).* Sometime later, the role of the *Brownian motion* in the *random processes* has been summarized in *Brush (1968, 1977)*. Moreover, *Shiryaev, Grossinho, Oliveira, Esquível (editors) (2006)* write: "*A.N. Kolmogorov*, in his own landmark work *Über die analytischen Methoden in der Wahrscheinlichkeitsrechnung, Math. Annalen 104 (1931), pp.415-458*, credits *Bachelier* with the first systematic study of *stochastic processes* in *continuous time*."

As it has been explained in *Ledenyov, Ledenyov (2014d)*, the ingenious remarkable research ideas on the application of *probability theory* in *finances* in *Bachelier(1900)* have been further developed in the research works in *Slutsky (1922a, b, 1925a, b, 1927a, 1937a, b).* The groundbreaking propositions on the application of both the *theory of probability* and the *theory* ***of random processes*** in the *finances* in *Bachelier (1900)* have been comprehensively considered

during the formulation of the ***mathematical theory of the Wiener processes*** in *Wiener (1923, 1930, 1949)*. At later date, aiming to overcome the critical limitations of *classical theoretical models* like the *fractional Brownian motion*, the *multi-fractals* have been introduced in the *finances* from the *mathematical physics* in *Mandelbrot (1960, 1963a, b, 1965, 1965, 1967a, b, 1969, 1971, 1972, 1975a, b, 1977, 1982, 1997), Mandelbrot, Taylor (1967), Mandelbrot, van Ness (1968), Mandelbrot, Wallis (1969), Ausloos (2000)*, *Kantelhardt, Zschiegner, Koscielny-Bunde, Havlin, Bunde, Stanley (2002)*, *Norouzzadeh, Rahmani (2006)*, *Kim, Yoon (2004)*, *Jiang, Ma, Cai (2007)*, *Jiang, Zhou (2009)*, *Liu, Qian, Lu (2010)*, *Wang, Yu, Suo (2012)*, *Trenca, Plesoianu, Căpusan (2012)*.

In the early *XX* century, *Schumpeter (1911, 1939, 1947)* highlighted a notable fact that, the ***creative disruptive innovation*** appears due to the *innovation breakthrough processes* during the *capitalism evolution process* in *Schumpeter (1911, 1939, 1947)*. This research outcome has been investigated in details in *Christensen (Christensen (June 16, 1977; Fall, 1992a, b; 1997; 1998; December, 1998; April, 1999a, b, c; 1999a, b; Summer, 2001; June, 2002; 2003; March, April, 2003; January, 2006), Bower, Christensen (January, February, 1995; 1997; 1999), Christensen, Armstrong (Spring, 1998), Christensen, Cape (December, 1998), Christensen, Dann (June, 1999), Christensen, Tedlow (January, February, 2000), Christensen, Donovan (March, 2000; May, 2010), Christensen, Overdorf (March, April, 2000), Christensen, Bohmer, Kenagy (September, October, 2000), Christensen, Craig, Hart (March, April, 2001), Christensen, Milunovich (March, 2002), Bass, Christensen (April, 2002), Anthony, Roth, Christensen (April, 2002), Kenagy, Christensen (May, 2002; 2002), Christensen, Johnson, Rigby (Spring, 2002), Hart, Christensen (Fall, 2002), Christensen, Verlinden, Westerman (November, 2002), Shah, Brennan, Christensen (April, 2003), Christensen, Raynor (2003), Burgelman, Christensen, Wheelwright (2003), Christensen, Anthony (January, February, 2004), Christensen, Anthony, Roth (2004), Christensen, Baumann, Ruggles, Sadtler (December, 2006), Christensen, Horn, Johnson (2008), Christensen, Grossman, Hwang (2009), Dyer, Gregersen, Christensen (December, 2009; 2011), Christensen, Talukdar, Alton, Horn (Spring, 2011), Christensen, Wang, van Bever (October, 2013))*, resulting in a conclusion about a considerable necessity to establish and optimize the *business processes* in *Berle, Means (1932)* with the help of the *financial engineering techniques* toward the *socially responsible investment* in *Sparkes (1998, 2004, 2008)*, *Renneboog, Horst, Zhang (2008), Crifo, Forget (February, 2012)* of the ***private equity (PE)*** in *Kaplan, Schoar (2005), Allen (2012)* by means of both the ***venture capital (VC) funds*** in *Fast (1978), Rind (1981), Gompers (2002), Lerner (2002), Allen (2012), Ledenyov D. O., Ledenyov V. O. (2013i)* and the ***leveraged buyout (LBO) funds*** in *Jensen,*

Meckling (1976), Jensen (1986, 1989), Jensen, Murphy (1990), Baker and Wruck (1989), Kaplan (1989), Kaplan, Stein (1993), Kaplan, Strömberg (2009) into the *selected companies* in the conditions of *free market economy.*

Firstly, let us explain the meaning of the ***private equity (PE)*** in *Jegadeesh, Kräussl, Pollet (2009):* "*Private equity (PE)* refers to *equity securities* in *private companies* that are not publicly traded. *Private equity funds* that specialize in *PE investments* opened up this *asset class* to *institutional investors* and other capital market participants. The early successes of some large *PE funds* led to a rapid growth of this asset class. Capital commitment to *private equity* in the *U.S.* has grown rapidly from around *$20 billion* in *1990* to over *$496 billion* in *2007*."

The *private equity* plays an important role in the country's innovation potential as explained in *Bernothy, Colavecchioz, Sass (2010):* "*Private equity (PE)*, which was relatively unknown in the early *1980s*, has become an important *asset class* in global financial markets. A number of studies have documented the key role that *PE* plays in a *country's entrepreneurial performance* as *PE-backed firms* create more innovations, employment and growth than their peers."

Edgerton (January, 2011) notes: "Three components are generally identified as key to the *PE funds'* approach to managing firms:

1. *highly performance-sensitive managerial compensation*,
2. *highly levered financing*, and
3. *active monitoring of firm activities* by skilled professionals from the *PE fund*.

These changes are intended to transform firms into better-managed, more efficient organizations."

Secondly, let us make a historical overview on the ***venture capital funds*** origination in *Allen (2012)*: "Two seminal figures in the development of *venture capital* were *George Doriot*, a *former general* affiliated with *Harvard Business School*, and *MIT President Karl Comptom*. They effectively launched the *venture capital industry* in *1946* with the founding of *American Research and Development (ARD)*, a *publicly traded closed-end mutual fund* marketed mostly to individuals. *Doriot* had an ability to identify the most promising entrepreneurs, and he found two in *Kenneth Olson* and *Harlan Anderson*, who wanted to start a firm to manufacture *small computers*. They had no money and no credit when they incorporated *Digital Equipment*. In *1956 Doriot* offered to invest *$70,000* in the company in return for a *60* percent stock interest; *Olson and Anderson* eagerly accepted. The company and the investment proved to be very successful." *Paul A. Gompers*, *Professor of Business Administration at Harvard Business School* writes that the first examples of *successful venture capital funded companies* are the *Digital*

Equipment Corporation, *Memorex*, *Raychem*, and *Scientific Data Systems* in *Fast (1978), Gompers (2002)*. The *authors* would like to add that, presently, there is a number of the *high-tech clusters* with the *venture capital funded hi-tech companies,* which are situated at the *Long Island* in *New York*; *Silicon Valley* near *San Francisco* in *California*; *Fort Worth* near *Dallas* in *Texas*; *Research Triangle Park* near *Durham* in *North Carolina* and at some other places like *San – Diego* in *California*, *Miami* in *Florida*, and *Hawaii* in the *USA*. The *biggest financial and law services clusters* are located in the *New York*, *Chicago*, *Atlanta* in the *USA*. The *advanced technologies* are usually developed in the *hi-tech start-up companies,* founded by the *talented entrepreneurs*; financed by the *venture capital firms/funds* or by the *state agencies* such as the *U.S. National Science Foundation (NSF)*, *Defense Advanced Research Projects Agency (DARPA)*, *Air Force Office of Scientific Research (AFOSR), Office of Naval Research (ONR), Army Research Office (ARO), National Aero Space Agency (NASA), National Security Agency (NSA), Central Intelligence Agency (CIA). The Small Business Innovation Research (SBIR)* program represents another example of *startup financing initiative* by the *US government* in *Link, Ruhm, Siegel (August 2012)*, *Gompers (2002)*. In many cases, these *startup companies* are situated at the *business incubators* within *high-tech clusters* near the *leading American universities.* There are the strong connections between the *state agencies* and the *universities*: the *Air Force Office of Scientific Research – Massachusetts Institute of Technology*; the *Army Research Office – Duke University*; the *National Security Office – Maryland University*; the *Central Intelligence Agency – Virginia University*; the *Office of Naval Research – California University Los Angeles*; the *National Aero Space Agency – Texas University*. Also, there are *the relatively small high-tech clusters* in *Canada* such as the *Kanata high-tech cluster* near *Ottawa* in *Ontario;* the *Calgary high-tech cluster* in Calgary in *Alberta*; the *Richmond high-tech cluster* near *Vancouver* in *British Columbia* in the *North America*. The *early stage financing* of the *Canadian high-tech companies* is mainly performed with the use of the *American / Canadian venture capital*. For example, *Josh Lerner*, *the Jacob H. Schiff Professor of Investment Banking at Harvard Business School* explains in *Lerner (2002)*: "*Decisions* about whether to finance *firms* are made not by *centralized bodies* but rather devolved in many *agencies* to *program managers* who are seeking to address *very specific technical needs* (for example, an *Air Force research administrator* who is seeking to encourage the development of new composites). As a result, many offbeat technologies that are not of interest to *traditional venture investors* have been funded through this program." The *authors* would like to add that an *outsourcing* of the *R&D function* and the *production function* to the *Japan, Korea, Taiwan, Malaysia, Singapore, P. R. China* on one side, as well as a preservation of the *corporate governance*, *financial*

engineering and *legal support functions* in the *USA* on other side, are *commonly spread business practices* among the *VC financed high-tech companies* in the *USA* in the *time of globalization*. The detailed discussion on the *venture capital investing strategies* has been conducted in *Ledenyov D. O., Ledenyov V. O. (2013i)*.

Thirdly, let us continue by providing a few ***leveraged buyout definitions*** in the *contemporary academic literature* (see below).

Diamond (editor) (1985): "*Leveraged buyouts* are all buyout transactions, which increase the *leverage* (the *total debt to total equity ratio*) of the purchased company."

Lichtenberg, Siegel (June, 1989) write: "In an *LBO*, a group of investors (which sometimes includes incumbent management) takes a *company* (or a *division of a company*) ***private*** by purchasing all of the *outstanding equity of the company*, mainly using borrowed funds. The enterprise is much more highly leveraged (it has a *higher debt/equity ratio*) after the *LBO* than before. The financing of *LBOs* often involves the sale of *high-yield (or "junk") bonds*. The *debt* incurred to buy out the *company* is expected to be serviced by a combination of *operating income* and *asset sales*."

Burrough, Heylar (1990, 2005) state: "The basics of *LBO* are relatively simple: A [*consulting investment*] firm, working with a *company's management*, buys the *company*, using money raised from *banks* and the *public sale of securities*; the *debt* is paid down with *cash* from the *company's operations* and, often, by *selling pieces of the business*."

Piatkowski (June, 2001) write: "*Leveraged buyouts (LBOs)* represent *transactions* where a buyer utilizes *external financing* (*bank debt, bonds, third party equity*) to finance a *purchase of a company*. *Share of external financing* represents the *majority part of the total value of the purchase*; *buyer's own capital* constitutes the *minor portion of the total purchase price*. *Assets of the purchased company* along with *its cash flow* provide collateral and a source of repayment for the *incurred debt* in the transaction. In the case of a *LBO* of a *public company*, quite often the *purchased company is delisted from the stock market* in what is called as taking it private. Yet, delisting is not necessary."

Le Nadant, Perdreau (2006) explain: "*LBO transactions* can be defined as acquisitions of a significant equity stake of a *company* by *private venture capital investors* using additional *debt financing*. They comprise both the case of *Management Buy-outs (MBOs)* and *Management Buy-ins (MBIs)*. In a *MBO*, *current management* with the aid of financial investors takes over the *company's equity* from its previous owners, whereas in a *MBI*, an *external management team* funded by outside investors takes over the control of a given *target company*."

Groh, Baule, Gottschalg (2008) write: "*Leveraged Buyouts (LBOs)* are transactions in which a *financial investor* takes over a *company* via a *special purpose vehicle*. The funding of the *special purpose vehicle* is typically composed of several layers of *debt* and *non-traded equity claims*. In most of the cases the *debt/equity ratios* of *LBO transactions* are above what is considered normal. These two properties - the *illiquidity of the private equity market* and the *leverage ratio* make *LBOs high-risk investments*."

Kaplan, Strömberg (2008, 2009) denote: "In a *leveraged buyout*, a company is acquired by a specialized investment firm using a relatively small portion of *equity* and a relatively large portion of *outside debt* financing. The *leveraged buyout investment firms* today refer to themselves (and are generally referred to) as *private equity firms*. In a typical *leveraged buyout transaction*, the *private equity firm* buys majority control of an existing or mature firm. This is distinct from *venture capital (VC) firms* that typically invest in young or emerging companies, and typically do not obtain majority control."

Schäfer, Fisher (October 16, 2008) explain: "*Private equity investors* are primarily active on the market for debt-financed corporate acquisitions (*leverage buy-outs*). The necessary equity capital for these acquisitions is provided by the *buy-out funds* and—to a lesser extent—also the future management of the *acquired companies*. The *debt capital* generally comes from a syndicate comprised of *banks* and increasingly also *institutional investors*. After conclusion of the *acquisition*, the different risk-bearing loan tranches are passed on to the participating investors and, in some cases, also to the market. The share of *debt capital* in the *total acquisition* price generally fluctuates between *60%* and *80%*. The aim of the *fund* is to generate a high return. The investment horizon is usually limited to several years."

Tåg (2010) defines the *leveraged buyout* as: "*Private equity buyouts* are *acquisitions* of *established companies* undertaken by *private equity firms*. They are partly financed with *debt* and partly with *equity raised from institutional investors for private equity funds with a predetermined life span*. *Private equity buyouts* are also known as *leveraged buyouts* or *bootstrap acquisitions*. When management participates, they are sometimes called *management buyouts*."

Allen (2012) explains: "*Fenn, Liang and Prowse (1997)* point out that before the *1980's* funds for *non-venture private equity investments* came from *venture capital funds* and *informal investor groups*. During the *1980s*, *limited partnership funds* were created specifically to provide *non-venture funds*. The largest of these specialized in the *leveraged buyouts of large public companies*. These *funds* tended to be much larger in size than *venture capital funds*. This meant they appealed more to *pension funds* with large amounts of funds to invest."

In other words, the *authors* can sum up all the above research statements and formulate a *precise definition of leveraged buyout*: ***The Leveraged Buyout (LBO) is a powerful economic and financial mechanism for the corporate transformation by the means of the financial engineering techniques such as a chain of financial transactions implementation with the purpose of corporate ownership change, allowing the management to acquire a company as a result of leveraged buyout deal***. In other words, ***the leveraged buyout is the purchase of a company or division of a company using significant debt, whereby the target company's cash flows are used to support the loan repayments.*** The *Debt* can be in the form of the *traditional bank financing*, *bond offerings*, *seller financing* and *loans* from the *specialized funds*. *The issuance of high yield debt is a key to private equity deals*.

Fig. 1 shows the *value of LBO transactions in USA in 1986-1997 (in USD billion) in Piatkowski (June, 2001).*

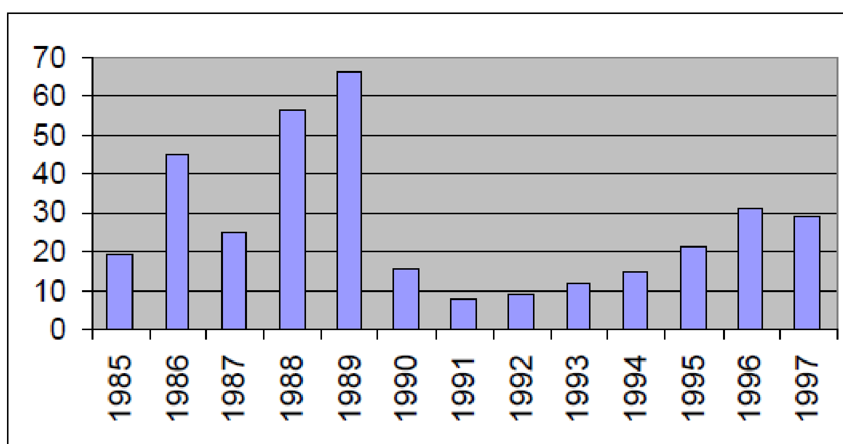


Fig. 1. *Value of LBO transactions in USA in 1986-1997 (in USD billion) (after Piatkowski (June, 2001)).*

Let us illustrate the relative volume of the *private equity market* in *France* in *2011* in *Crifo, Forget (February, 2012).* Fig. 2 shows the *French private equity market* (data *AFIC 2011* and *UN PRI 2011*) in amounts of funds raised, funds invested and *UN PRI* signatories in *Crifo, Forget (February, 2012).*

Also, let us demonstrate the structure and relative volume of the *private equity market* in *Germany* in *2008* in *Bannier, Müsch (August, 2008).* Fig. 3 displays the structure of *private equity market* in *Germany* in *Bannier, Müsch (August, 2008).* Fig. 4 demonstrates the *leveraged buyout transactions valuation* in *Germany* in *Bannier, Müsch (August, 2008).*

In the shown figures, it can be seen that the *LBO firms/funds/transactions* contribute to both: 1) the *optimization of business processes,* 2) the *business innovations introduction* in the *USA*, *France, Germany* and other countries globally.

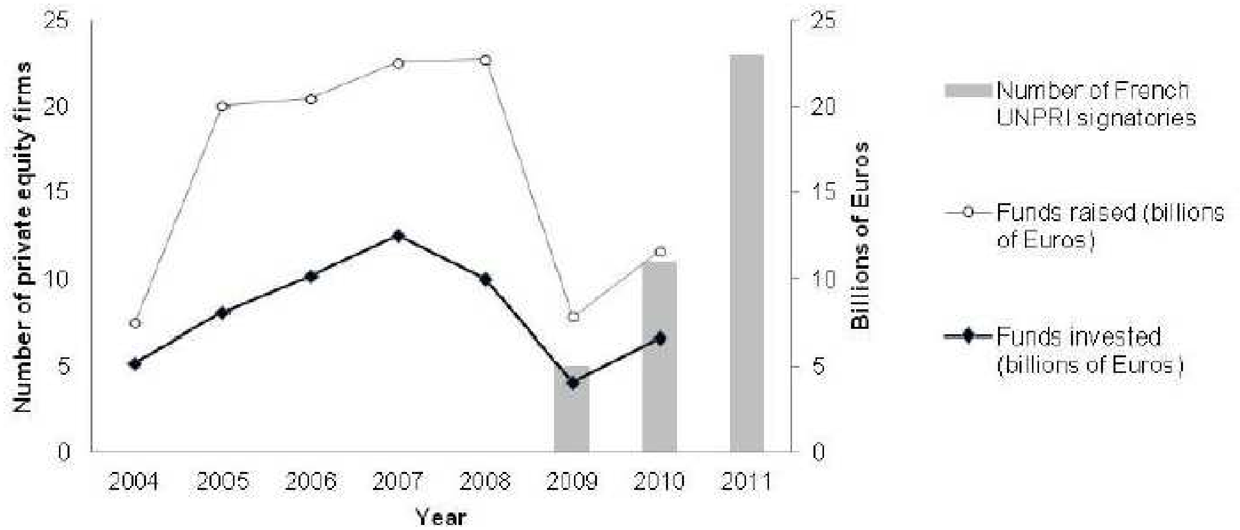


Fig. 2. *French private equity market (data AFIC 2011 and UN PRI 2011) in amounts of funds raised, funds invested and UN PRI signatories (after Crifo, Forget (February, 2012)).*

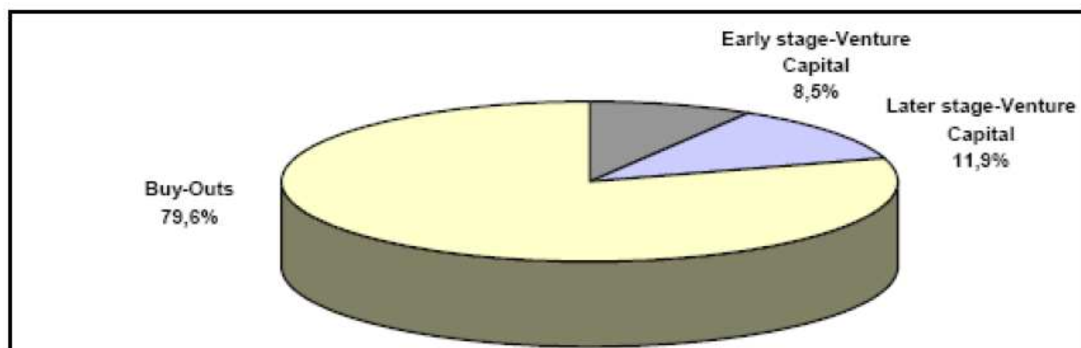


Fig. 3. *Structure of Private Equity market in Germany (after Bannier, Müsch (August, 2008)).*

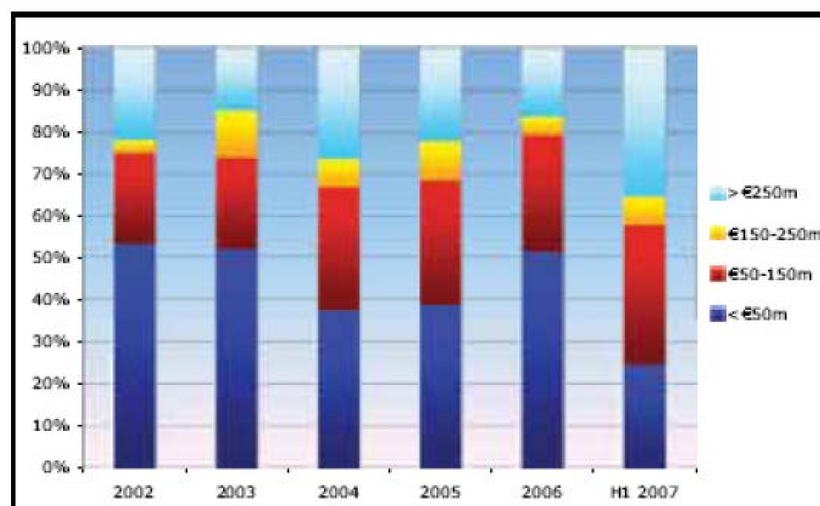


Fig. 4. *Leveraged buyout transactions in Germany (after Bannier, Müsch (August, 2008)).*

Fig. 5 shows a number of closed or effective transactions worldwide from 1.1.1970 - 31.12.2009 in the *Capital IQ database* that are marked as *LBO* or *MBO* in *Strömberg (2008), Tåg (2010)).*

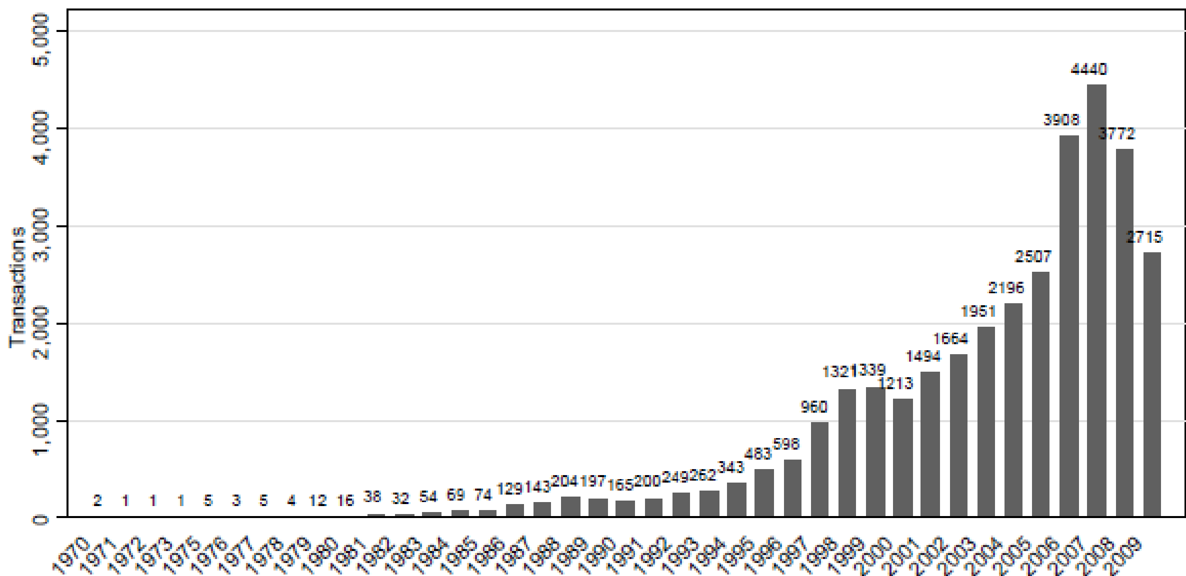


Fig. 5. *Number of closed or effective transactions worldwide from 1.1.1970-31.12.2009 in the Capital IQ database that are marked as LBO or MBO. For a careful discussion on the coverage of the Capital IQ database (after Strömberg (2008), Tåg (2010)).*

Fig. 6 depicts the geographical breakdown of the number of closed or effective transactions worldwide from 1.1.1970-31.12.2009 in the *Capital IQ database* that are marked as *LBO* or *MBO* in *Strömberg (2008), Tåg (2010)).*

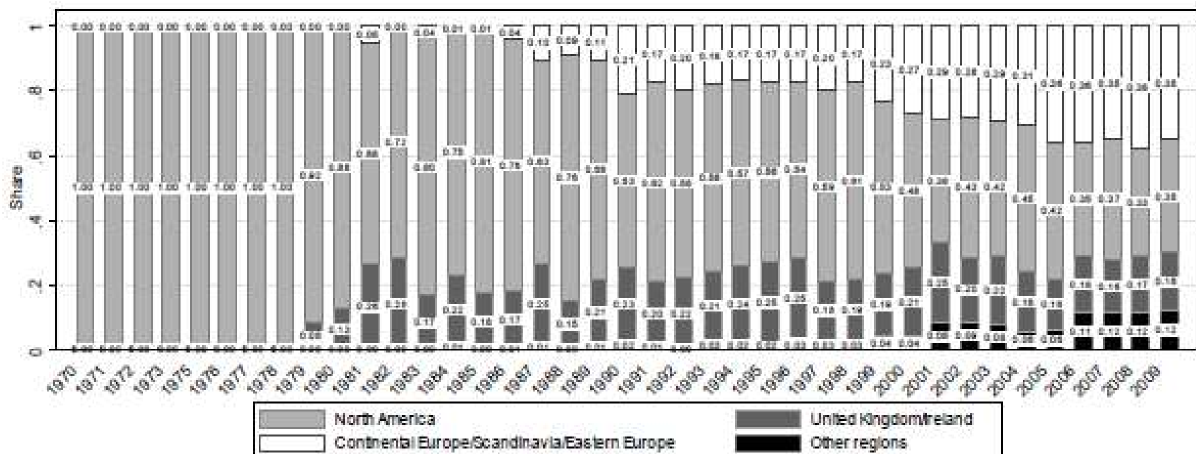


Fig. 6. *Geographical breakdown of the number of closed or effective transactions worldwide from 1.1.1970-31.12.2009 in the Capital IQ database that are marked as LBO or MBO (after Strömberg (2008), Tåg (2010)).*

Let us note that the *research article discussions* will include, but they certainly will not be limited to, the following *research themes*:

1. Introduction on the *private equity*, including the *venture capital* and *leveraged buyout firms, funds and transactions* in the *economics* and *finances*.

2. The review on some aspects of *modern financial engineering approaches* to design the *leveraged buyout firms, funds and transactions* in the *economics* and *finances*, going from the *contemporary research findings* in the *academic literature*.

3. The discussion on a *private equity's important role* in the *Schumpeterian creative destruction processes* in the *free market economy,* considering the *leverage buyout transactions process and the accurate characterization* of the *leverage buyout transactions properties* at the *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities*.

4. The discussion on the fundamentals of *winning virtuous strategies creation* toward the *leveraged buyout transactions implementation* during the *private equity investments* in the conditions of the *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities* in particular, and at the influences by the *Schumpeterian creative disruption processes* at all.

5. Concluding remarks.

Modern financial engineering approaches to leveraged buyout firms, funds and transactions during private equity investment in conditions of resonant absorption of discrete information in diffusion - type financial system with induced nonlinearities

Let us make a comprehensive review on the ***leveraged buyout firms, funds and transactions***, explaining the essence of *scientific terms* as in the *academic literature*. We will pay special attention to the modern definitions and interpretations of *scientific terms* in the reviewed research papers.

The *leveraged buyouts* have been researched, because of the reasons outlined in *Opler, Titman (1991)*: "The *American corporate sector* experienced a dramatic increase in *leveraged buyout activity* in the *1980s*. Between *1979* and *1989* there were over *2,000 leveraged buyouts (LBOs)* valued in excess of *$250 billion*. A number of possible motivations for these transactions have been advanced, most of which fall into one of the following categories:

1. Incentive realignment, i.e. gains from operating improvements resulting from realigning the interests of stockholders and management,

2. Favorable inside information, i.e. gains from acquiring undervalued assets,

3. Stakeholder wealth transfers, i.e. gains from employee layoffs, union-busting or raising the risk of preexisting debt, and

4. Tax savings, i.e. tax reductions from increasing leverage and stepping up asset basis."

Let us define the ***leveraged buyout (LBO) firm*** as in *Kaplan, Strömberg (2008; Winter, 2009):* "The typical *private equity firm* is organized as a *partnership* or *limited liability corporation*. *Blackstone*, *Carlyle*, and *KKR* are three of the most prominent *private equity firms*. In the late *1980s*, *Jensen (1989)* described these firms as lean, decentralized organizations with relatively few investment professionals and employees. In his survey of seven large *leveraged buyout partnerships*, *Jensen* found an average of *13* investment professionals, who tended to come from an investment banking background. Today, the large *private equity firms* are substantially larger, although they are still small relative to the firms in which they invest. *KKR's S-1* (a form filed with the *Securities and Exchange Commission* in preparation for *KKR's initial public offering*) reported *139* investment professionals in *2007*. At least four other large *private equity firms* appear to have more than *100* investment professionals. In addition, *private equity firms* now appear to employ professionals with a wider variety of skills and experience than was true *20* years ago."

Let us understand a meaning of the ***leveraged buyout (LBO) fund*** as in *Kaplan, Strömberg (2008; Winter, 2009): "*A *private equity firm* raises equity capital through a *private equity fund*. Most *private equity funds* are *"closed-end" vehicles* in which *investors* commit to provide a *certain amount of money* to pay for *investments* in companies as well as *management fees* to the *private equity firm*. Legally, *private equity funds* are organized as *limited partnerships* in which the *general partners* manage the fund and the *limited partners* provide most of the capital. The *limited partners* typically include *institutional investors*, such as *corporate and public pension funds*, *endowments*, and *insurance companies*, as well as *wealthy individuals*. The *private equity firm* serves as the *fund's general partner*. It is customary for the *general partner* to provide at least *1* percent of the *total capital*.

The fund typically has a fixed life, usually *ten years*, but can be extended for up to *three additional years*. The *private equity firm* normally has up to *five years* to invest the *fund's capital* committed into companies, and then has an *additional five to eight years* to return the *capital* to its investors. After committing their capital, the *limited partners* have little say in how

the *general partner* deploys the *investment funds*, as long as the basic covenants of the *fund* agreement are followed. Common covenants include restrictions on *how much fund capital can be invested in one company*, on *types of securities a fund can invest in*, and on *debt at the fund level* (as opposed to *debt at the portfolio company level*, which is unrestricted). *Sahlman (1990)*, *Gompers and Lerner (1996)*, and *Axelson, Strömberg, and Weisbach (2008)* (forthcoming) discuss the economic rationale for these fund structures.

The *private equity firm* or *general partner* is compensated in three ways. First, the *general partner earns an annual management fee*, usually a *percentage of capital committed*, and then, as *investments* are realized, a *percentage of capital employed*. Second, the *general partner earns a share of the profits of the fund*, referred to as "*carried interest*," that almost always equals *20 percent*. Finally, some *general partners charge deal and monitoring fees to the companies in which they invest*. *Metrick and Yasuda (2007)* describe the structure of fees in detail and provide empirical evidence on those fees."

Some aspects of the *LBO fund business structure* and its operational issues have been researched in *Shell (2006)*.

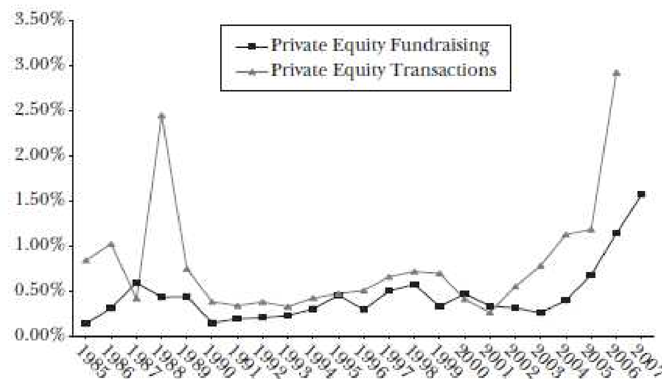
Let us provide the ***leveraged buyout (LBO) transaction*** definition as in *Kaplan, Strömberg (2008; Winter, 2009): "*In a typical *private equity transaction*, the *private equity firm* agrees to buy a *company*. If the *company* is *public*, the *private equity firm* typically pays a premium of *15* to *50 percent over the current stock price Kaplan (1989b)*; *Bargeron, Schlingemann, Stulz, and Zutter (2007)*. The *buyout* is typically financed with *60* to *90 percent debt*—hence the term*, leveraged buyout*. The *debt* almost always includes a *loan portion* that is senior and secured, and is arranged by a *bank* or an *investment bank*. In the *1980s* and *1990s*, *banks* were also the *primary investors* in these *loans*. More recently, however, *institutional investors* purchased a large fraction of the *senior and secured loans*. Those *investors* include *hedge fund investors* and *"collateralized loan obligation" managers*, who combine a number of term *loans* into a *pool* and then carve the *pool* into different pieces (with different seniority) to sell to *institutional investors*. The *debt* in *leveraged buyouts* also often includes a *junior*, unsecured portion that is financed by either *high-yield bonds* or *"mezzanine debt"* (that is, *debt* that is subordinated to the *senior debt*). *Demiroglu and James (2007)* and *Standard and Poor's (2008)* provide more detailed descriptions.

The *private equity firm* invests *funds* from its *investors* as *equity* to cover the remaining *10* to *40 percent of the purchase price*. The new *management team* of the purchased company (which may or may not be identical to the *pre-buyout management team*) typically also

contributes to the new equity, although the amount is usually a small fraction of the *equity dollars* contributed.

Kaplan (2005) describes a large *leveraged buyout* - the *2005 buyout of Sun-Gard Data Systems* - in detail. *Axelson, Jenkinson, Strömberg, and Weisbach (2008)* provide a detailed description of capital structures in these kinds of leveraged buyouts."

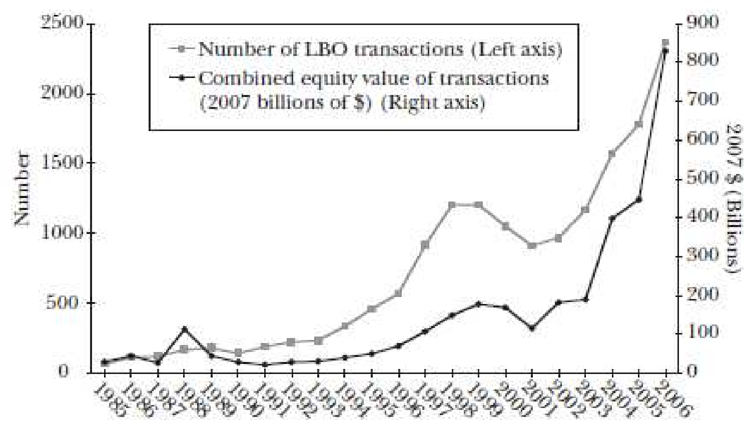
Fig. 7 shows the U.S. private equity fundraising and transaction values as a percentage of total U.S. stock market value from 1985 to 2007 in *Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009).*



Sources: Private Equity Analyst, CapitalIQ, Strömberg (2008), authors' calculations.

Fig. 7. *U.S. private equity fundraising and transaction values as a percentage of total U.S. stock market value from 1985 to 2007 (after Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009)).*

Fig. 8 depicts the global private equity transaction volume, 1985–2006 in *Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009).*



Sources: CapitalIQ, Strömberg (2008), authors' calculations.
Note: "LBO" is "leveraged buyout."

Fig. 8. *Global private equity transaction volume, 1985–2006 (after Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009)).*

Tab. 1 shows the global leveraged buyout transaction characteristics across time in *Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009).*

Table 1: Global Leveraged Buyout Transaction Characteristics Across Time.
The table reports transaction characteristics for 17,171 worldwide leveraged buyout transactions that include every transaction with a financial sponsor in the CapitalIQ database announced between 1/1/1970 and 6/30/2007. Enterprise value is the sum of the sum of equity and net debt used to pay for the transaction in 2007 U.S. dollars. For the transactions where enterprise value was not recorded, these have been imputed using the methodology in Strömberg (2008).

Period	1985-1989	1990-1994	1995-1999	2000-2004	2005-6/30/2007	1970-6/30/ 2007
				Sum		
Combined Enterprise Value	$257,214	$148,614	$553,852	$1,055,070	$1,563,250	$3,616,787
Number of transactions	642	1,123	4,348	5,673	5,188	17,171
LBOs by type::			% of Combined Enterprise Value			
Public to private	49%	9%	15%	18%	34%	27%
Independent private	31%	54%	44%	19%	14%	23%
Divisional	17%	31%	27%	41%	25%	30%
Secondary	2%	6%	13%	20%	26%	20%
Distressed	0%	1%	1%	2%	1%	1%
LBOs by target location:						
United States and Canada	87%	72%	60%	44%	47%	52%
United Kingdom	7%	13%	16%	17%	15%	15%
Western Europe (except UK)	3%	13%	20%	32%	30%	26%
Asia and Australia	3%	1%	2%	4%	6%	4%
Rest of World	0%	2%	2%	3%	3%	3%

Tab. 1. *Global leveraged buyout transaction characteristics across time (after Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009)).*

Tab. 2 displays the exit characteristics of leveraged buyouts across time in *Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009).*

Table 2: Exit Characteristics of Leveraged Buyouts Across Time.
The table reports exit information for for 17,171 worldwide leveraged buyout transactions that include every transaction with a financial sponsor in the CapitalIQ database r announced between 1/1/1970 and 6/30/2007. The numbers are expressed as percentage of transactions, on an equally-weighted basis. Exit status is determined using various databases, including CapitalIQ, SDC, Worldscope, Amadeus, Cao and Lerner (2007), as well as company and LBO firm web sites. See Strömberg (2008) for a more detailed description of the methodology.

Year of original LBO	1970-1984	1985-1989	1990-1994	1995-1999	2000-2002	2003-2005	2006-2007	Whole period
Type of exit:								
Bankruptcy	7%	6%	5%	8%	6%	3%	3%	6%
IPO	28%	25%	23%	11%	9%	11%	1%	14%
Sold to strategic buyer	31%	35%	38%	40%	37%	40%	35%	38%
Sold to financial buyer	5%	13%	17%	23%	31%	31%	17%	24%
Sold to LBO-backed firm	2%	3%	3%	5%	6%	7%	19%	5%
Sold to management	1%	1%	1%	2%	2%	1%	1%	1%
Other / unknown	26%	18%	12%	11%	10%	7%	24%	11%
No exit by Nov. 2007	3%	5%	9%	27%	43%	74%	98%	54%
% of deals exited within								
24 months	14%	12%	14%	13%	9%	13%		12%
60 months	47%	40%	53%	41%	40%			42%
72 months	53%	48%	63%	49%	49%			51%
84 months	61%	58%	70%	56%	55%			58%
120 months	70%	75%	82%	73%				76%

Tab. 2. *Exit characteristics of leveraged buyouts across time (after Strömberg (2008), Kaplan, Strömberg (2008; Winter, 2009)).*

The most innovative research contributions to the ***modern theory of leveraged buyout transactions, firms, funds*** and closely linked scientific subjects have been done by a number of truly distinguished investigators as shown in a chronological order in *Berle, Means (1932a, b), Solow (August, 1957), Modigliani, Miller (June, 1958), Penrose (1959), Marris (May, 1963), Telser (1963), Williamson (1964, 1975, 1988), Fogel (1964), Manne (1965), Sharpe (1966), Stigler (1968), Black, Scholes (1973), Black, Cox (1976), Merton (1973, 1974), Jensen, Meckling (1976), Jensen, Ruback (1983), Fama, Jensen (1983), Jensen (1986, 1989a, September, October, b, c, 1993, 2007), Jensen, Kaplan, Stiglin (1989), Jensen, Murphy (1990), Latané, Rendleman (1976), Brennan, Schwartz (1977), Geske (1977, 1979), Leland, Pyle (1977), Myers (1977, 1984), Myers, Majluf (1984), Ross (1977), Chiras, Manaster (1978), Fisher (1978), Schmalensee, Trippi (1978), Cox, Ross, Rubinstein (1979), Ferri, Jones (1979), Holmström (1979), Holmstrom, Tirole (1997), Holmström, Kaplan (2001, 2003), Maddala (1979), Shepherd (1979), Smith, Warner (1979), Grossman, Hart (1980, 1982), Ho, Singer (1982, 1984), Manaster, Koehler (1982), Jones, Mason, Rosenfeld (1983, 1984), Jones, Mason, Rosenfeld (1984), Moore, Reichert (1984), DeAngelo H, DeAngelo L, Rice (1984), DeAngelo H, DeAngelo L (May, June, 1987), Diamond D W (August, 1984), Green (1984), Titman (1984), Titman, Wessels (1988), Wernerfelt (1984), Demsetz, Lehn (1985), Diamond S C (1985), Lowenstein (1985), Herman, Lowenstein (1988), Coffee, Lowenstein, Rose-Ackerman (1988), Michel, Shaked (1985, 1988), Murphy (1985), Spence (1985), Young (1985), Jose, Nichols, Stevens (1986), Shleifer, Vishny (1986, 1989, 1991), Shleifer, Summers (1988), Campbell (1987), Campbell, Shiller (1988), Crawford (1987), Lichtenberg, Siegel (1987, June, 1989, 1990), Lichtenberg (June, 1988, 1989a, b), Bartel, Lichtenberg (October, 1988), Maupin (1987), Ravenscraft, Scherer (1987), Ravenscraft, Scherer (1991), Singh, Montgomery (1987), Singh, Summer (1990), Fama, French (1988a, b, 1989), Hall (1988, 1990), Hill, Hitt, Hoskisson (1988), Hoskisson, Hitt (1988), Hoskisson, Turk (1990), Hoskisson, Hitt, Johnson, Moesel (March, 1991), Hitt, Hoskisson (1990), Harrison, Hitt, Hoskisson, Ireland (1991), Hitt, Hoskisson, Ireland, Harrison (1992), Kaplan (October, 1988, 1989a, b, c, 1991, 1994, 1997, 2005, 2008), Kaplan, Stein (1990, 1993), Kaplan, Weisbach (1990), Gertner, Kaplan (1996), Andrade, Kaplan (1998), Kaplan , Schoar (2005), Kaplan, Klebanov, Sorensen (2007), Kaplan, Strömberg (2008, Winter, 2009), Kaplan, Sensoy, Strömberg (2009), Kaplan, Rauh (2010), Harris, Jenkinson, Kaplan (2012), Kidder, Peabody & Co, Inc (1988), McGuckin, Andrews (1988), McGuckin, Pascoe (1988), McGuckin, Nguyen (2001), Mikkelson, Partch (1988), Mørck, Shleifer, Vishny (1988a, b, 1990), Tirole (1988), Baker, Wruck (1989), Baker (1992), Baker, Montgomery (1994), Baker, Smith (1998), Bull (1989a, b), Dertouzos, Lester, Solow, MIT*

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The most innovative research contributions to the ***modern theory of venture capital transactions, firms, funds*** and closely linked scientific subjects have been done by a number of truly distinguished researchers as shown in a chronological order in *Berle, Means (1932a, b), Solow (August, 1957), Modigliani, Miller (June, 1958), Penrose (1959), Marris (May, 1963),*

Telser (1963), Williamson (1964, 1975, 1988), Fogel (1964), Manne (1965), Sharpe (1966), Stigler (1968), Black, Scholes (1973), Black, Cox (1976), Merton (1973, 1974), Hoban (1976), Jensen, Meckling (1976), Jensen, Ruback (1983), Fama, Jensen (1983), Jensen (1986, September, October, 1989, 1993, 2007), Jensen, Murphy (1990), Poindexter (1976), Fast (1978), Rind (1981); Tyebjee, Bruno (1981, 1984), Bruno, Tyebjee (1983, 1986), Chan (1983), Felda, DeNino, Salter (1983), Martin, Petty (1983), Wilson (1983); Merkle (1984); Wernerfelt (1984), Hutt, Thomas (1985), MacMillan, Siegel, Narasimha (1985), MacMillan, Zemann, Narasimha (1987); MacMillan, Kulow (1989), Beatty, Ritter (1986), Nevermann, Falk (1986), Timmons, Bygrave (1986); Timmons (1994, 1999), Block, Ornati (1987), Bygrave (1987), Bygrave, Timmons (1992), Ibbotson, Brinson (1987), Robinson (1987), Ruhnka, Young (1987, 1991), Ruhnka, Felman, Dean (1992), Sandberg, Hofer (1987), Stedler (1987); Brophy, Guthner (1988), Clark (1988), Eisinger (1988, 1993), Florida, Kenney (1988), Florida, Smith (1993), Gladstone (1988), Harris, Raviv (1988), Sandberg, Schweiger, Hofer (1988), Schmidt (1988), MacMillan, Kulow, Khoylian (1988), Sandberg, Schweiger, Schmidt (1988), Siegel R, Siegel E, MacMillan (1988), Tirole (1988); Benveniste, Spindt (1989), Gorman, Sahlman (1989), Holmstrom, Tirole (1989), Poterba (1989a, b); Summers (editor) (1989), Amit, Glosten, Muller (1990a, b), Amit, Brander, Zott (1998), Barry, Muscarella, Peavy, Vetsuypens (1990), Barry (1994), Chan, Siegel, Thakor (1990), Hisrich, Jankowitz (1990), Sahlman (1990, 1993), Sykes (1990); Cochrane (1991, 2005, 2008, 2011), Dixon (1991), Megginson, Weiss (1991); Megginson (2004), Rich, Gumpert (1992), Roberts, Stevenson (1992), Sapienza (1992), Sapienza, Gupta (1994), Sapienza, Manigart, Vermeir (1996); Wright, Thompson, Robbie (1992), Wright, Robbie, Ennew (1997), Wright, Robbie (1998), Weir, Jones, Wright (2007, 2008), Wright, Gilligan, Amess (2009), Wright, Amess, Weir, Girma (2009), Wood, Wright (2009), Weir, Jones, Wright (2013), Hall, Hofer (1993), Rosenstein, Bruno, Bygrave, Taylor (1993), Sahlman (1993); Admati, Pfleiderer (1994), Aghion, Tirole (1994), Anton, Yao (1994), Berglöf (1994), Bhidé (1994), Fried, Hisrich (1994), Gompers (1994, 1995, 1996, 1998, 2002, 2007), Gompers, Lerner (1996, 1997, 1998a, b, c, 1999a, b, c, d, 2000a, b, 2001a, b), Brav, Gompers (1997, 2003), Gompers, Ishii, Metrick (2003), Baker, Gompers (2003), Gompers, Lerner, Scharfstein (2005), Gompers, Kovner, Lerner, Scharfstein (2006, 2008), Gompers, Kovner, Lerner (2009), Gompers, Lerner, Scharfstein, Kovner (2010), Knight (1994), Kroszner, Rajan (1994), Lerner (1994a, b, 1995a, b, 1998, 1999, 2002, 2008, 2009), Kortum, Lerner (1998, 2000), Lerner, Shane, Tsai (2003), Lerner, Schoar (2004, 2005), Lerner, Moore, Shepherd (2005), Lerner, Schoar, Wongsunwai (2007), Lerner, Sorensen, Strömberg (2009a, b), Chen, Gompers, Kovner, Lerner (2009), Lerner, Tufano (2010), Lerner, Tåg (2012), Puri (1994,

1996), Puri, Robinson (2011); Anton, Yao (1995), Elango, Fried, Hisrich, Polonchek (1995), Hart (1995), Jain, Kini (1995), Loughran, Ritter (1995), Willner (1995); Muzyka, Birley, Leleux (1996), Packer (1996), Pettway, Kaneko (1996); Amit, Brander, Zott (1997), Cai, Wei (1997), Chevalier, Ellison (1997), Gilford (1997), Karsai, Wright, Filatotchev (1997), Karsai, Wright, Dudzinski, Morovic (1998, 1999), Karsai (1998, 2003, 2004, 2009), La Porta, Lpez-de-Silanes, Shleifer, Vishny (1997, 1998), La Porta, Lopez-de-Silane, Shleifer (June, 1998), Manigart, Wright, Robbie, Desbrieres, De Waele (1997), Manigart, De Waele, Wright, Robbie, Desbrieres, Sapienza, Beekman (2000), Manigart, De Waele, Wright, Robbie, Desbrieres, Sapienza, Beekman (2000, 2002), Manigart, Baeyens, Hyfte (2002), Reynolds, Sammins (1997), Baldwin, Link (1998), Link, Ruhm (2009, 2011), Link, Scott (2010, 2012a, b), Link, Ruhm, Siegel (August, 2012), Gicheva, Link (2012), Bergemann, Hege (1998), Berger, Udell (1998), Berger, Schaek (2011), Black, Gilson (1998), Cornelius , Isaksson (1998), Fried, Bruton, Hisrich (1998), Gerke (1998), Hellmann (1998, 2000, 2002, 2004a, b, 2006, 2007a, b, 2008, 2009), Hellmann, Puri (2000, 2002), Becker, Hellmann (2005), Hellmann, Lindsey, Puri (2004, 2008), Hyde (1998), Jacobs, Scheffler (1998), Lin, Smith (1998), Marx (1998), Marx, Strumsky, Fleming (2009), Murray, Marriott (1998), Prowse (1998), Rajan, Zingales (1998), Trester (1998), Zider (1998); Aernoudt (1999), Bliss (1999), Bygrave, Hay, Peeters (1999), Gilson (1999), Gilson, Schizer (2002, 2003), Gulati, Gargiulo (1999), Hamao, Packer, Ritter (1999), Leopold (1999), Mason, Harrison (January, March, 1999), Murray (October, December, 1999), Neher (1999), Schmidt (1999, 2002), Shepherd (1999), Shepherd, Zacharakis (1999), Stillman, Sunderland, Heyl, Swart (1999); Baygan, Freudenberg (2000), Baygan (2003), Bharat, Galetovic (2000), Cumming (2000, 2001, 2008), Cumming, MacIntosh (2000, 2001, 2002a, 2002b, 2002c, 2002d, 2003a, b, 2006), Cumming, Fleming (2002), Cumming, Fleming, Schwienbacher (2005, 2006, 2009), Cumming, Fleming, Suchard (2005), Cumming, Johan (2008), Cumming, Walz (2010), Cumming, Schmidt, Walz (2010), Gans, Stern (2000, 2003), Gans, Hsu, Stern (2002), Jain, Kini (2000), Jeng, Wells (2000), Kaplan, Strömberg (2000, 2001, 2002, 2003, 2004, 2009), Kaplan, Schoar (2005), Kaplan, Martel, Strömberg (2007), Kaplan, Sensoy, Strömberg (2009), Kaplan, Lerner (2010), Karaömerlioğlu, Jacobsson (2000), Koski (2000), Lee (2000), Lehtonen (2000), Quindlen (2000), Schefczyk (2000), Schefczyk, Gerpott (2000), Schertler (2000); Bascha, Walz (2001), Chu, Hisrich (2001), Engel (2001a, b, 2002); Francis, Hasan (2001), Fredriksen, Klofsten (2001), Hyytinen, Pajarinen (2001), Keuschnigg, Nielsen (2001, 2003a, b, 2004a, b), Keuschnigg (2003, 2004a, b), Kanniainen, Keuschnigg (2004), Kirilenko (2001), Lockett, Wright (2001), Maula, Murray (2001), Peng (2001), Seppä, Laamanen (2001), Seppä (2003), Shachmurove Y (2001, 2007a, b), Shachmurove A, Shachmurove Y (2004), Shachmurove E,

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Design of leverage buyout process and accurate characterization of leverage buyout transactions properties during private equity investment in conditions of resonant absorption of discrete information in diffusion - type financial system with induced nonlinearities

Let us discuss the *financial engineering techniques to design the LBO process and compute the direct and reverse leverage buyout transactions completion probability number* during the private *equity investment* in the conditions of *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities*.

According to *Piatkowski (June, 2001),* the *strategic investors* and *sellers* in the *LBO* process can be defined as (see below) and the *financing for the leverage transactions* can be described as (see below):

1. *“**Strategic investors*** are represented by:

(1) *incumbent management* (the so-called *management buyout - MBO*),

(2) *employees* (mostly through *Employee Share Ownership Programs - ESOP*),

(3) *external management* (*management buy-in - MBI*), and

(4) *other corporations*.

2. Sellers are comprised of three main groups:

(1) *private, family-owned companies* willing to share business with new investors or quit entirely, because of retirement, desire for liquidity or problems with management succession;

(2) *corporations*, which spin-off their non-core, non-strategic assets, which do not fit the business strategy or do not meet criteria on return on equity or market potential;

(3) and finally *shareholders in public companies*, which want to sell their stakes in return for some premium over the prevailing market stock price.

3. Financing for the leverage transactions is provided by various financial institutions:

(1) commercial banks,

(2) insurance companies,

(3) pension funds, which usually assume the role of secured debt lenders, and

(4) venture capital and private equity firms along with investment banks, which primarily position themselves as providers of subordinated debt or equity.”

Piatkowski (June, 2001) writes: “There are two main structures of the *leveraged buyout* depending on what is bought:

(1) ***assets of the company*** or

(2*) **its shares***.

In both cases, the economic result is the same: *the investor assumes control over the company*. Yet, *financial, tax, accounting and legal implications* may largely differ depending on the chosen transaction structure.”

Piatkowski (June, 2001) explains:

*“**Asset purchase***: The leveraged buyout of the company based on the purchase of its assets offers some benefits versus the purchase of the company’s shares. In short, the purchase of assets considerably limits the legal risk associated with the buyout . the buyer assumes the liabilities, which are directly related to the assets being bought. Almost none of the remaining liabilities of a target company are conveyed. Hence, the buyer is not liable for any of the selling corporation’s undisclosed or unknown liabilities (.skeletons in the cupboard.). Thanks to clear identification of the assets being purchased, lenders can secure themselves on identifiable pieces of assets rather than the total company’s property including both assets and liabilities. Consequently, the purchase of assets allows easier access to secured debt financing.

Share purchase: The purchase of shares rather than assets can be accomplished much faster. In addition, the purchase of shares allows automatic and complete takeover of all assets of the company, including those, which due to their nature are not transferable and can not be sold (contracts, administrative permits, licenses etc.). Those advantages are mitigated by the higher risk of buying a company with potential unreported liabilities (.skeletons.), and the higher cost of debt financing due to less clearly identifiable debt collateral (for more on legal aspects see the “*Legal, tax, and accounting aspects*” section of the paper).”

Piatkowski (June, 2001) proposes the following ***LBO business plan***: “The *LBO business plan* would normally comprise the following elements:

a) *Executive summary of the transaction*,

b) *Information memorandum on the target company*,

c) *Valuation of the target company*,

d) *Financing of the purchase*,

e) *Exit strategies* (ways of selling back the purchased company),

f) *Calculations of investor’s ROI for different scenarios*,

g) *Analysis of tax, legal and accounting aspects*.”

Piatkowski (June, 2001) notes: "*Leveraged buyouts* improve performance of companies owing to three effects:

1. Higher operating efficiency due to:

a) *reduction in agency costs* (conflicts of interests between management and shareholders) due to closer control of shareholders over the management,

b) *higher commitment of management due to salary incentive programs focused on the performance of a company rather than its size* (share options etc.),

c) *disciplinary impact of the debt burden, which prompts the management to conserve cash and pursue investment projects with undoubted positive returns* (*NPV*).

2. More efficient financial structure *with higher debt leverage*, which, while decreasing the overall cost of a company's capital, increases a company's ROE. Tax deduction of debt interests (tax shield) decreases tax payments and consequently results in larger free cash flow, which is an another source of value for shareholders.

3. Better allocation of assets achieved through the sale of non-core or redundant assets and rigorous assessment of all investment projects aimed at selection of the investment projects with high net present values."

Fig. 9 shows the *LBO market players* in *Michel, Schaked (1988), Piatkowski (June, 2001). Tab. 3 depicts the investment in largest LBO funds in 1997 (in USD billion) in Piatkowski (June, 2001)).* Tab. 4 demonstrates the *LBO financing sources and its structure in American market* in *Gaughan (1996), Piatkowski (June, 2001).* Fig. 10 presents some information on the *cost of LBO financing* in *Piatkowski (June, 2001).*

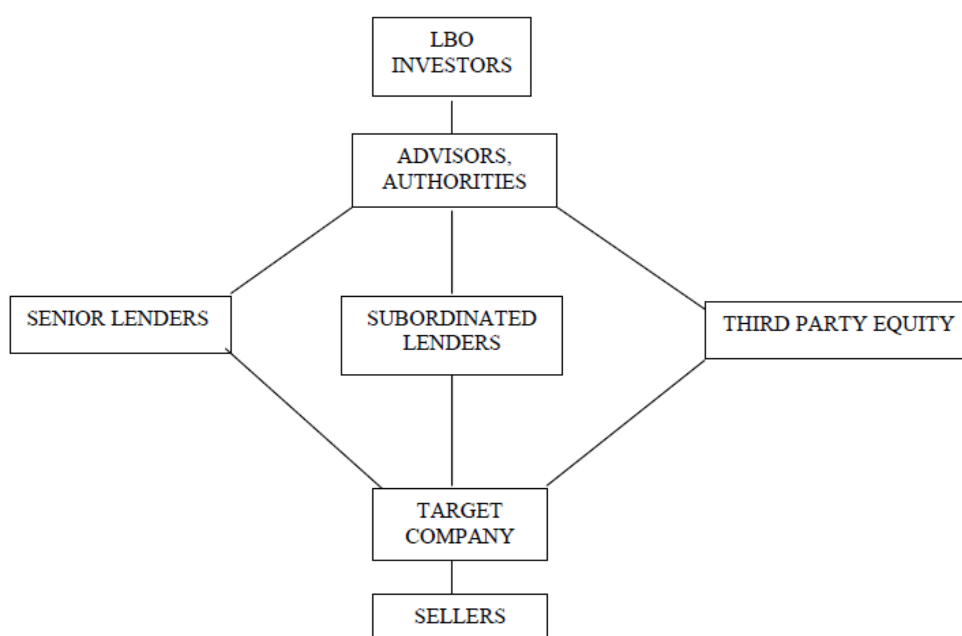

Fig. 9. *LBO market players (after Michel, Schaked (1988), Piatkowski (June, 2001)).*

LBO Fund	Investment received
Kohlberg, Kravis, Roberts & Co. (KKR)	5.8
Blackstone Group	3.8
Forstmann Little	3.2
Thomas H. Lee Company	3.5
Hicks, Muse, Tate and Furst	3.5
Texas Pacific Group	2.5
Total	**22.3**

Tab. 3. *Investment in largest LBO funds in 1997 (in USD billion) (after Piatkowski (June, 2001)).*

Type of financing	Per cent in total financing	Source
Secured debt	5-20%	Commercial banks
Subordinated debt (long-term debt, junk bonds, convertible bonds)	40-80%	Commercial banks, insurance companies, pension funds, investment banks
Third-party equity	10-20%	insurance companies, investment banks, venture capital funds, LBO funds
Own equity	1-20%	LBO investors

Tab. 4. *LBO financing sources and its structure in American market (after Gaughan (1996), Piatkowski (June, 2001)).*

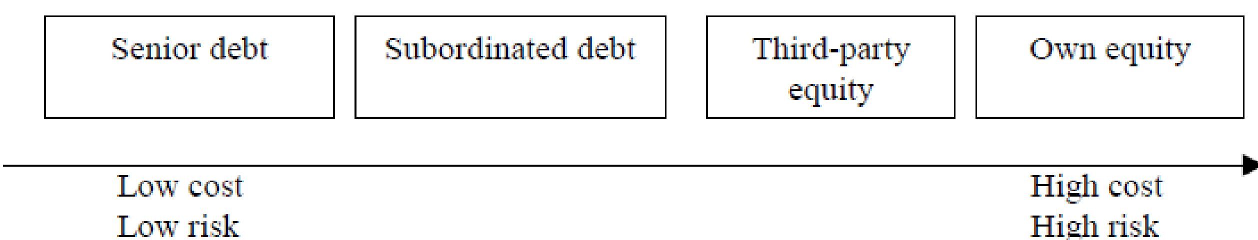

Fig. 10. *Cost of LBO financing (after Piatkowski (June, 2001)).*

Let us emphasis that the ***main strategic purpose of an LBO transaction is to increase the company value*** *through the following financial engineering processes*:

1. Buying low and selling high (*value arbitrage* or *multiple expansion*).

2. Structuring an improved combination of equity and debt (*restructuring the balance sheet* or *re-capitalizing to add value*).

3. Improving operations to increase cash flow (*restructuring the income statement*).

Let us highlight the interesting facts ***about the LBO transactions***, namely that the following business goals may be achieved due to the *leveraged buyout transaction implementation*:

1. *The* **business strategic objectives changes** *with concentration of long term investments in the R&D* in *Hall (1990)*, *Lichtenberg, Siegel (1990)*, *Smith (1990)*, *Opler (1992)*, *Zahra (1995)*, *Wright, Thompson, Robbie (1992)*, *Long, Ravenscraft (1993)*, *Lerner, Sorensen, Strömberg (2008)*, *Ughetto (2010).*

2. *The* ***significant business operation improvements*** in *Lichtenberg, Siegel (1990), Lichtenberg, Siegel (1990), Davis, Haltiwanger, Jarmin, Lerner, Miranda (2009), Amess (2002), Amess (2003), Harris, Siegel, Wright (2005), Tåg (2010).*

3. *The* ***employees compensation increase/decrease*** in *Kaplan (1989), Muscarella, Vetsuypens (1990), Lichtenberg and Siegel (1990), Opler (1992), Wright, Thompson, Robbie (1992), Amess, Brown, Thompson (2007), Amess, Wright (2007), Amess, Girma, Wright (2008), Bergström, Grubb, Jonsson (2007), Cressy, Munari, Malipiero (2007), Davis, Haltiwanger, Jarmin, Lerner, Miranda (2008, 2009), Weir, Jones, Wright (2008), Boucly, Sraer, Thesmar (2009), Bernstein, Lerner, Sørensen, Strömberg (2010), Tåg (2010)*

The ***LBO*** has the following positive characteristics:

1. *A* ***buyout reduces the agency problems*** between the *dispersed owners of the company* and the *manager of the company*, by increasing the leverage as a result of an optimization of the *human capital*, *financial capital*, *customer capital*, *business strategy*, *business operational performance* in *Berle and Means (1932)*, *Williamson (1964)*, *Jensen and Meckling (1976*), *Jensen (1986, 1989)*, *Jensen and Murphy (1990)*, *Myers (1977)*, *Holmström (1979)*, *Grossman and Hart (1982)*, *Murphy (1985)*, *Shleifer and Vishny (1986)*, *Opler and Titman (1993), Perotti and Spier (1993)*, *Himmelberg and Petersen (1994)*, *Zwiebel (1996)*, *Lazear (2005), Tåg (2010).*

2. *A* ***buyout introduces the uncertainty*** in the *creation and implementation* of the *business strategies*, *business operation objectives*, *managerial incentives and executive compensation plans*, *contracts with the well established suppliers, contracts with the existing business*

stakeholders in *Shleifer and Summers (1988)*, *Schaefer (1998)*, *Cuny and Talmor (2007)*, *Kaplan and Strömberg (2009)*, *Lopez de Silanes, Phalippou, Gottschalg (2009), Tåg (2010).*

3. *A* ***buyout makes the temporary ownership possible*** as a result the *strategic business objectives* by the *temporary owners* and the *strategic business objectives* by *permanent owners* may differ significantly, for instance, the *decisions on the short or long time investments,* the decisions on the business operation, the supply chain decision, etc in *Hellmann (2007)*, *Norbäck, Persson, Tåg (2010)*, *Tåg (2010).*

4. *A* ***buyout brings in the capital and knowledge***, leading to the *new investments*, *financial stability* and *greatly improved knowledge base creation* by the *involved private equity firms* in *Bloom, Sadun, van Reenen (2009).*

Guo, Hotchkiss, Song (2008) write: "A substantial body of empirical work based on *leveraged buyout transactions* from the *1980s* supports the notion that ***leveraged transactions*** **create** ***value*****;** specifically, those studies have documented either

1. ***gains in value from pre-buyout to a later change in ownership*** *or restructuring*,
2. ***gains in operating performance post-buyout***, or
3. ***the relationship between buyouts premiums and proxies for sources of the value gain***.

The theories proposed to explain these gains include *benefits of tax shields*, *disciplining effects of leverage*, and *better governance* (monitoring by the *financial sponsor*, *concentrated ownership*, etc)."

Guo, Hotchkiss, Song (2008) write on the *cash flow gains*:

1. "***Increased tax shields***. A large increase in *debt* used to finance the *buyout* generates increased *interest tax shields*, particularly if the *debt* remains at high levels following the *transaction*. *Kaplan (1989b)* shows that *tax benefits* are an important source of *wealth gains* for a sample of *76 management buyouts (MBOs)* between *1980* and *1986*, and that these gains are reflected in the premiums paid to *pre-buyout shareholders*.
2. ***Disciplining effect of debt***. Increasing required *debt payments* can also reduce *free cash flow* available to management to potentially dissipate on *value reducing investments* (*Jensen (1986)*). In the context of *buyouts*, the heavier *debt burden* forces management to efficiently run the *firm* to avoid default, and also will force a restructuring of the *firm* before substantial *value* can be lost (*Jensen (1989b), Wruck (1990*), *Andrade and Kaplan (1998)*).
3. ***Increased monitoring reduces agency costs***. *Senior lenders* (*banks*) may be effective monitors, leading managers to focus on performance and value, and reducing wasteful uses of corporate resources. *Financial sponsors of the buyout* (*private equity firms*) may be important to *firm governance*, either through their presence on the board or through their selection of new

management. Recent deals involving some *private equity firms* have been criticized, however, either because the *private equity firm* allegedly channeled *gains* from the *transaction* to their own *investors* through dividends or other payments, or because *lower prices* are paid when companies are acquired by more than one *private equity firm (club deals)*.

4. ***Better management incentives***. *Management ownership* may become more concentrated with the *buyout* if management provides some portion of the *equity financing* (as in an *MBO*). The alignment of incentives of management and shareholders can reduce agency conflicts (*Jensen and Meckling (1976)*). However, high levels of management ownership can lead to *management entrenchment*.

5. ***Other pre-buyout characteristics***. *Gains in operating efficiency* due to post-*buyout actions of management*, as well as monitoring by *lenders* or *buyout specialists*, may be particularly useful for firms with *poorer pre-buyout performance*."

Let us discuss the ***capital structure*** of a typical *LBO,* which consists of the *four types of capital*:

1. ***Bank Debt***, which usually accounts for about *50* per cent. Bank debt consists of a revolving credit facility that can be paid back and drawn down as needed by the company, as well as several tranches or categories of term loans differing in seniority, maturity and cost.

2. ***High-Yield Debt*** at about 10 per cent. High-yield debt is used to increase leverage beyond levels that banks are willing to provide. Companies will make offerings to either the public bond market or the private institutional market (for example, insurance companies and pension plans) of debt with a relatively high interest rate (or large discount to par) reflecting the risks involved in being in a subordinate position to bank debt.

3. ***Mezzanine Debt*** at about *10* per cent. Mezzanine debt is in an even lower position, so buyout funds, hedge funds and other lenders will provide this capital with a high interest rate and require warrants (options to purchase stock) as additional compensation.

4. ***Private Equity***, which represents the remaining *30* per cent. Private equity is the riskiest form of capital. If a company goes bankrupt, debt holders control the bankruptcy process and, in the case of liquidation, have priority in receiving the proceeds from the sale of any assets such as real estate and equipment. Equity investors, being last in line, lose control of the company and usually lose their entire investment. The nature of taking a public company private may impose a higher cost of capital to the ***capital market***. You have huge costs involved, because of the management private equity fees, less transparency, less liquidity in the market.

5. Other forms of debt may also be utilized, such as ***asset-based loans*** and ***securitizations***, ***second-lien loans***, ***equipment leases*** and ***seller financing***, but these are less common.

Burrough and Helyar (1990) mention: "Of the money raised for any *LBO*, about *60* percent, the *secured debt*, comes in the form of *loans* from *commercial banks*. Only about *10* percent comes from the *buyer itself*. For years the remaining *30* percent - the meat in the sandwich – came from a handful of major insurance companies, whose commitments sometimes took months to obtain. Then, in the mid-eighties, *Drexel Burnham* began using ***high-risk "Junk" bonds*** to replace the *insurance company funds*. The firm's bond czar, *Michael Milken*, had proven his ability to raise enormous amounts of these securities on a moment's notice for hostile takeovers. Pumped into buyouts, *Milken's junk bonds* became a high-octane fuel that transformed the *LBO industry* from a *Volkswagen Beetle* into a monstrous drag racer belching smoke and fire. Thanks to junk bonds, *LBO* buyers, once thought too slow to compete in a takeover battle, were able to mount split-second tender offers of their own for the first time. Suddenly *LBOs* became a viable alternative in every takeover situation; because they held out the promise of operating autonomy and vast riches..."

The topic on *junk bonds* is further discussed in *Ridpath (1995)*: "***Junk bonds***, or "*high yield bonds*" as they are sometimes more politely called, can be very profitable. They can also be very dangerous. The name "*high-yield*" comes from the *high –interest coupon* that these *bonds* pay. The name "*junk*" comes from the *high risk* that they represent. They are usually issued by *companies*, burdened with high levels of debt. If everything goes well, then everyone is happy; the investors get theirs high coupon, and the owners of the company make a fortune out of an often *small initial investment*. If everything does not go well, then the company is unable to earn enough *cash* to meet its *interest bills* and goes *bankrupt*, leaving its *junk-bondholders* and its *owners* with paper fit only for the dustbin. The secret is to pick those companies that will survive..."

The following topics of interest toward the *leveraged buyout transactions management* must be considered in details in *Lexpert (2006)*:

1. What are *financial implications of transaction*?
2. Is it *dilutive* or *accretive* for earnings?
3. How will *pooling* vs. *purchase accounting* affect the *company's financial ratios*?
4. What are *the short term* and *long term implications* for the *stock price*?
5. What are the *risks involved*?
6. Are they best managed with *cash or equity swaps*?
7. How will *Security and Exchange Commission* react to the *bid*?
8. How does a *company* get around a *target's shareholder right plan*?
9. Are there *competition concerns* that might force a *restructuring of the offer*?

The LBOs are sometimes criticized and perceived negatively, because of the following reasons:

1. The *reducing R&D and capital expenditures*,

2. The *extending accounts payable*,

3. The *lowering accounts receivable, selling real estate and other assets*,

4. The *modifying compensation to reduce base salaries and increase performance bonuses*,

5. The *restructuring health and retirement benefits*.

Let us demonstrate the *buyout transactions statistics* in *Europe*, considering the *Germany* and the *UK buyout markets* as possible examples in *Schäfer, Fisher (2008)*: *"Buy-outs* by *financial investors* have become the most important segment of the *private equity sector* in *Germany* in recent years. Two drivers are assumed for these trends, with respect to *supply* and *demand*: On the one hand, *efficiency advantages result from the restructuring of affected companies*, on the other hand, *demand for innovative financial instruments* can be assumed. Both aspects have a *positive effect* on the "coming together" of company buyers and sellers. These statements are compatible with the majority of the findings of relevant empirical economic research. Without *bank loans* and *liquid bond markets*, *buy-outs* are not conceivable. The current *liquidity crisis in the banking sector* and the *quasi collapse of the market for credit sales* therefore also leave traces in the *private equity sector* and tend to have a *restrictive effect*. Clear legal regulations that do not impair the *market* are all the more important."

Tab. 5 provides some information on the buy-outs / buy-ins in *Germany*, according to origin, in *Schäfer, Fisher (2008)*.

Table

Buy-Outs/Buy-Ins in Germany, according to origin

Sale by ...	2002	2003	2004	2005	2006
Number					
Family-owned or private company	19	9	14	27	38
Foreign parent company	18	16	17	24	17
Domestic parent company	47	42	49	48	53
Privatization	0	0	0	0	1
Reorganization/insolvency	15	12	5	5	3
Buy-out fund1	2	14	18	12	31
Others	1	3	1	3	1
Unknown	6	9	7	5	11
Total	**108**	**105**	**111**	**124**	**155**
Shares in percent					
Family-owned or private companies	17.6	8.6	12.6	21.8	24.5
Foreign parent company	16.7	15.2	15.3	19.4	11.0
Domestic parent company	43.5	40.0	44.1	38.7	34.2
Privatization	0.0	0.0	0.0	0.0	0.6
Reorganization/insolvency	13.9	11.4	4.5	4.0	1.9
Buy-out fund1	1.9	13.3	16.2	9.7	20.0
Others	0.9	2.9	0.9	2.4	0.6
Unknown	5.6	8.6	6.3	4.0	7.1

1 Onward sale of a previous buy-out to a buy-out fund

Quellen: CMBOR/Barclays Private Equity/Deloitte. **DIW** Berlin 2008

Tab. 5. *Buy-outs / buy-ins in Germany, according to origin (after Schäfer, Fisher (2008)).*

Fig. 11 shows the *average equity capital ratio* of mainly *debt-capital-financed corporate acquisitions* in *Axelson, Jenkinson, Strömberg, Weisbach (2007, 2008), Schäfer, Fisher (2008)*. Fig. 12 illustrates the *market capitalization* in *selected countries* in *Schäfer, Fisher (2008)*. Fig. 13 displays the *funds* raised for *buy-out funds* in *Germany* and in *Great Britain* in *Schäfer, Fisher (2008)*. Fig. 14 depicts the *invested funds* from *buy-out funds* in *Germany* and *Great Britain* in *Schäfer, Fisher (2008)*.

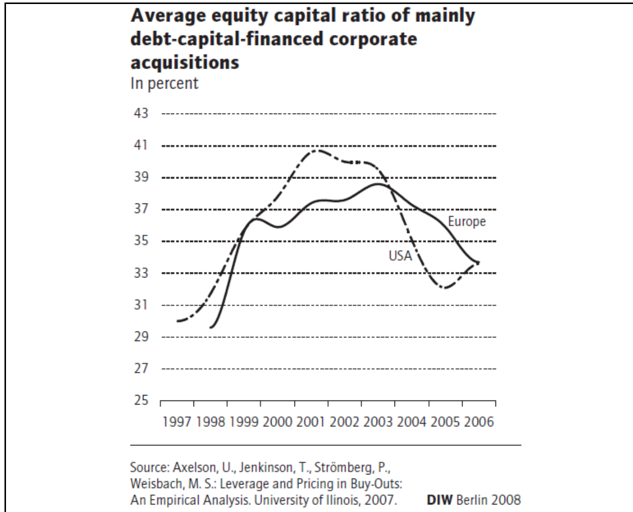

Fig. 11. *Average equity capital ratio of mainly debt-capital-financed corporate acquisitions (after Axelson, Jenkinson, Strömberg, Weisbach (2007, 2008), Schäfer, Fisher (2008)).*

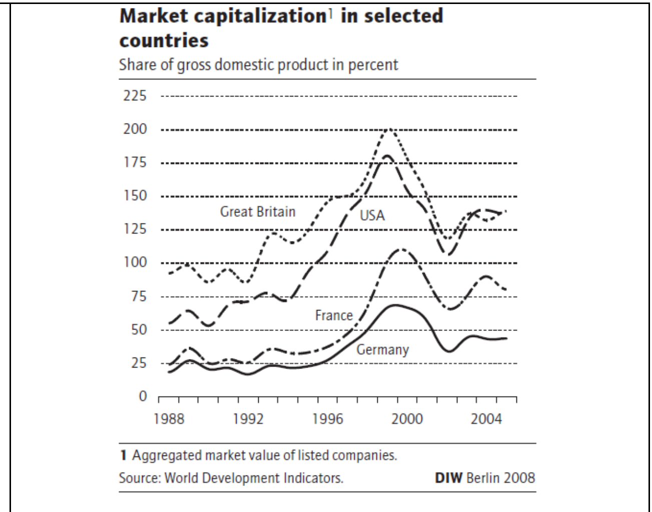

Fig. 12. *Market capitalization in selected countries (after Schäfer, Fisher (2008)).*

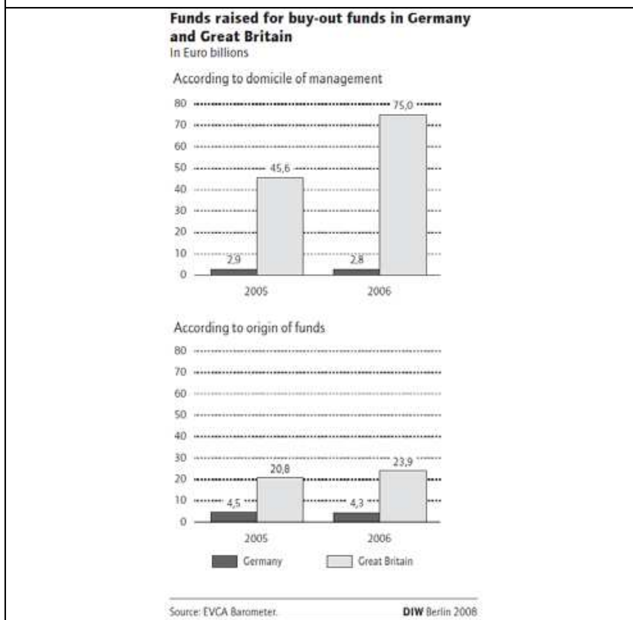

Fig. 13. *Funds raised for buy-out funds in Germany and in Great Britain (after Schäfer, Fisher (2008)).*

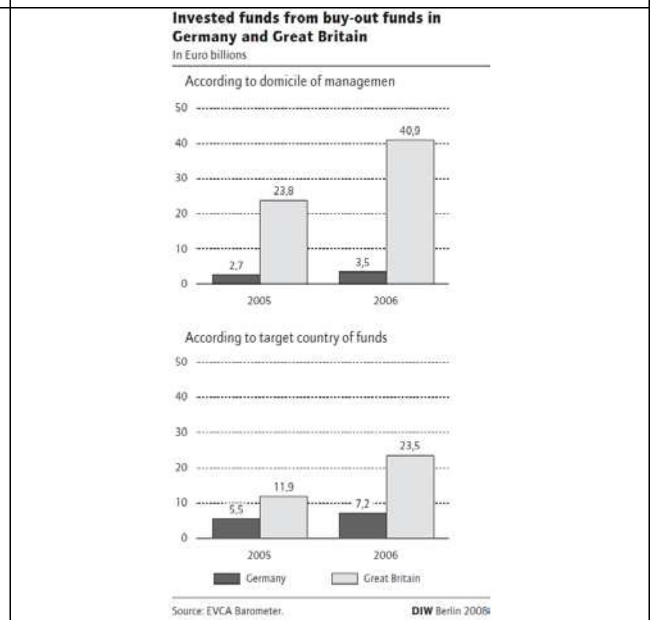

Fig. 14. *Invested funds from buy-out funds in Germany and Great Britain (after Schäfer, Fisher (2008)).*

Fig. 15 presents the *number* and *total value of companies* acquired in *Germany* by *buy-out funds* in *Schäfer, Fisher (2008).*

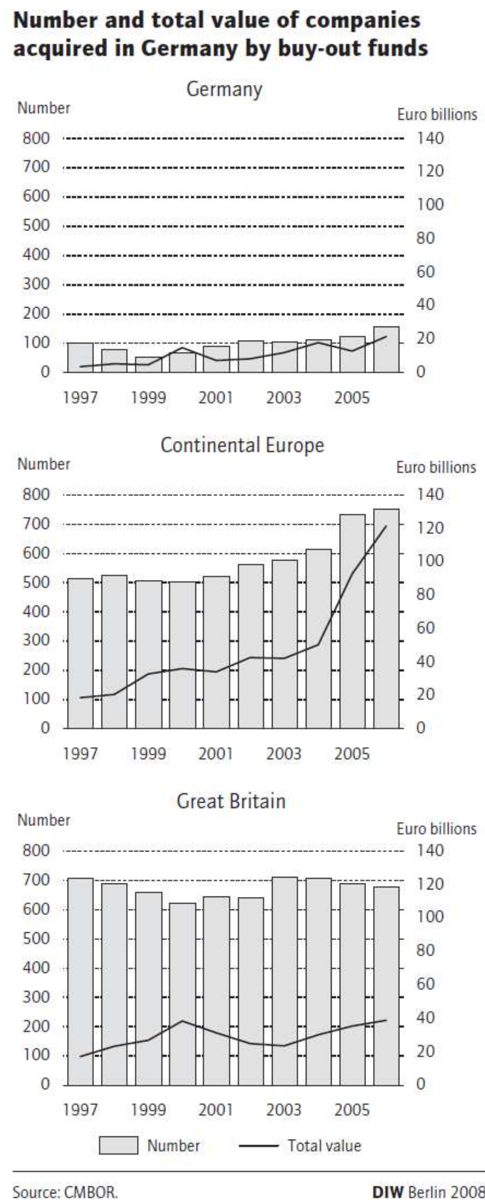

Fig. 15. *Number and total value of companies acquired in Germany by buy-out funds (after Schäfer, Fisher (2008)).*

Allen (2012) states: "The evidence presented suggests that ***venture capital and LBOs do contribute to economic efficiency*** in a number of ways. *Venture capital* has helped many prominent firms do well and there is evidence that it increases *innovation*. Similarly, *LBOs* seem to also improve *economic efficiency* in a number of dimensions." *Allen (2012) write:* "The conclusion is that *venture capital* and *LBOs* have contributed significantly to *economic progress*. These are therefore important *innovations* and have allowed higher growth and improved welfare."

In the *business administration science*, a considerable attention is paid to develop the methodologies for an *accurate characterization* of ***various risks***, which are associated with the *private equity investments*, including the *VC and LBO investments*, because as it is described in *Groh, Baule, Gottschalg (2008)*: "*LBOs* play an increasingly important role as a financing alternative in corporate lifecycles and as an asset class for institutional investors." A considerable number of other researchers worked to solve the *risk management problem* for the *LBO investments* in *Peng (2001), Piatkowski (June, 2001), Quigley and Woodward (2003), Ljungqvist and Richardson (2003), Cochrane (2005), Groh and Gottschalg (2007, 2008),* and *Groh, Baule, Gottschalg (2008).*

Piatkowski (June, 2001) write: "*Higher risk of bankruptcy of the leveraged companies* is nonetheless a real concern. According to *Jensen (September, October, 1989b)*, *leveraged companies* are more likely to experience financial difficulties than *non-leveraged companies*. However, only a few *leveraged companies* finally go bust. Thanks to concentrated ownership, companies in financial distress are quickly and successfully restructured; the improvement in financial health and prevention of bankruptcy is achieved at much lower cost than with non-leveraged companies *Jensen (September, October, 1989b)*. Nonetheless, *higher risk of financial distress* is real. There is no free lunch - higher benefits of *LBO* come with higher financial risk."

Groh, Baule, Gottschalg (2008) write: "… *Cochrane (2005)* reports a mean volatility of *86% p.a.* for a sample of *16,638* private equity transactions – calculated via *maximum likelihood estimates* and sample bias correction for unobservable returns but does not differentiate between *VC* and *LBOs*; more importantly, he does not take account of the degrees of leverage deployed in the *LBOs*. *Kaplan and Schoar (2005)* analyze the performance of private equity investments and create a sub sample of *LBOs*. They do not consider idiosyncratic risk, but systematic risk - which they assume to be both equal for every transaction, and equal to the systematic risk of the *S&P 500 Index*. Their approach also implies, therefore, that leverage in public and private markets is identical on average. *Quigley and Woodward (2003)* create a *VC index* similar to that of *Peng (2001)*, and report a mean annual standard deviation of returns of *14.6%*, while *Peng (2001)* reports annual standard deviations of returns between *9.5%* and *70.3%* for the period from *1987* to *1999*. Both papers focus on correcting missing values and selection bias and fail to either create a *LBO* sub-sample or to consider individual *LBO* capital structures in their approach. *Ljungqvist and Richardson (2003)* distinguish between *VC* and *LBO* market segments and analyze *LBO* performance while controlling for *systematic risk*. However, because they do not have access to exact data for individual deals, they assume industry averages for the *debt/equity ratios* in their calculations of *LBO beta factors*. These *authors* report an *average beta factor of*

1.08 for their *LBO* sample. *Groh and Gottschalg (2008)* investigate *LBO* performance and focus on systematic risk for transactions using detailed information on *debt/equity ratios*. For several scenarios based on differentiated assumptions about the risk of debt and of debt tax shields, they calculate *average equity beta factors (for each scenario) ranging from 0.78 to 2.57* at transaction closing. However, it is not clear which of their scenarios is the "right" one. Furthermore, their focus on *systematic risk* does not enable to calculate rewards for variability."

Lang, Cremers, Hentze (February, 2010) researched the *risk factors*, associated with the *leveraged buyout (LBO) transactions* and demonstrated a *new rating method* based on a *logistic regression* to predict the defaulting and non-defaulting *LBO transactions*.

Therefore, the *main scientific problem,* faced by the *investors,* can be described as: What are the *winning virtuous strategies* for the *LBOs implementation* during the *private equity investment* in the conditions of the *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities*?

Resonant absorption of discrete information in diffusion - type financial system with induced nonlinearities and its influence on investor's ability to create winning virtuous strategies toward leveraged buyout transactions implementation during private equity investment process

Let us begin our research by presenting the important research results on the selected scientific subjects in the following order:

1. The *technologies overview for the information transmission in the information communication technologies (ICT) science*.

2. The discussion on the *definition of the phenomena of* **resonance** *in the science of physics*.

3. The discussion on the *research results on the* **resonant absorption** *of electromagnetic signals in the science of condensed matter physics*.

4. The discussion on the *research findings on the* **resonant absorption** *of radioactive chemical elements and their isotopes in the science of nuclear physics*.

5. The discussion on the *obtained research results by other authors on the* ***information absorption*** *in the econophysics* and in *the finances*.

6. The discussion on the *existing* ***risk factors*** *during the private equity investments in conditions of the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities.*

7. The formulation of the ***Ledenyov theory on the winning virtuous strategy creation toward the leveraged buyout transactions implementation during the private equity investments in conditions of the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities.***

8. The discussion on the *understanding of the existing differences between the* **influences on the investors by the symmetric/asymmetric information transmission phenomena** *from one side*, and the ***impacts on the investors by the changing levels of the information absorption capacity*** *from other side*.

In the ***science of information communication technologies***, it is a well known fact that the *information* can be transmitted in the *information communication channels* over the *certain frequency bands*, using the different ***modulation, coding, error correction, access, multiplexing techniques*** in *Ledenyov D O, Ledenyov V O (2014)*:

1. The ***information modulation techniques***, for example: The *low order modulation techniques* such as the ***Pulse Code*** modulation in the ***Ultra Wide Band (UWB)*** communications or the *high order modulation techniques* such as the ***256 Qudrature Phase Shift Keying*** modulation in the ***Narrow Band*** (***NB***) communications.

2. The ***information coding techniques***, for example: ***The Walsh coding*** in the ***spread spectrum communications.***

3. The ***information error correction techniques***, for example: The ***forward error correction*** techniques in the ***spread spectrum communications***.

4. The ***information access techniques*** *(the transmission bandwidth allocation and utilization techniques)*, for example: The ***Wide band Code Division Multiple Access (WCDMA)*** technique; or the ***Frequency Hoping*** technique (***GSM***); or *Orthogonal Frequency Division Multiplexing (OFDM)* in the *wireless communications and* the *optical communications (all optical WCDMA network).*

5. The ***information multiplexing techniques*** *(over the selected optical bandwidth)*, for example: The ***Synchronous Optical Network (SONET)*** or the ***Asynchronous Transfer Mode (ATM)*** in the *optical communications*, where the information multiplexing or de-multiplexing can be done with the application of the *in-fiber Bragg gratings and other optical devices*.

In the ***information communication theory*** in *Ledenyov D O, Ledenyov V O (2014),* it was shown that the *physical* or *virtual information communication channels* can be ***symmetric*** or ***asymmetric***. For example, the ***asymmetric physical information communication channels*** can have *different bandwidths* in the *frequency (wavelength) domain*, hence the *different data streams* over the *same time period* can be transmitted with the application of *same modulation*

techniques. The ***asymmetric virtual information communication channels*** can have the *same bandwidths* in the *frequency domain or other physical domains*, however the *different data streams* over the *same time period* can be transmitted, because of *various modulation techniques application*. The use of the *different bandwidths* or the *modulation techniques* at the *uplink* and *downlink* in the *satellite wireless communications* or the *wireline communications* ***(Asymmetric Digital Subscriber Line (ADSL))*** results in an appearance of the ***asymmetric information communication channels with the asymmetric data streams***.

In the ***science of physics*** the ***phenomena of resonance*** is defined as in *Morris (1913, 1982, 1985)*, *Ledenyov D O, Ledenyov V O (2014)*:

a) The *enhancement of the response of an electric or mechanical system to a periodic driving force*, when the driving frequency is equal to the natural undamped frequency of the system.

b) The *condition of a system of subatomic particles in which the probability of a particular reaction, as for nuclear capture of a neutron, is a maximum*.

c) The *event corresponding to such a maximum*, esp. the formation of a particle state, having only a few possible modes of decay and characterized by a lifetime considerably longer than neighbouring states.

In the ***science of condensed matter physics***, the research on the accurate characterization of ***the condensed matter*** by the measurements of ***the absorbed electromagnetic signals in the sub-surface layers in the condensed matter (the high temperature superconducting ceramics and dielectrics) at the resonance in the range of the ultra high frequencies*** has been conducted in *Ledenyov D O, Mazierska, Allen, Jacob (2012), Leong, Mazierska, Jacob, Ledenyov D O, Batt (2012), Mazierska, Ledenyov D O, Jacob, Krupka (2012), Jacob, Mazierska, Ledenyov D O, Krupka (2012), Mazierska, Krupka, Jacob, Ledenyov D O (2012), Jacob, Mazierska, Leong, Ledenyov D O, Krupka (2012), Jacob, Mazierska, Krupka, Ledenyov D O, Takeuchi (2012), Mazierska, Jacob, Ledenyov D O, Krupka (2012), Ledenyov D O (2013), Ledenyov D O, Ledenyov V O (2014), Mazierska, Leong, Ledenyov, Rains, Zuchowski, Krupka (2014).*

In the ***science of nuclear physics***, the research on the *resonant structure of absorbed radioactive chemical elements and their isotopes distribution in the iodine air filters with the coal granules of different geometric shapes and the coal dust particles of micro- and nano- sizes at the nuclear power plants by the gamma activation analysis method* has been completed in *Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2014), Ledenyov O P, Neklyudov (2013), Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2013), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2013a, 2013b), Neklyudov, Fedorova, Poltinin, Ledenyov O P (2013),*

Ledenyov O P, Neklyudov, Poltinin, Fedorova (2012a, 2012b), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2012). The ***resonant structure of absorbed radioactive chemical elements and their isotopes distribution*** *in the iodine air filters with the coal granules of different geometric shapes and coal dust particles of micro- and nano- sizes* was observed in *Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2014), Ledenyov O P, Neklyudov (2013), Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2013), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2013a, 2013b), Neklyudov, Fedorova, Poltinin, Ledenyov O P (2013), Ledenyov O P, Neklyudov, Poltinin, Fedorova (2012a, 2012b), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2012).* The ***phenomenon of resonant - type absorption of radioactive chemical elements and their isotopes*** *in the iodine air filters with the coal granules of different geometric shapes and the coal dust particles of micro- and nano- sizes* was discovered in *Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2014), Ledenyov O P, Neklyudov (2013), Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2013), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2013a, 2013b), Neklyudov, Fedorova, Poltinin, Ledenyov O P (2013), Ledenyov O P, Neklyudov, Poltinin, Fedorova (2012a, 2012b), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2012).*

In addition, the ***absorption phenomena*** in the *condensed matter* and *soft condensed matter physics* and *chemistry* has been researched by the *authors* in following publications:

1. The ***absorption of the different radioactive chemical elements and their isotopes in the soft condensed matter (the coal granules of different geometric shapes, the coal dust particles of micro- and nano- sizes) at the sound frequencies*** have been researched in the *nuclear physics* in *Ledenyov O P, Neklyudov (2013), Neklyudov, Dovbnya, Dikiy, Ledenyov O P, Lyashko (2013), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2013a, b), Neklyudov, Fedorova, Poltinin, Ledenyov O P (2013), Ledenyov O P, Neklyudov, Poltinin, Fedorova (2012a, b), Neklyudov, Ledenyov O P, Fedorova, Poltinin (2012), etc*.

2. The ***absorption of the electromagnetic signals in the condensed matter (the high pure metals and superconductors) at the ultrasonic frequencies*** has been investigated in the *solid state physics* at the in *Ledenyov O P (2012a, b, c), Ledenyov V O, Ledenyov D O, Ledenyov O P, Tikhonovsky (2012), Ledenyov O P, Fursa V P (2012), Shepelev, Ledenyov O P, Filimonov (2012a, b, c, d, e), etc*.

3. The ***absorption of the electromagnetic signals in the sub-surface layers in the condensed matter (the high temperature superconducting ceramics and dielectrics) at the ultra high frequencies*** has been studied in the *solid state physics* in *Ledenyov D O, Mazierska, Allen, Jacob (2012), Leong, Mazierska, Jacob, Ledenyov D O, Batt (2012), Mazierska, Ledenyov D O, Jacob, Krupka (2012), Jacob, Mazierska, Ledenyov D O, Krupka (2012), Mazierska, Krupka,*

Jacob, Ledenyov D O (2012), Jacob, Mazierska, Leong, Ledenyov D O, Krupka (2012), Jacob, Mazierska, Krupka, Ledenyov D O, Takeuchi (2012), Mazierska, Jacob, Ledenyov D O, Krupka (2012), Ledenyov D O (2013), Ledenyov D O, Ledenyov V O (2014), Mazierska, Leong, Ledenyov, Rains, Zuchowski, Krupka (2014), etc.

In the ***sciences of economics and finances,*** it is a well known fact that an access to the *information* by the *market agents* can be ***symmetric*** or ***asymmetric***, depending on the *information volumes* or the *information quality.* The possible presence of the ***asymmetric information phenomena*** and its influence on the various processes in the *economics* (the *automobiles market*) has been explained for the first time in *Akerlof (1970, 2014).* The early research on the *informational asymmetries*, *financial structure* and *financial intermediation* has been also conducted in *Leland, Pyle (1977).* Researching the *corporate financing problems,* it was confirmed that there is an *information asymmetry* between the *firm's management* and the *capital investors* in *Myers (1984), Myers, Majluf (1984).* Considering the structure of *corporate ownership*, *Demsetz and Lehn (1985)* proposed that the *asymmetric information* results in a *change of corporate ownership structure* toward the *concentration of the corporate ownership* in the hands of better informed managers. *Long, Ravenscraft (1993)* explain that there is a *problem of asymmetric information* in the *firms:* "*Myers (1984)* focuses on the *asymmetric information between the firm's management and external funding agencies. Insiders* have superior information about *R&D projects* that is difficult to reveal to the *capital markets*. For example, revealing this *confidential information* can provide an important signal to competitors (*Bhattacharya and Ritter, 1983*). Even announcing that an *R&D project* is being undertaken may provide the competition with *valuable information*. This *asymmetric information* creates a pecking order where *internal funds* are preferred to *external sources of capital*." In the case of leveraged buyouts, there are various information asymmetries, which have been researched by scientists. *Opler, Titman (1991)* write: "Another influence on *leveraged buyout activity* may be the extent of *informational asymmetry* between *managers* and *shareholders*. There are two reasons why *informational asymmetry* may induce a firm to go private:

(i) *informational asymmetry increases the chances that a firm is undervalued, creating opportunities for individuals with superior information (such as management) to gain from going private*;

(ii) *informational asymmetry gives managers more latitude to implement their own agendas without sanction from public shareholders and thus increases gains from high ownership concentration*.

The second reason is related to work by *Demsetz and Lehn (1985)* who argue that *share ownership* is likely to be more concentrated when there is more *asymmetric information* because of *larger gains from monitoring*. They argue that *unsystematic risk* is related to the *uncertainty of the firm's operating environment* and thus proxies for the *degree of asymmetric information*."

Most recently, *Schäfer, Fisher (October 16, 2008)* stated: "*Asymmetric information between entrepreneurs and capital investors and behavior risks limit the financing opportunities for companies.* This can result in rationing by lenders—or as regards listing in an illiquid stock market segment—by the capital market. Companies that are owned privately and by families are regarded as being particularly in-transparent for a potential lender or shareholder and therefore tend to be limited in terms of financing. *Buy-out funds* can alleviate this. *Off-market equity capital* is suitable for strengthening the companies' assets."

The *LBO transactions* completion problem in the *conditions of asymmetric information* has been investigated in *Opler, Titman (1991), Kaplan, Strömberg (2008; Winter, 2009), Schäfer, Fisher (October 16, 2008), Yousfi (2012).*

In the ***science of econophysics***, the *authors* studied a role of the ***absorptive capacity*** in the *learning and innovation processes* in *Cohen, Levinthal (1990), Farina (2008), Hussinger (2010, 2012). Farina (2008) write on the knowledge and information absorptive capacity* by the firm: "According to *Cohen and Levinthal's (1990)* "*absorptive capacity*" concept, firms' ability to get knowledge and information from their external environment is a function of the firms' specialization choices and experiences. In particular, firms operating in many market segments are likely to possess more internal capabilities than firms operating in few market segments since, as the volume and complexity of information in the environment increase, the organization needs to have correspondingly high levels of information processing capacity (*Miller and Chen (1994); Hambrick, (1982); Khandwalla (1973)*)." *Farina (2008)* continues to explain: "In fact firms' ability to use network ties for accessing information about opportunities and choices otherwise not available is depending on internal resource endowments and in particular on "*absorptive capacity*".

In the ***science of business administration***, the *authors* analyzed the important scientific findings in the ***research on the strategy creation problems*** in *Porter (1979, 1980, 1982a, b, 1983, 1985, 1987a, b, 1991, 1994a, b, 1996a, b, 1997, 2001a, b, 2008, 2013), Porter, Harrigan (1981), Porter, Salter (1982), Montgomery, Porter (1991), Porter, Rivkin (2000), Porter, Sakakibara (2004), Anand, Bradley, Ghemawat, Khanna, Montgomery, Porter, Rivkin, Rukstad, Wells, Yoffie (2005), Porter, Kramer (2006), Grant (2001), Besanko, Shanley, Dranove (2007), Gavetti, Rivkin (2007), Teece, Winter (2007), Martin (1998-1999b, 2005-2006b)* with the

purpose to formulate the ***Ledenyov theory*** *on the winning virtuous strategy creation toward the LBO transactions implementation during the private equity investments at the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities.*

The *Ledenyov theory* postulates that the *lucky investors* with the *highest information absorption capacity, who experience the phenomenon of resonant - type absorption of information,* are able to create the *winning virtuous strategies through the decision making process on the available choices* toward the *leveraged buyout transactions implementation* in the *diffusion - type financial system* with the *induced nonlinearities*, applying the *econophysical econometrical analysis techniques* in *Schumpeter (1906, 1933), Bowley (1924)*, *Box, Jenkins (1970)*, *Grangel, Newbold (1977)*, *Van Horne (1984)*, *Taylor S (1986), Tong (1986, 1990)*, *Judge, Hill, Griffiths, Lee, Lutkepol (1988)*, *Hardle (1990)*, *Grangel, Teräsvirta (1993)*, *Pesaran, Potter (1993)*, *Banerjee, Dolado, Galbraith, Hendry (1993)*, *Hamilton (1994)*, *Karatzas, Shreve (1995)*, *Campbell, Lo, MacKinlay (1997)*, *Rogers, Talay (1997)*, *Hayashi (2000)*, *Durbin, Koopman (2000, 2002, 2012), Ilinski (2001), Greene (2003)*, *Koop (2003)*, *Davidson, MacKinnon (2004), Campbell, Lo, MacKinlay (1996)* and using the *creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking process* with the use of the *inductive, deductive and abductive logics* in *Martin (1998-1999, 2005-2006)* in the frames of the *strategic choice structuring process,* that is the *winning through the distinctive choices process* in *Martin (1998-1999a, 2005-2006a, 2004, 2009), Moldoveanu, Martin (2001), Lafley, Martin (2013),* aiming both to get an *increased return premium* and to make a *positive social impact in the local community and society* in the frames of the *socially responsible investment (SRI) process* that integrates *social, environmental,* and *ethical considerations* into *investment decision making* in *Waddock, Graves, (1994), Arora, Gangopadhyay (1995), Sparkes (1998, 2004, 2008), Johnson, Greening (1999), Lyndenburg (2002), Cox, Brammer, Millington (2004), Kotler, Lee (2005), Louche, Lydenberg (2006), McWilliams, Siegel, Wright (2006), Scholtens (2006), Cespa, Cestone (2007), Cumming, Johan (2007), Williams (2007), Hull, Rothenberg (2008), Reinhardt, Stavins, Vietor (2008), Renneboog, Horst, Zhang (2008), Arjalies (2010), Crifo, Mottis (2010), Morrell, Clark (2010), Baron, Harjoto, Jo (2011), Crifo, Forget (February, 2012).*

In other words, the *absorbed information* by the *investors*, who experience the ***phenomenon of resonant absorption of information***, creates a ***knowledge base***, which is necessary for the successful creation and execution of the *winning virtuous strategies* toward the *leveraged buyout transactions implementation* during the *private equity investments* at the

resonant absorption of discrete information in the *diffusion - type financial system* with the *induced nonlinearities*. It follows from the **Ledenyov theory** that the ***level of information absorption by the investor (the deal maker) in the free market economy is predefined by the information absorption capacity, which may depend on the investor's education degree, professional skills and competence, professional experience, access to the consulting advices, access to the computing power, presence of simulation software and some other factors.***

In general, the *authors* think that the ***information modulation techniques, information coding techniques***, ***information error correction techniques***, ***information access techniques, information multiplexing techniques*** can lead to the *information asymmetries* appearance and have multiple possible impacts on the various *economic variables* in the *economics and finances*, which have to be researched in details. However, let us distinguish the impacts by both:

1. The ***asymmetric information*** *(the asymmetric information communication channels, asymmetric information data streams)* by the *market agents,* and
2. The influences by the ***asymmetric information absorption*** (the *different levels of information absorption*) by the *market agents*.

For instance, in accordance with the *Ledenyov theory on the information absorption in the economics and finances,* we can assume that the *different investment strategies* (the *successful or failed investment strategies)* can be created to implement the *LBO transactions* in the case, when there are the ***symmetric information communication channels*** for all the *investors* (the *market agents*), because there may be the *different levels of information absorption (the different information absorptive capacity)* by the *investors*. This result is not trivial and it is in a contradiction with the *existing understanding* that the ***asymmetric information is*** mainly responsible for the creation of the *different investment strategies* (the *successful or failed investment strategies)* by the *investors* (the *market agents*) to implement the *LBO transactions*.

In the case of the *LBO transactions*, going from the *existing understanding*, all the *investors* have to create the *same investment strategies* to implement the *LBO transactions* in the ideal case of the ***symmetric information communication channels***; however, as it is shown in the ***Ledenyov theory on the information absorption in the economics and finances***, there may be the ***phenomena of asymmetric information absorption*** by the *investors*, which results in the *various investment strategies creation* by the *investors* in the real life conditions.

The *authors* think that the next avenue for our prospective research will be an understanding of the scientific problem: 1) How can the *different levels* of *information absorption* by the *investor* impact the *winning virtuous strategy creation ability* during the *PE investment process* by the *investor*?; 2) What is an *optimal level of information absorption* by the

investor, which can allow the *winning virtuous strategy creation* during the *PE investment process* by the *investor*?

Conclusion

The *authors* performed an original research on the fundamentals of *winning virtuous strategies creation* toward the *leveraged buyout transactions implementation* during the *private equity investment* in the conditions of the *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities* in particular, and at the influences by the *Schumpeterian creative disruption processes* in the *free market economy* in general. Going from the *academic literature*, we made a comprehensive review on the various aspects of *modern financial engineering approaches* to make the *private equity investments* and to design the *leveraged buyout* and *venture capital firms, funds and transactions* in the *finances*. We highlighted a *private equity's important role* in the *Schumpeterian creative destruction processes* in the *free market economy*, discussing the *leverage buyout transactions process* and the *accurate characterization of the leverage buyout transactions properties* at the resonant absorption of discrete information in the diffusion - type financial system with the induced nonlinearities. We formulated the *Ledenyov theory* on the *winning virtuous strategies creation* toward the *leveraged buyout transactions implementation* during the *private equity investment* in conditions of the *resonant absorption of discrete information* in the *diffusion - type financial system* with the *induced nonlinearities*.

Acknowledgement

The *science of econophysics*, which considers the *physics of finance and economics*, is becoming very popular among the *financiers* in *Weatherall (2013).* In this *introductory condensed research article,* the *authors* attempted to apply the *theoretical econometrical* and *econophysical principles* from the *academic literature* to research and better understand the *complex private equity issues* with a particular attention to the *venture capital funds* and *leveraged buyout funds.* In our opinion, the *presented research findings* may be of some use for the *young scientists, professors in the finances and economics, subject experts, financial analytics, experienced financiers,* and *business leaders*, who have a desire to learn more on the *fundamentals of leveraged buyout transactions* in conditions of the *continuous and discrete information absorption processes* in the *diffusion – type financial systems* with the *induced*

nonlinearities. It makes sense to say that the *research article* is written on the basis of *lecture notes*, which have been prepared for and presented at the *courses of our invited lectures* on the *fundamentals of leveraged buyout transactions* under the *influences* by the *continuous and discrete information absorption processes* in the *diffusion – type financial systems* with the *induced nonlinearities* at the leading universities around the *World* over the recent decades. We also decided to include some our thoughts, expressed during the subsequent *Q&A* sessions after the presented lectures and kindly recorded by our students.

The *first author's* knowledge on the *origins of the nonlinearities* in the *complex systems* in the *electrical, electronic, computer and financial engineering* has been obtained during the intensive innovative scientific collaboration with *Prof. Janina E. Mazierska, Personal Chair, Electrical and Computer Engineering Department, James Cook University, Townsville, Australia* and *former Dean, Electrical and Computer Engineering Department, James Cook University, Townsville, Australia,* and *former IEEE Director Region 10 in Australia,* and *IEEE Fellow*. The first author would like to acknowledge *Prof. Janina E. Mazierska* by expressing his sincere gratitude for the kind scientific advices on how to develop the *logical mathematical analysis skills*, the *scientific problems analytic solving ability* and the *abstract scientific thinking* to tackle the complex scientific problems on *the nonlinearities in the microwave superconductivity* as well as on *the nonlinearities in the finances*, applying the interdisciplinary scientific knowledge together with the advanced computer modeling techniques in the course of the cutting-edge highly innovative research projects at *James Cook University* in *Townsville* in *Queensland* in *Australia* in *2000 – 2014* after the graduation from *V. N. Karazyn Kharkov National University* in *Kharkov* in *Ukraine* in *1994 – 1999*.

There would be appropriate to say that, in an *information age*, the first author's special efforts have been primarily directed towards the *scientific information gathering, systematization* and *detailed analysis* in the frames of this research project on the *fundamentals of leveraged buyout transactions* at an influence by the *continuous and discrete information absorption processes* in the *diffusion – type financial systems* with the *induced nonlinearities*; hence, the *first author* would like to thank the professional stuff at the *central library* at *James Cook University* in *Townsville*, *Queensland, Australia* for providing the *first author* with all the necessary technical support in relation to the literature search on the subjects of his *multidisciplinary research interest* in the electronic research databases at *Australian* universities, replying to the numerous chaotic research requests timely, and making everything possible to assist with the completion of the highly innovative advanced research on the *fundamentals of leveraged buyout transactions* at presence of the *continuous and discrete information absorption*

processes in the *diffusion – type financial systems* with the *induced nonlinearities* at the *James Cook University* in *Townsville, Queensland* in *Australia* in *2000 – 2014*.

The *first author* would like to comment that the *informative scientific discussions* on the *accurate characterization* of the *fundamentals of leveraged buyout transactions* at an impact by the *continuous and discrete information absorption processes* in the *diffusion – type financial systems* with the *induced nonlinearities,* which have been conducted by the *first author* with the *M.Sc. students, Ph.D. candidates, professors, visiting scientists and other faculty members* during the *numerous scientific seminars* and *brain storm research meetings* at *James Cook University* in *Townsville* in *Queensland* in *Australia,* are generously appreciated, because these *valuable scientific opinions exchanges* encouraged the *first author* to generate the new original scientific ideas and make the *creative imperative integrative intelligent conceptual co-lateral adaptive logarithmic thinking* with the application of the *inductive, deductive and abductive logics analysis* as far as the *fundamentals of leveraged buyout transactions* is concerned.

A certain part of an *introductory condensed research article* has been written during the *first author's* yachting with the *Australian friends* in *Melbourne, Victoria, Australia* and in *Brisbane, Queensland, Australia*, when a number of the *creative research ideas* and *important research findings* on the *private equity*, including the *venture capital* and *leveraged buyout firms, funds, transactions,* came to his mind. Most of the ideas have been discussed with the *Australian friends*, when on the yachts. Sometimes, the thoughtful discussions have been further conducted during the "*numerous meetings without the ties*" with the great *Australian philosophers, professors, scientists, businessmen, lawyers, governmental officials and political leaders* in the relaxing trusted mutual-respect atmosphere, characterized by the *pluralism of research opinions* on the topics of interest, during the *Yara valley* and *Mornington-Peninsula limo tours* (*www.yaravalleylimowinetours.com.au*). All these exchanges of opinions fascinated the *first author's mind*, stimulated the *abstract thinking on the presented assumptions*, and inspired to *work consistently* to complete the writing of this highly innovative condensed research article on the fundamentals of the *leveraged buyout transactions* in the case, when the *resonant discrete information absorption processes* are present in the *diffusion – type financial systems* with the *various types of induced nonlinearities*, at *James Cook University* in *Townsville, Brisbane,* and *Gold Coast* in *Queensland* in *Australia* in *2014*.

The *first author* would like to thank cordially all the *European universities rectors*, *universities deans*, *distinguished professors*, *world renowned financiers* and *well respected businessmen* for *many tens of highly creative and productive business meetings* during the *first author's global intellectual journey* over the *European capitals*, including: *Warsaw, Poland*;

Berlin, Germany; Amsterdam, The Netherlands; Brussels, Belgium; Luxemburg, Luxemburg; Paris, France; Barcelona, Madrid, Spain; and *Coimbra, Lisbon, Porto, Portugal* in *October, 2014.* It was nice to meet and discuss all the *problems of mutual research interest* with the *old European Friends,* coming from *Brisbane, Australia*.

The *second author* would like to kindly acknowledge the numerous private communications with the participants of the *V. Ya. Bunyakovsky international conference* with the special focus on the *V. Ya. Bunyakovsky's research contributions* to the *mathematical theory of probability* and its modern applications in the *econophysics* and *econometrics*, which had place during a tour to the *Town of Bar, Vinnytsya Region, State of Ukraine* in the time of the conference, organized by the *Institute of Mathematics of National Academy of Sciences of Ukraine (NASU)*, *Kyiv*, *Ukraine* on *August 20 – 21*, *2004*. Absorbing the brilliant research ideas during a fruitful exchange by the scientific opinions among the conference attendees, the *second author* came up with a remarkable conclusion that the foundations of the *mathematical theory of probability* by *V. Ya. Bunyakovsky* enable us to perform a more accurate scientific analysis and characterization of the complex research problems on the *fundamentals of the leveraged buyout transactions* in the circumstances, when the *resonant discrete information absorption processes* are present in the *diffusion – type financial systems* with the *various types of induced nonlinearities. T*he *first author's* has been worked on the research article, discussing the *points of mutual research interest* with the *second author,* during his regular visits to the *Town of Bar, Vinnytsya Region, State of Ukraine* over the recent years.

It is a real tremendous pleasure to comment that some fundamental issues on the *strategy creation and execution* toward the *leveraged buyout transactions implementation* have been researched by the *second author* during his intensive research assignments at the *Rotman School of Management*, *University of Toronto*, *Canada* in *1998 – 1999* and *2005 – 2006*. The *second author* met with many hundreds of *North American Corporations Presidents, Board of Directors Chairmen, Chief Executive Officers (CEOs), Chief Information Officers (CIOs), Chief Operating Officers (COOs)* and visited the *Research Triangle Park high-tech cluster* near *Durham* in *North Caroline* in the *USA* as well as the *Kanata high-tech cluster* near *Ottawa* in *Ontario;* the *Calgary high-tech cluster* in Calgary in *Alberta*; the *Richmond high-tech cluster* near *Vancouver* in *British Columbia* in the *North America* in *1998 – 2006*, making his innovative research on the *private equity investment*, including the *leverage buyouts* and *venture capital investments*. The obtained information has been researched and analyzed by the *second author* at the *Rotman School of Management*, *University of Toronto*, *Canada*, which was a *global hub of innovative scientific thinking* in the *economics* and *finances* mainly due to the *high level organizational and*

personal efforts by *Prof. Roger L. Martin*, *former Dean*, *Rotman School of Management*, *University of Toronto*, *Canada*, who strongly supported and facilitated the *initiation of innovative research* and the *creation of intensive business education courses* in *Canada* on that time. It is important to underline the fact that the *Rotman School of Management*, *University of Toronto*, *Canada* was a *global financial center of gravity* on that time, where the *highly innovative research work* has been conducted by the *second author* from the early morning hours until the deep night, being occasionally interrupted by the *thoughtful long hours scientific discussions* on a variety of *research problems* in the *finances* with *Profs. John C. Hull* and *Roger L. Martin*, *Rotman School of Management*, *University of Toronto*, *Canada* in *1998 – 1999* and in *2005 - 2006*. It makes sense to note that, in some cases, the *intensive research discussions and consultations* have been continued during *our frequent meetings* at the *Economic Club of Toronto*, *Empire Club of Canada* and *Canadian Club* in *Toronto, Canada* outside the *U of T* in *2005 – 2006*. Using every free minute in our busy research schedules, we discussed all the scientific problems of mutual research interest, aiming to find the possible solutions of challenging research problems in time of globalization.

As always, we are very grateful to *Prof. Michael E. Porter, Bishop William Lawrence University Professor* and *former Dean of Harvard Business School, Harvard University*, who is considered by the authors as a *father of the modern business strategy*, for his *valuable personal efforts and time* to write a number *of interesting informative research articles and books* as well as to create the *lecture notes*, providing us with his professional expertise, exceptional quality professional advices and wise opinions in the *field of competitive strategy in the 21st century*. In fact, *Prof. Michael E. Porter* is regarded by the *authors* as a *"guiding star"* in the *science of strategy.*

Of course, the *important groundbreaking research results* on the *creative disruption and evolutionary economics*, obtained by *Prof. Joseph Alois Schumpeter* at the *University of Vienna* in *Austria* in *1905 – 1908*, *University of Czernowitz* in *Ukraine* in *1909 – 1911*, *University of Graz* in *Austria* in *1912 – 1914*, *University of Bonn* in *Germany* in *1925 – 1932*, *Harvard University* in the *USA* in *1932 – 1950*, had a considerable influence on the *presented research opinions* by the *authors*. As we all know, the *ideas on the creative destruction* have been further researched by *Prof. Clayton M. Christensen, Kim B. Clark University Professor of Business Administration, Harvard Business School, Harvard University* and other notable scientists, hence we absorbed the *modern research approaches and findings* on the *creative destruction* by *Clayton M. Christensen* as well.

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