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# **All Things Considered: The Interaction of the Reasons for the Financial Crisis**

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13 September 2011

Online at <https://mpra.ub.uni-muenchen.de/33408/>  
MPRA Paper No. 33408, posted 15 Sep 2011 14:45 UTC

## 1. Introduction

The analysis of certain evidence taking place in the years prior to the crisis makes apparent the unraveling of the crisis. The financial market presented features which conceived complex securities and derivatives, paired up with sophisticated interrelations that bore systemic risk. These interconnections were on the same page as questions surrounding credit ratings, insufficient regulation and the application of certain types of models on pricing and risk measurement, as well as the assumptions imputed in such valuations. Additionally, macroeconomic conditions aided a favorable stance for the development of the crisis. Large capital inflows to the U.S. propelled partially by surpluses in emerging markets, along with low domestic interest rates, braced with the aim of providing affordable housing to high risk borrowers and the subsequent securitization of high risk loans, completed a design in which market distress became unavoidable.

The signs of the crisis and its beginning point vary based on the approach to its triggers. Some believe that signs of recession and upcoming unfolding events happened in March 2007, when some subprime investors proclaimed severed losses, as it was the case of Accredited Home Lenders and New Century Financial (Eichengreen, 2008).

Other proponents appoint the start when the U.S. trade deficit began to pick up, that is, in 1998 and 1999 (Mann, 1999, in Suominen, 2010). Signs can be found even earlier if it is considered that insufficient regulation turned the financial system into the ideal scenario for a breakdown. In this case the path to the crisis began in the 1970's, when departure from the Glass-Steagall Act was enforced.

Another viewpoint focuses on the imminent signs of crisis, such as sharp decreases in asset prices and in international trade, which came to effect in the second semester of 2007, and thus places emphasis on the imminence of a breakdown rather than on the build up of factors (Astley et al., 2009).

Therefore, crisis inception will depend on the root cause assigned as the sole origin or as the main event leading a set of drivers that developed the state of affairs resulting in market turmoil and the subsequent recession that still prevails.

Although these roots and beginning points differ, there is agreement on the severity and the long lasting effects that the crisis projected. Indeed, the current economic conditions are often referred to by technical articles and newspapers as the worst cycle since the Great Depression in terms of intensity and extent of its damage.

Proponents who focus on a certain major reason sometimes consider other secondary pressure points, which could have been overcome had not the main reason been present. This view may focus on any single source, such as the complexity of the securitization market, the departure from regulation, the misapplication of the Government Sponsored Enterprises (GSE), the misuse of predictive models, which impacted trading and capitalization requirements, the housing bubble, features in subprime lending and lending standards, low domestic interest rates, moral hazard and the unyielding principles of academic economics.

Other viewpoints highlight a set of features that contributed to the final outcome, for which prominence is given to the increase in wealth experienced by U.S. households, leading to a decrease in savings and investment. These outcomes were grouped with increased trade deficits and the bloom of certain world economies as a blend that conditioned financial and international markets to such inevitable results. Additionally, credit rating and asymmetric information combined with the complexity of the derivatives market are considered as intervening factors which, interacting with other causes, produced unavoidable consequences.

The present paper analyzes all these major reasons and their interconnections. When evidence permits, reasons are validated and their potential consequences are reviewed by means of *reductio ad absurdum*, specifically by proof by contradiction to assert the validity of the arguments applied in each case. I

consider all major standpoints highlighted by research and media prior, during and after the financial market turmoil in 2007. I propose arguments that are in favor and against a specific source whenever applicable, so as to address each cause's major implications and deterrents.

Finally, the array of the interconnections among the causes is presented through graph theory. The results of graphing and the relations revealed lead to the conclusion that there is no definite and single separation among the events and drivers assigned as sources to the crisis, but that the synergy of the conditions that prevailed presented an adverse scenario from which the crisis became unyielding.

## **2. Intricate Securitization**

Woodford (2010) explains that upon the regulatory changes that banks were subject to during the 1980's and the 1990's, deposits have been gradually superseded by other funding options, losing their primary role as sources of liquidity. This was confirmed during the crisis, as the level of deposits did not experience variations, assigning to illiquidity from decrease in deposits a null role in the financial turmoil.

Failure in the financial system was related to the sharp decline in lending by institutions that did not issue deposits as a main line of business. In the financial scenario prior and upon the crisis, intermediation is portrayed by other market participants, such as mutual funds, brokers-dealers, the GSE, real estate investment funds, trusts, funding corporations and finance companies, among others. Hence, the financial meltdown represented a crisis in financial intermediation.

The financial system does no longer entail a relationship among clients, banks and the Federal Reserve. It is driven by what is nowadays referred to as the financial market. Structured finance has attracted different types of institutions that share the market with commercial banks, where deposits are not sources of funds for these intermediaries, but rather they fund themselves by means of the sale of securities in the market.

Along time, sophisticated interconnections were created, paired up with products that supplemented the previous deposit-lending scheme (Gorton, 2008). The departure from the deposit-lending structure brought by the removal of fixed commissions, motivated banks to become involved in other complex sources of revenue (Eichengreen, 2008) and consequently, intermediation began to play a crucial role in the financial market and, afterwards, in the crisis (Woodford, 2010).

The complexity in the securities market and in hedging activities seem to be a major inquiry in the examination of the root causes for the crisis, especially in regards to regulation and risk perception. The diversification of risks as a benefit allowed by securitization<sup>1</sup> was undermined by the incentive to incur in securities bearing high risk and high profits combined with short term funding. This scenario propelled traders to originate certain types of high risk securities, creating a market environment that motivated the increased originations of products referred to as toxic assets.

Another viewpoint considers that the need for a complex market rose with the origination of loans to high risk consumers that were given the opportunity to homeownership (Gorton, 2008). The increase in subprime originations paired up with permissive lending standards resulted in a market weakness promoted by the issuance of asset-backed securities (ABS)<sup>2</sup>. Such risks had to be mitigated through hedging, which led to securitization and the trading of Collateralized Debt Obligations (CDO) tranches. In turn, expectations over short term increase in property prices rendered lending to high risk borrowers feasible. Upon a steep increase, especially during the years 2005 and 2006, the growth in asset prices came to a halt, leading to defaults and foreclosures with the subsequent decline in the financial market and across parties through systemic risk.

Nonetheless, some authors hold the view that the deceleration in real estate prices and the subsequent price decrease should not be considered the leading causes for the subprime crisis (Gorton, 2008), as under that scenario de crisis could have been prevented if market participants had experienced access to

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<sup>1</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, "The Subprime Mortgage Market. National and Twelfth District Developments. 2007 Report", <http://www.frbsf.org/publications/federalreserve/annual/2007/subprime.pdf>

<sup>2</sup> Federal Reserve Board of San Francisco, 2007 Annual Report, op. cit.

financial information necessary to make predictions and decisions in regards to portfolio management, as explained further in this paper. The complex structures featured by financial products led to entangled interconnections that prevented investors to access information on the quality of the assets underlying the securities and on the parties and risks involved with them. This was considered a major driver to a panic that motivated the crisis.

### ***The originate-to-distribute model***

In the originate-to-distribute (OTD) model the institution does not hold the loans that it originates, as it is the case with the originate-to-hold model. Instead, loans are bundled into securities, which are in turn sold to investors in the secondary market. Due to its incentive structure, the OTD has been discussed as a potential driver for the crisis, in specific in regards to its liaison with agency problems (Gorton, 2008), which are explained further in the moral hazard section.

Under the OTD, there is motivation for the institution generating the loan to issue as much volume as possible, as this translates into higher revenues and the transfer of risk to other parties' balance sheets. Additionally, generating loans represents an increase in other revenue streams, such as in servicing rights. Institutions could recognize these fees in their balance sheets and would later amortize them, for which balance sheet capital ratios were favorable at the time of loan generation. In fact, the capitalization of servicing fees was a means to achieve long term loan holding (Watts, 2010). However, even if a loan was not be paid back upon a certain period, the initial asset recognition allowed banks to recycle the writedowns pursued by defaulting lines with new streams of loans, hopefully in volumes that would allow offsetting writedowns, and hence propelling more loan origination and creating incentives to increase lending transactions. Ultimately, the recording of servicing rights on loans that were mostly subprime jeopardized the initial motivation to encourage sustainable loans. Other approaches, such as cash basis recognition, would have tied revenues to loan performance, inciting better underwriting standards to avoid revenue swings in an institution's bottom line.

Another view about the impact of the OTD in the crisis is the assessment on whether risks were shared at the same level by both, the originating institution and the final investors (Gorton, 2008) and on how risk perception was taken in consideration at the time of portfolio selection. Material writedowns and losses were in the end recognized by the leading institutions upon the financial market turmoil, which could lead to the assumption that banks, mortgage brokers and other entities underestimated originally the risk that subprime loans bore. This was due partly to the fact that systemic failure was not evident at the time of a peaking housing market. In the surge of the securitization market, systemic risk was not a model input, as explained in the section related to models, and hence defaults on other market participants' books were not viewed as a primary concern by originating institutions. Value-at-Risk (VaR) models showed higher risk undertaken, as discussed later, but these did not supply sufficient evidence on systemic risk and on the potential spillovers in the securitization and the secondary market, which some authors argue led to over expanded positions and to the investment in high risk portfolios.

In this case, herd behavior (Shiller, 2008) and agency problems shed some light as to the on going loan origination outburst that led to a peak in 2005. Herd behavior, on the other hand, does not appear to provide an explanation for the deceleration in loan originations, ABS issuances and house price steep increases commencing in 2005, when the real estate market experienced some of the highest price and activity levels in these areas.

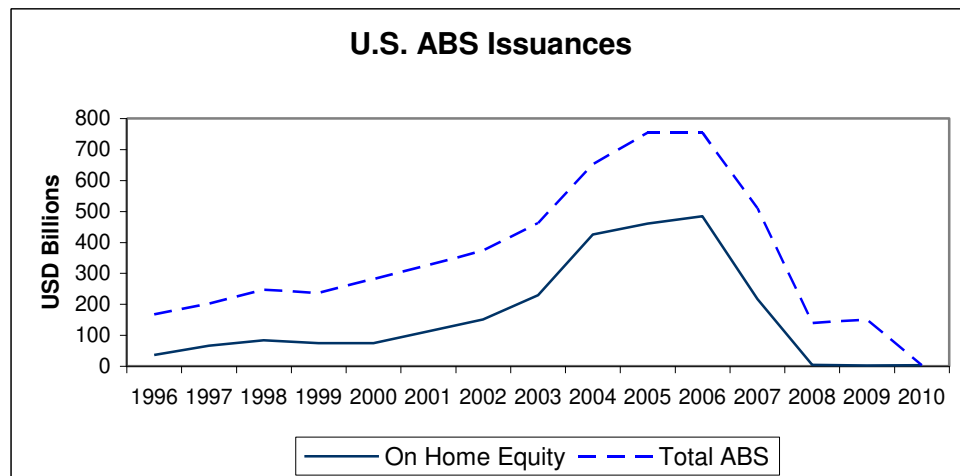
It is worth mentioning that some institutions that originated securities bearing subprime risk did not follow the OTD model, but held these assets in their balance sheets and funded them with short term borrowing (Kashyap et. al, 2008). In addition, in 2006 and 2007 a number of financial institutions held a substantial portion of CDO (Gorton, 2008), as opposed to trading them under the OTD model. However, this decision realized at the time when the crisis was becoming apparent and when its first symptoms, such as fire sales and price decrease in real estate assets, were evident.

### ***Asset-backed securities***

ABS are a type of security which draw income from a pool of assets used as collaterals. Forms of ABS are the CDO and the Mortgage-backed Securities (MBS), with special focus during the crisis on the Residential MBS (RMBS).

ABS poses high risk from various perspectives. Firstly, they can be issued by Special Purpose Vehicles (SPV), such as the Real Estate Mortgage Investment Conduits (REMIC), which are allowed to build pools of assets and to sell them as a bundle in the open market (Gorton, 2008). Although the SPV do not convey the same structure as the Structured Investment Vehicles (SIV), both played a similar role in regards to their effects on the sophistication and the absence of regulation in the securitization market. This poses the risks associated with non-regulated market participants, differing from the treatment given to banks, as explained in the section pertaining to regulation. Other risks related to the ABS are those involved with credit ratings, short term funding, high risk subprime collaterals and systemic risk, as explained throughout the present paper. Additionally, the sophistication created around subprime MBS and its features, as compared to prime or jumbo MBS, may render a source of misperception of risk for some of the market participants.

From a timing standpoint, in the period from 2001 through 2004, home equity ABS issuances increased at a faster pace than total ABS issuances, influenced by a deceleration in other underlying loans, such as credit cards receivables. As seen in the following graph, the particular change worth to notice is the deceleration in issuances in 2005, when the housing boom reached its peak:



Source: SIFMA<sup>3</sup>

With the increasing issuances in the years prior to the crisis, including on different types of ABS, the financial market became a highly structured environment where a wide array of products with diverse features were interconnected.

<sup>3</sup> Available at <http://www.sifma.org/research/statistics.aspx>

**Home Equity and Total ABS Originations by Year**  
In millions of USD

Year	Home Equity			Total ABS	
	Issuances	Year-over- Change	Percentage of Total ABS	Issuances	Year-over- Change
1996	36,158		22%	166,756	
1997	65,724	82%	33%	202,066	21%
1998	83,953	28%	34%	247,105	22%
1999	74,815	-11%	32%	236,098	-4%
2000	74,402	-1%	26%	281,467	19%
2001	112,210	51%	34%	326,206	16%
2002	150,775	34%	40%	373,903	15%
2003	229,074	52%	50%	461,542	23%
2004	425,029	86%	65%	651,531	41%
2005	460,494	8%	61%	753,515	16%
2006	483,913	5%	64%	753,876	0%
2007	216,890	-55%	43%	509,732	-32%
2008	3,816	-98%	3%	139,492	-73%
2009	2,070	-46%	1%	150,913	8%
2010	3,507	69%	3%	107,494	-29%
2011	0	-100%	0%	16,864	-84%

*Data source: Securities Industry and Financial Markets Association (SIFMA)<sup>4</sup>*

From the previous table it can be noted that a material portion of ABS issuances was related to the home equity lines class, building close connections between residential mortgage originations and the securitization market.

In the case of 2005, Equity ABS increased only 10 percent from the increase in the prior year (8% growth in 2005 as compared to 86% in 2004), and total ABS increased less than half of prior year's growth (16% in 2005 as compared to 41% in the previous year). This slow down is related to the deceleration in mortgage originations, which reduced its pace further than subprime lines. A decrease in pace also applied to MBS, although the securitization percentage over originations remained strong, and the CDO grew from 2004 through 2006 almost doubling each year.

In the period from 2001 through 2006, total mortgage originations for all types of loans also expanded, experiencing a peak of \$3,945 billion in 2003<sup>5</sup>, while they did not recover to such level ever since. As seen in the monetary policy section, this period experienced the lowest interest rates since 1980.

Analyzing the slow down between 2004 and 2005 provides imminent signs of a crisis build up. Although delinquencies declined and house prices rose, interest rates experienced a steep increase in comparison to previous years. The Federal Funds rate and the treasury nominal one-year rates increased sharply (from 1.35 percent to 3.22 percent, and from 1.89 percent to 3.62 percent, respectively), although effective mortgage rates presented a nominal fluctuation. Credit availability remained strong, but under signs of potential further rate increases in the short term, which would impact lending activities, especially as cash out options on mortgage lines depended heavily on asset price increase.

This not only reveals the link between monetary policy and the securitization market, but it also presents the issues surrounding the housing bubble. These topics are discussed further in their respective sections.

### ***Mortgage-backed securities***

Within the MBS market, there is a diversity of structures through which pools of mortgages may be securitized. The senior/subordinate structure ("senior/sub") includes six tranches, half of which are

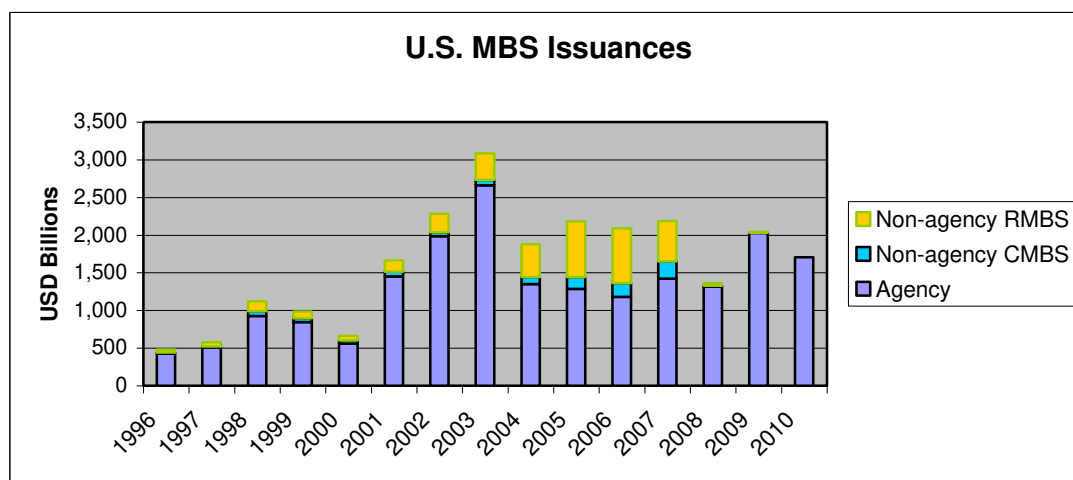
<sup>4</sup> Available at <http://www.sifma.org/research/statistics.aspx>

<sup>5</sup> Gorton (2008)

mezzanine bonds and the three remaining bonds are junior subordinate to AAA bonds. Jumbo MBS are structured as senior/sub.

A different product structure is the spread/overcollateralization (“XS/OC”) where in essence, debt volume is less than the total value of the collateral assets. The XS/OC type requires extra cushion because it bears higher risk than prime loans. Additionally, as XS/OC are mostly tied to subprime deals, tranches are not fixed because they need to allocate new protection against defaults as loans are repaid or defaults are declared (Gorton, 2008). This allocation makes MBS highly dependant on cash flows and on the asset value, adding increased risk exposure.

These features evidence the complex nature behind the MBS. Furthermore, MBS hold a series of other features, such as triggers, caps, lock-out periods and overcollateralization targets, to name a few.



Source: Securities Industry and Financial Markets Association (SIFMA)<sup>6</sup>

As seen in the previous graph, MBS were mostly issued by the government agencies, such as the GSE. This coincides with the sharp increase in originations of all types of mortgages previous to the crisis, especially in 2003, as mentioned before, as there was a direct relation between mortgage issuance and MBS originations, showing that the mortgage and the securitization markets involved contracts with multiple parties concomitantly and high participation by the GSE.

In regards to market exposure, a limited portion of the MBS market was hedged through the Asset-backed Securities Index (ABX). Therefore, there was limited risk to market spillovers, as the ABX included MBS issuances partially (Fender and Scheicher, 2008). However, subprime loans were highly securitized through MBS, which ultimately represented a source of market fault (Gorton, 2008), making both, MBS and ABX highly active participants in the intricate securitization market.

### ***Collateralized debt obligations***

CDO are considered to have caused the most detriment to financial institutions’ balance sheets and to the financial market than other types of securities. Although cash flow or synthetic CDO would have similar functionalities, the former was prominent in volume, whereas synthetic types bore additional risks.

<sup>6</sup> Available at <http://www.sifma.org/research/statistics.aspx>

**Global CDO Issuance**  
In millions of USD

Year	Cash Flow and Hybrid	Percentage of Total	Synthetic	Percentage of Total	Total
2005	206,224	82%	44,421	18%	251,265
2006	410,504	90%	44,421	10%	455,545
2007	340,376	79%	88,842	21%	430,458
2008	43,596	70%	1,341	2%	61,887
2009	2,561	59%	254	6%	4,336
2010	7,640	95%	42	1%	8,003

*Source: Securities Industry and Financial Markets Association (SIFMA)<sup>7</sup>*

CDO issuance increased from \$100-\$150 billion of yearly issuances in the period from 1998 to 2004 (Calomiris, 2009), to \$250 billion in 2005 and nearly doubled in the year prior to the crisis as compared to 2005. As it is the case for the years reflected in the table, cash flow CDO was the prominent type also before 2005. Cash flow CDO invest in bonds and loans among other assets. Bonds, in turn, can be issued by CDO pools as means of a financing source, creating the systemic risk that provided the fire sales and spillovers through the crisis.

Furthermore, when holding MBS in their portfolios, some cash CDO would perform what is called notching by requiring credit agencies to rate a given CDO that included MBS rated previously by a different credit agency (Calomiris, 2009). In this case, notching allowed the new rating agency to avoid analyzing already rated MBS by downgrading their previous ratings. Although this was seen as a conservative approach to credit rating, which could have compensated the harmful effects caused by rating shopping as described in the credit ratings section, it provided a misperception of the genuine risk that should have been applied to the underlying portfolio, as well as an impairment on the accuracy sought on credit ratings. Moreover, if a portfolio manager sought triple A ratings and a part of the MBS had to receive notching, there was pressure to receive high ratings on the remaining part of the portfolio to be rated so as to maintain a high grade. This created a pervasive environment to the definition of credit ratings.

Cash CDO, the most prominent type of CDO as observed, mostly included MBS at a subprime rate (Calomiris, 2009; Gorton 2008). Usually, a CDO portfolio involves different pools of long term debt<sup>8</sup>. In the years prior to the crisis, global issuance of ABS CDO increased almost 200 percent and mainly concentrated on U.S. MBS of the subprime type (Gorton, 2008), carrying the risks associated with the subprime mortgage market and underwriting practices. Moreover, the lack of information surrounding the underlying subprime mortgages on CDO disclosures forced investors to make across the board comparisons by firstly analyzing each MBS included in the portfolio and then on the individual subprime lines. As models are not standardized in the CDO market, then tailored analysis had to be carried in order to make decisions on investment opportunities. This lack of standardization increased complexity throughout the market, leading to asymmetric information and misperception of portfolio and systemic risk.

Synthetic CDO gather cash in escrow prior to hedging into other securities, which are mostly Credit Default Swaps (CDS). This created a combination of the risks associated with CDS, with those related to the CDO. For instance, the sharp raise in synthetic CDO issuances increased demand for the underlying CDS, raising short term revenue creation and propelling speculation.

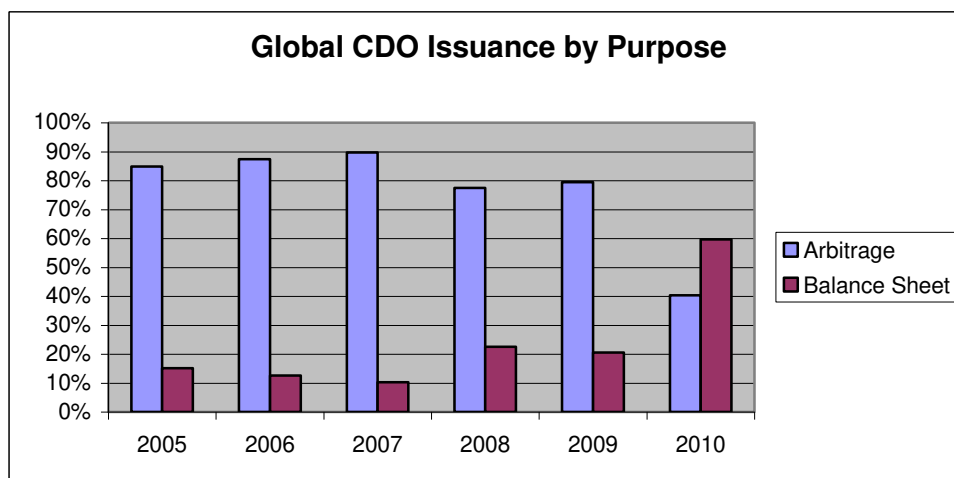
Another source of risk for the CDO was that a material portion was held by the SIV, which are part of large banks and other financial institutions and which allow for off-balance sheet recording of loans and other transactions, as discussed further in the regulations section. This practice offloaded risk and capital

<sup>7</sup> Available at <http://www.sifma.org/research/statistics.aspx>

<sup>8</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.



requirements from the main institution's books, which became an apparent source of market failure during the crisis, as material writedowns were assumed by the parent institutions. The SIV were unregulated, leading to risk taking practices that lacked monitoring by governmental agencies.



Data source: Securities Industry and Financial Markets Association (SIFMA)<sup>9</sup>

CDO issuance for the purpose of offloading assets from a bank or financial institution's balance sheet results in a balance sheet CDO, which in turn could decrease capital requirements. As seen from the previous graph, this purpose was exceeded in issuance volume by arbitrage CDO, whose aim is the creation of sources of revenue from managing a portfolio. Hence, prior to the crisis, most of the CDO were intended as a stream of revenue rather than as a decrease of capital requirements. However, having channeled issuance and investment of CDO through the SIV and other non-regulated institutions, banks experienced a decrease in capital and risk ratios, as it was evidenced through the writedowns that they assumed upon the crisis. As off-balance sheet entities were not regulated, and as transactions took place over-the-counter (OTC), absence of record keeping renders the total volume of securities that were transacted unknown.

In addition, CDO sought protection not only through CDS, but also through hedging by monoline insurance, especially before CDS began to be issued in the 1990's<sup>10</sup>. This was another factor that revealed detrimental consequences upon the crisis as insurers failed to provide the expected coverage, leading to further market vulnerability and to uncertainty in regards to the types of interconnections and the health of the underlying portfolios<sup>11</sup>, propelling fire sales and market the downturn.

Monoliners were also subject to the shortcomings in credit ratings, which in turn affected capital requirements. This situation, in addition to the issue of holding the same credit ratings as the products that they insured, led to uncovered positions and the propagation of systemic risk<sup>12</sup>.

As with the MBS, CDO have features such as triggers, which are specific to each portfolio, following that modeling issues arise on a case-by-case basis (Gorton, 2008). There is no standard comparison that can be made across CDO because there were no rules requiring the SIV to make extensive disclosures on the assumptions used in these models. Likewise, CDO tranches cannot be compared throughout the market because each CDO was analyzed on individual premises, leading to the propagation of market failure upon the crisis, as mentioned previously.

The following section should provide additional effects on synthetic CDO, as they shared the materialization of risks born by the CDS during the crisis.

<sup>9</sup> Available at <http://www.sifma.org/research/statistics.aspx>

<sup>10</sup> "Risk Management Watch: The Monoline Insurance Delusion", April 6, 2009, <http://seekingalpha.com/article/129605-risk-management-watch-the-monoline-insurance-delusion>

<sup>11</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>12</sup> "Risk Management Watch: The Monoline Insurance Delusion", op. cit.

## Credit default swaps

CDS were used predominantly in hedging CDO, and also for speculative reasons. Purchases of CDO triggered the acquisition of protection by investors through the CDS (Gorton, 2008), increasing the demand for swaps due to the higher use of synthetic CDO, which was boosted by the increase in subprime exposure in the years prior to the crisis. This allowed for expanded coverage, which drove the increase in CDS. Moreover, a higher demand for high risk products, such as for subprime CDO and in consequence for CDS, provoked insufficient supply of cash ABS, having to rely on synthetic CDO to cover the excess on demand (Gorton, 2008), hence propelling further demand for CDS. As of September 30, 2008, CDS exposure over total assets held by commercial banks reached one time and a half of their total assets, as displayed in the following table:

<b><u>Asset Exposure on Notional Amounts of CDS by Commercial Banks</u></b>	
<b>In Millions of USD, as of September 30, 2008</b>	
Credit Derivatives	16,148,388
<b>CDS portion: 98.8%</b>	<b>15,954,607</b>
<b>Total Assets</b>	<b>10,550,430</b>
<b>Total CDS exposure over total Assets</b>	<b>151%</b>

*Data source: Office of the Comptroller of the Currency<sup>13</sup>*

A protection buyer would not have to hold the actual bond to be able to hedge. In that case, the swaps were called naked CDS, which motivated trading with the expectation of security defaulting on the underlying derivative that was being hedged, as such event would trigger the payment of the par value to the protection buyer while not holding the actual paper. Hence, a protection buyer with no holdings could receive revenues. As 80% of the CDS were of the naked type<sup>14</sup>, this led to the propagation of systemic risks and speculation, impelling moral hazard issues.

Both naked CDS and synthetic CDO have been focus of controversy during the financial crisis<sup>15</sup>. As with the ABS products discussed above, CDS were surrounded by misperceptions of risk inherent to portfolio and to market spillovers. In addition, the increased speculation was concentrated on large sums of single investments (from \$10 to \$20 million dollars) and to a limited group of institutions, which increased impact of cascade effects upon fire sales began when the crisis became apparent. Furthermore, some protection buyers held the CDS in their portfolios upon default for arbitrage purposes, allowing for revenue channels by the collection of fees and the quarterly payments<sup>16</sup>. These activities motivated the issuance of CDS with the aim of creating alternative sources of revenues.

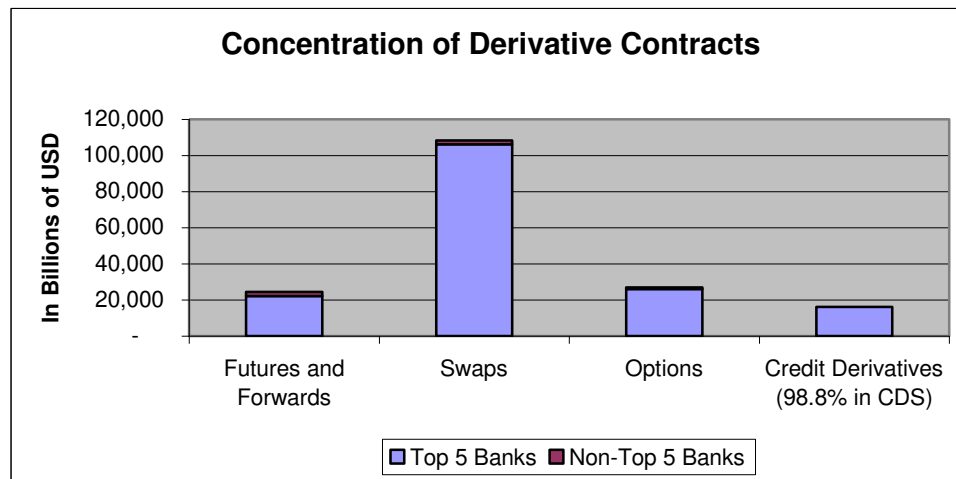
As some investors considered swaps to bear less risk than the assets themselves because of the diversity of assets that the former included (Astley et al., 2009), the underlying connections among parties created by the CDS market was belittled by regulators (Eichengreen, 2008). These relations were highly concentrated in five institutions that led the market, as shown in the following graph.

<sup>13</sup> "OCC's Quarterly Report on Bank Trading and Derivatives Activities: Third Quarter 2008", [www.occ.gov/news-issuances/news-releases/2008/nr-occ-2008-152a.pdf](http://www.occ.gov/news-issuances/news-releases/2008/nr-occ-2008-152a.pdf). This report accounts for commercial banks in the U.S. and it is based on the Call Report provided to the OCC by all insured banks and trust companies, as well as by other data populated by the OCC. As they were not required to file such reports, the SIV and other investment conduits are not included in this analysis.

<sup>14</sup> Bloomberg, "Banning 'Naked' Default Swaps May Raise Corporate Funding Costs", July 24, 2009, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=awJDsS9.OHjc>

<sup>15</sup> The New York Times Deal Book, "S.E.C. Chair: Regulate Credit-Default Swaps Now", September 23, 2008, <http://dealbook.nytimes.com/2008/09/23/sec-chair-regulate-credit-default-swaps-now/>; The New York Times, "Looters in Loaners", April 18, 2010, [http://www.nytimes.com/2010/04/19/opinion/19krugman.html?\\_r=1&hp](http://www.nytimes.com/2010/04/19/opinion/19krugman.html?_r=1&hp)

<sup>16</sup> Annual Report for the year ended December 31, 2008 filed on form 10-K by American International Group. Arbitrage represented approximately 29 percent and 21 percent of the total super senior CDS portfolio as of December 31, 2007 and 2008 respectively.



Data source: Office of the Comptroller of the Currency<sup>17</sup>

In the CDS market, as with the other products analyzed, reporting requirements became unclear, as participants were not only financial institutions, but also corporations, some of which were subject to limited regulation prior to the crisis, as it happened with the SIV (Colander et al., 2009). CDS are not meant to represent insurance, for which the contract between the protection buyer and the protection seller is a security agreement. This allowed market participants to avoid insurance, as well as capital requirement requirements. This activity could not be monitored by regulators because it was performed through what is called the shadow banking system, which is explained further in the section dedicated to regulation. However, offloading assets for the purpose of easing capital requirements was a practice disclosed to market participants, to the public and to regulating agencies through filings with the Securities and Exchange Commission<sup>18</sup>.

Additional risks associated with counterparties involved with CDS were highlighted by the operational arrangements among market participants, leading to pending transactions that bore institutional risks (Eichengreen, 2008). According to the Office of the Comptroller of the Currency, although not specified in the Call Reports analyzed by the entity, CDS are expected to have traded by means of OTC for the most part, where 95.5 percent of all derivatives were traded via OTC, as shown in the next table. This included derivatives holding subprime loans, as well as short sellers and traders with speculative purposes, in which cases the OTC prevented to recognize the identities of the participants and the purposes for trading (Gorton, 2008), along with lack of visibility with regards to potential and upcoming downturns.

<sup>17</sup> “OCC’s Quarterly Report on Bank Trading and Derivatives Activities: Third Quarter 2008”, op. cit. The report shows solely transactions by commercial banks, as off-balance sheet entities, such as SIV, were unregulated and therefore, were not included in the OCC Quarterly Report. Estimates for the off-balance-sheet institutions are sometimes derived from the amount of writedowns experienced upon the crisis, although this practice does not reveal the market value of the portfolios at the time of trading, when prices were on the rise and unaffected by fire sales, as it was the case upon the financial market declined.

<sup>18</sup> Kling, A. (2009), “Regulatory Arbitrage, AIG Edition”, Library of Economics and Liberty, March 18, [http://econlog.econlib.org/archives/2009/03/regulatory\\_arbi\\_1.html](http://econlog.econlib.org/archives/2009/03/regulatory_arbi_1.html) and Annual Report for the year ended December 31, 2008 filed on form 10-K with the Securities and Exchange Commission by American International Group.

## Notional Amounts of Derivative Contracts through OTC

In Millions USD

Total Derivatives Holdings as of September 30, 2008	175,841,765
Forwards	20,424,203
Swaps	108,276,088
Options	23,167,006
Credit Derivatives (assumed as OTC by OCC, although not specified in the Call Reports) - 98.8% CDS	16,148,388
	<u>168,015,685</u>

**Percentage of derivatives through OTC**

**95.5%**

*Data source: Office of the Comptroller of the Currency<sup>19</sup>*

Conversely, a clearing house would have mitigated these shortcomings on naked CDS and synthetic CDO, limiting systemic risk exposure to those entities enrolled as members of the clearing house and allowing for monitoring by financial market participants and governmental agencies. This would be similar to a tripartite Repurchase Agreement (Repo), in which a third party institution acts as a custodian, assuming the role of a clearing organization (Gorton, 2008).

### **3. Blemished Models**

Upon the crisis, valuation models were challenged as to their capability to capture the layers embedded in a given portfolio and, consequently, the risks associated with the underlying products and the parties involved (Gorton, 2008). This was due mainly to asymmetric information, as it was the case with the CDO, which included MBS, while the latter held loans and collaterals, representing a top down structure that escaped the approach to valuation of a bundle of products as a whole.

Risks should have been assessed with the bearing of the interconnections that a particular entity potentially extended with the rest of the market participants, allowing for the inclusion of counterparty risk and systemic risk. These two types of risk involved not only domestic institutions, but also countries and international banks (Astley et al., 2009), as capital flows are significant with regards to the role of the U.S. dollar in the international financial market (Goldberg, 2010). Given that the banking system represents half of the international capital flows (Astley et al., 2009), risks in the international financial market have become significant in the past decades.

Moreover, during the crisis, some investors were unknowledgeable about which banks were exposed to higher risks, a fact that lowered the volume of transactions and the availability of funds for financial institutions when the crisis arose (Astley et al., 2009; Gorton, 2008). The Repo market came to a halt, as pricing on the securities on which funding was based became unavailable (Gorton, 2008). Consequently, liquidity constraints took place and banks tried to pursue funding through the sale of assets abroad, plunging the prices of such assets even further (with a beneficial impact in the current account). Therefore, the assessment of risk had repercussions beyond domestic markets and the relationships between the issuers of securities and the end investors.

On the other hand, the basis used for modeling in economics has been subject to questioning. Some principles that have been challenged include rational expectations, macroeconomic impact derived from an individual perspective and under the action of a representative agent, overridden shortcomings that should be disclosed, lack of interaction with other human sciences and the assumption of perfect information, among others (Colander et. al, 2009). Some authors consider that short term analysis should be significant over the long-term, as economic agents arrive to their decisions in the short term, whereas in the long run the tendency is to operate over unpredictable shifts (Estrada, 2010). Oppositely, other proponents assign an adverse outcome to modeling with short term data due to the recent history that some of the instruments had in the financial market at the time of valuation (Eichengreen, 2008). Because

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<sup>19</sup> "OCC's Quarterly Report on Bank Trading and Derivatives Activities: Third Quarter 2008", op. cit.

of low inflation and stability that followed the crisis of 2001, as well as the inflow of capital to the U.S., with the subsequent decrease in the interest rates of long term government bonds, modelers were led to believe that the existing economic conditions at the time were sustainable and assigned low price risk to their forecasts (Astley et al., 2009). This was detrimental to the analysis, particularly as some series did not exhibit volatility, impacting the risk assessed.

Models have been questioned also in regards to ratios that are defined by rules and regulations. Capital ratios or loan-to-value ratios are considered by some authors as insufficient for policy mechanisms to stabilize monetary and financial cycles (Blanchard et. al, 2010). Other proponents consider that liquidity and capital requirements could have been adjusted accordingly insofar models had contemplated instances of risk with lower probabilities. As models impact regulation in the definition of capital and liquidity requirements, as explained further in the regulation section, discrepancies between these requirements and the actual amounts reserved became evident, leading to the conclusion that ratios underestimated market needs (Whealan, 2010). Some models in this case were out of pace, discarding temporal series considered irrelevant as they were assigned low probabilities of occurrence, and hence, low risk. Tentatively, pertinent regulation in regards to booking potential liabilities could have lessened the impact of the crisis in the financial market and in the real economy (Eichengreen, 2008).

Additionally, the Internal-Ratings-Based (IRB) method by Basel II relies on the models prepared internally by financial institutions (Kashyap et. al, 2008), which combined with the limitations surrounding credit ratings and agency issues, had an effect on the disclosures about risk.

### ***Value-at-Risk models***

Objections in regards to the application of VaR models and its features have arisen from a diversity of areas and market participants, such as academics, risk managers, financial institutions and other end users<sup>20</sup>. In particular, VaR has been challenged to the extent of its methodology and application to the assessment of risk in the subprime chain (Estrada, 2010), especially in risk pricing.

VaR was introduced at the end of the 1980's and was the benchmark in risk management. It is widely used in the financial services industry to determine risk on assets prices or to assess on market risk (Hendricks, 1996). Its result is efficient, as it shows risk managers and investors a single number, allowing across the board comparisons. The lower the VaR, the lower the risk and, therefore, the lower the probability of defaulting by a given investment or portfolio. VaR summarizes in one report both, market and firm wide risks by taking in consideration a series of variables, such as leverage, diversification and volatility.

Its methodology prompts a series of limitations, which were highlighted not only upon the financial crisis, but also in prior academic publications. VaR was widely used at the beginning of the 1990s and was accepted by the end of the decade as a disclosure of risk by the Securities and Exchange Commission (SEC) and by Basel II regulations on capital and liquidity requirements. Some financial institutions relied on its prompt gathering as much as fifteen minutes upon market close, in the so called 415 report.

As part of its methodology, VaR relies on two inputs: the confidence level and the time period, which are determined by risk managers based on their ex ante assessment of the data to be modeled.

The confidence level is a result of an upfront estimation by risk managers of the probability of a decrease in the value by a given portfolio (Hendricks, 1996), representing by definition a potential for miscalculation prior to the execution of the model. Econometrical models involve a series of estimations and variables for which behavior is unknown. However, in the case of a VaR, the probability that a certain asset or a portfolio may default is indeed the outcome that a financial institution is seeking in order to make investment decisions, whereas it is also the input that will provide the final conclusion. This renders a paradox in portfolio valuation.

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<sup>20</sup> The New York Times, "Risk Mismanagement", January 2, 2009, [http://www.nytimes.com/2009/01/04/magazine/04risk-t.html?\\_r=1](http://www.nytimes.com/2009/01/04/magazine/04risk-t.html?_r=1)

For this reason, tail risk becomes a concern. Some authors agree that models built on Black-Scholes and Gaussian distributions should be avoided because they are unable to forecast variations in the confidence levels within a given market (Estrada, 2010; Colander et. al, 2009). On a study of a portfolio containing 12 foreign exchange rates, Hendricks (1996) shows that the ends of the Gaussian distribution are usually wider than predicted, leading to the conclusion that daily volatility observed in the financial market is often times higher than expected.

The normal distribution under the Gaussian bell-shaped curve assigns higher likelihood to events located closer to the mean value, that is, to the center. Hence, less likely events will be placed at the ends of the curve, representing tail risk. In this sense, when evaluating an asset or portfolio and its probability of value decline, Gaussian distributions analyzed in the financial market suggest that, with 3 standard deviations from normal returns, these will move on almost zero probability, giving the appearance that the asset or portfolio behaves in a normal way, whereas the standard application of 3 deviations is supposed to understate the deviation.

Alternatively, Hendricks explains that changes in market behavior are not incorporated in VaR, whereas these are substantial to the calculations. A potential mix of model application and percentile, along with different timeframes, could provide a complete scenario that would forecast the potential losses that a portfolio may face, while circumventing the limitations carried by the application of a single VaR output.

Conversely, some authors (Figlweski in Hendricks, 1996) suggest that certain concepts included in these models, such as standard means, are inaccurate because assets do present volatility, thus averages or normality would be misleading and would add noise to the calculation. Therefore, a zero value is suggested as a standard mean in the application of VaR.

### ***Confidence levels***

Hendricks (1996) shows that a change from the 95<sup>th</sup> percentile to the 99<sup>th</sup> percentile provides a materially different outcome, where in the former risk is accurately predicted and in the latter it is underestimated. Hence, using VaR models as an upper limit for the estimation of potential portfolio losses will imply underestimating the outcome. This was a major concern debated over the misallocation of risk upon the financial crisis<sup>21</sup>. Moreover, percentiles are greatly affected by the size of the observation sample, as the 99<sup>th</sup> and the 95<sup>th</sup> percentiles have extremely small room for accuracy when the number of observations is small, which prevents portfolios bearing short historical data from modeling risk appropriately. As a result, and except for historical simulations that do not apply normality, a higher probability of default inputted into the model will render more accurate results.

Furthermore, confidence levels and sample size are influenced by the type of model adopted. Some VaR models will place higher weight in recent data through a decay factor, for instance in the case of exponentially weighted moving average approaches, which have proved to capture risk volatility more accurately (Hendricks, 1996). As a result, choices on the type of model, sample size and confidence levels all lead to a variety of outcomes that imply the need to take diverse decisions, making VaR and the results produced highly sensitive to small variations in the assumptions, data or type of model used.

### ***Data and timeframe***

Almost all risk managers base their predictions on value decline founded on historical data (Hendricks, 1996). However, data sets in historical valuation usually do not exceed two years, whereas some focus on the prior year. This presented a particular challenge when the crisis unraveled. In examining house pricing combined with the increase in originations and the stable delinquency rates, models were not able to predict the outcome during the period 2006 to 2007 by analyzing data from 2004 and 2005. Furthermore, whether data are sought as linear series or exponentially modeled will depend on the risk manager's decision, which will be based on the type of asset, its history and any expected news on upcoming behavior, among other factors.

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<sup>21</sup> The New York Times, "Risk Mismanagement", op. cit.

Market behavior can present differences in patterns depending on the timeframe, but it could conversely provide more room for error because of the decrease in the sample size, especially in the historical approach. Hendricks (1996) concludes that in historical simulation approaches, where potential outcomes are derived from previous price behavior, modeling longer periods will render greater stability in the outcome than short term analysis, especially in the uppermost percentiles. Oppositely, a number of trading decisions conducted in hedging and MBS sales during 2006 were based on short term analysis, which prevented higher writedowns when the crisis befell<sup>22</sup>.

Conversely, and despite the disadvantages surrounding short term analysis, using recent data in a highly volatile asset could prove necessary due to the inexistence of prior data. This is because some products were relatively new prior to the crisis and lacked history (Eichengreen, 2008). Eventually, models should be considered based on their ability to assess risk over time (Hendricks, 1996), raising the question as to whether VaR was an appropriate tool to lead decisions on risk in cases of innovative products with insufficient data.

### ***Risk revealed by VaR***

On the other hand, VaR might not have represented an insufficient tool to reveal risk exposure. As VaR disclosures were required by the SEC, financial institutions and other regulated entities included VaR values in their financial reports filed with the Commission. A review of the trend on VaR in the years prior to the crisis revealed increasing exposure assumed in trading, as shown in the following table.

**VaR: Average Overall Issuer Specific Trading at Year-end  
Year-over-Year Fluctuation**

							<b>2004-2006 Cumulative Fluctuation (Million of USD)</b>
		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	
(1), (2)	<b>Merrill Lynch</b>	n/a	18%	30%	202%	-74%	\$18
(3)	<b>Lehman Brothers</b>	22%	46%	8%	117%	n/a	\$20
(4)	<b>Goldman Sachs</b>	16%	4%	44%	37%	30%	\$43
(5)	<b>JP Morgan</b>	31%	1%	-2%	27%	83%	\$19
(6)	<b>Bear Sterns</b>	0%	30%	40%	16%	n/a	\$13

*Source: Annual Reports filed with the SEC*

- (1) 95% Confidence - 1 day trading period
- (2) 2007 includes ABS CDO. "However, as noted, we believe that the application of traditional VaR techniques is not reflective of the true levels of risk in these positions"
- (3) 95% Confidence - 1 day trading period - Historical simulation - 4 year historical data, higher weighting on recent term
- (4) 95% Confidence - 1 day trading period
- (5) 99% Confidence - 1 year historical simulation - application of RIFLE (Risk Identification for Large Exposures)
- (6) 95% Confidence - 1 day trading period - Historical simulation and "Monte Carlo" approach

The single dollar amount provided by VaR represents the minimum losses that the portfolio analyzed may incur in, given the level of confidence and the probability of default assigned to the model. By observing the increases of VaR values in the three-year period prior to the crisis as seen from the table, it is evident that the model was not prioritized in making trading decisions, as exposure signals shown by VaR increased over time. These calculations were made available to investors with a quarter lag, as annual reports are not filed immediately upon fiscal year-end by the issuer. In spite of this, institutions trading securities had on going access to the results supplied by their VaR estimations, which evidenced acceleration in risk taking in the years previous to the crisis.

As seen from the table, confidence levels applied were on the 95<sup>th</sup> percentile except for one case, reducing the risks previously explained, related to assigning low probabilities of default, as explained previously.

<sup>22</sup> The New York Times, "Risk Mismanagement", op. cit.

Historical simulation, at times weighted on recent periods, was also applied in most cases, and alternatively VaR was complemented by other models, such as the Monte Carlo approach or the Risk Identification for Large Exposures (RIFLE).

These observations lead to the conclusion that VaR values were not taken fully in consideration when assuming investing positions and that its outcome was underestimated. Agency problems, as explained in the moral hazard section, combined with optimistic market conditions in the years prior to the crisis motivated the overriding of increases in VaR, which culminated in the materialization of the risks embedded in the tail of the Gaussian distribution.

### ***Overcoming model limitations***

To the extent that quantitative analysis was not sufficient, some entities added other statistical and non-statistical estimations to enhance decision making. From a statistical standpoint, some institutions performed periodic back-testing, in order to ensure that VaR results had been properly measured, as well as sensitivity and stress testing, examined together with net income and other indicators. Additionally, some considered risk that could be perceived solely by judgment, due diligence, assumption challenging and a culture of risk control<sup>23</sup>.

These measures, along with the analysis of outcomes obtained from modeling, were overridden. This is explained by the increased risk taking and systemic risk spillovers that took place at the unfolding of the crisis. Furthermore, some entities raised their exposure in the face of the market turmoil, which leads to the conclusion that some entities sought high risk behavior, which was the primary driver in the expansion of the complex and interconnected financial market<sup>24</sup>. A stimulated housing market, along with the booming origination and securitization pace, an expanding securitization scheme and the high inflows of capital led potentially to conclusions that the placement of higher risks could derive in potential increased market earnings with the absence of market spillovers and that those instances were of a permanent nature.

To remediate the shortcomings that arise from models, some proponents suggest avoiding model simulation and building theoretical models through data, placing empirical research as the founding step for the design and verification of financial and economic analysis (Colander et al., 2009). Ultimately, this was the methodology applied during the construction of Var, which took seven years to accomplish. The potential obstacle on relying solely in raw data draws from products that have limited history, as mentioned previously. Moreover, in some cases, such as with the financial crisis, the existence of the benign market conditions explained may have rendered data sets unappreciative of potential declines not captured in historical analysis. This is the major fault assigned to VaR, that is, the oversight of tail risk.

## **4. Inaccurate Credit Ratings and Asymmetric Information**

Upon the financial crisis, the Repo market encountered issues surrounding ratings on ABS, MBS and other structured products, which produced an interruption in funding deals (Gorton, 2008).

As centralized credit ratings have replaced the use of individual research by investors, which can lead to loss of information (Colander et al., 2009), asymmetric information among the institutions that carried the OTD model and the ultimate investor gave a misperception of the potential default by the portfolios transacted (Astley et al., 2009).

### ***Credit ratings***

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<sup>23</sup> UBS, “Annual Reporting 2008”, restated May 20, 2009, [http://www.ubs.com/1/e/investors/annual\\_reporting2008/rtm2008/0001.html#qualitative](http://www.ubs.com/1/e/investors/annual_reporting2008/rtm2008/0001.html#qualitative)

<sup>24</sup> The New York Times (2007), “Merrill’s Chief Is Being Held to Account”, October 25, <http://www.nytimes.com/2007/10/25/business/25merrill.html?pagewanted=1& r=1>



The downgrading of AAA products was material after the financial market turmoil, amounting to 83 percent in 2006 and 89 percent in 2007 of all AAA rated products<sup>25</sup>. Agencies issuing ratings were part of a network in which they represented a conflict of interest, as the generation of their fees depended on the outcome in the evaluation of their own clients (Eichengreen, 2008; Tarr, 2010; Taylor, 2008). Additionally, some financial institutions would pursue rating shopping by inquiring into different agencies as to potential ratings for their portfolios and selecting the most favorable report, which heightened the compromise between the agencies and their objectivity in the evaluation of portfolios and institutions.

Another market practice was called notching, which involved rating adjustments to better the portfolio when, already rated by another agency, the securities were presented for evaluation to a new firm (Calomiris, 2009). As explained in the CDO section, this practice distorted the genuine risk involved with the underlying portfolio. In addition, it placed unwanted burden on risk analysts because of the increasing pressure to receive the highest ratings possible on a security or portfolio. That is, if a security had previously been graded less than AAA, the remaining underlying products in the pool necessarily were compelled to receive a AAA level or at least a higher rating than on the previous report so as to qualify as a highly rated product, which in the end achieved portraying a low risk profile to products with a variety of risk stances underneath.

Calomiris (2009) suggests that institutional investors are the main parties who have an incentive to pursue biased risk models. Holding portfolios with AAA ratings that produce returns of a lesser rating boosts the portfolio's reputation. This combined with the revenue motivation by the agencies created a setting for favorable ratings.

In addition, capital requirements are based on the ratings assigned to the securities, as explained in the capital and liquidity reserves section. This added a new source of pressure for banks and financial institutions regulated by Basel II to obtain the best ratings possible. However, this was not applicable to SIV, as analyzed previously, since off balance sheet entities were not subject to capital or liquidity requirements.

A consequence of these ratings mechanisms was that favorable ratings were not compatible with pricing (Gorton, 2008). Many of the CDO holding AAA designations were composed by subprime products and were priced higher than those holding lesser grades, evidencing higher risk perceived by investors than the level reflected by ratings. This leads to the question as to whether ratings were sought as critical drivers for investment decisions and if market participants relied on additional information other than ratings to arrive to their investment decisions, palliating some of the limitations inherent to the asymmetry of information experienced in the financial markets.

The designation of credit rating agencies was carried by the Securities and Exchange Commission (SEC). Agencies were identified and approved as Nationally Recognized Statistical Rating Organizations (NRSRO), which limited the market to no more than five agencies (Tarr, 2010). Some authors suggest that the role of the SEC should be extended to better ratings through periodic inspection of errors and the enforcement of claw back penalties and suspensions (Calomiris, 2009). As it is the case with other root causes to the crisis, improvements to the banker-credit-agency relationship have been implemented since, such as the selection by regulators of ratings agencies instead of by the institution assembling the security or derivative.

Eventually, the practices described prevented some risks associated with the underlying assets from being available to investors. As requesting investors to pay for ratings would have not avoided these practices (Calomiris, 2009), other incentives could have been considered when the discrepancies between prices and risk became evident. Conversely, some authors consider that credit agencies were the main parties affected by asymmetry of information due to the complexities of the securitization market (Taylor, 2008), which led investors and other market participants to rely on these ratings and on the low risk profile

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<sup>25</sup> "Moody's chief says CDO ratings were 'Deeply Disappointing'", Bloomberg, June 2, 2010. Percentages provided by the Chairman of the U.S. Financial Crisis Inquiry Commission (FCIC), <http://www.bloomberg.com/news/2010-06-02/moody-s-chief-mcdaniel-says-ratings-of-cdos-were-deeply-disappointing-.html>

provided by the AAA denomination<sup>26</sup> when the complexity was beyond their design and the participants' understanding of the entangled connections among products and parties.

### ***Asymmetric information and herd behavior***

Apart from facing insufficient and incomplete information about products and parties, individual and institutional investors faced challenges when analyzing the complexity of the products that were presented to them. The models applied, as well as to the intricate connections and product structure within a given security required a certain expertise and background to enable portfolio decisions. Some securities as the CDO held different layers of products, such as loans and securities, leading to shortcomings on analysis and the reliance by investors' on their relationships with bankers and financial institutions (Gorton, 2008).

Conversely, originators had access to data and information that in turn represented shortcomings to final investors. When bundling securities that held subprime mortgages and high risk loans, the originating agency or broker had access to documentation on the lines not available to the back end security holders, such as lack of support on the borrower's income verification. This was heightened by issues surrounding liar loans. As explained in the moral hazard section, liar loans were lines provided to borrowers who did not meet the income criteria, while the agent issuing the loan created a favorable report on inexistent or insufficient income so as to receive approval for such borrowers.

This scenario reveals a gap in the borrowing phase that is transferred into the securitization market. This gap is created by a lack of segregation of duties in the parties involved. The originating agency is motivated to issue as many loans as possible for revenue purposes. When quantity earned priority over quality, bundled lines would carry over the risks associated with the original lines and defaults would not revert to the issuing party. On the other hand, higher demand for securitized products made it plausible to accept an increase in supply with little supervision. The end result was an incentive to profit without accountability.

Hedging could have come into play as a potential temporary supplement, although it could have not covered the fire sales that took place upon the crisis. However, hedging and short selling were not easily available to be used as protection mechanisms by individual investors (Gorton, 2008). Data on the loans and other securities were mostly known by the immediately intervening parties, which led to a reliance on the ABX index, as discussed in the next section. Moreover, the ABX index was issued starting 2006, covering a short term period prior to the crisis. Therefore, for the most part, investors relied on banks, on other financial institutions and on their relationships with their financial advisors employed at such firms.

Information cascade produced by herd behavior is considered by some authors to have aided the housing bubble and the subsequent crisis (Shiller, 2008). Due to the enticing environment for real estate that households were subject to, purchases decisions became contagious, increasing home sales at the same time that home prices began to escalate. This view is based on lack of early assessment on the upcoming crisis by the majority of the parties intervening in the financial markets. It does not overrun the rationality characteristic in market participants, but it places the burden on the effects of collective decision and the implications of emotional factors.

Although a portion of borrowers may have followed herd behavior, this trend cannot be applied to the market in its entirety, firstly because analysts from various disciplines (not only economics, but also anthropology and sociology) began predicting the housing bubble as early as the end of the 1980's. These conclusions on an upcoming breakdown were based on different factors, such as the acceleration of growth in real estate prices, the level of interest rates, the on going changes in regulations, among others. Indeed, herd behavior assumes that the housing bubble was not recognized when it started to arise. However, some economists that were involved with the financial market issued warnings (Krugman, 2005). Taking no notice of such alarms could have been related to information cascade, to the enticing increase in consumer spending, or to prevailing speculation in the real estate market, as shown by the

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<sup>26</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

increased purchases of homes for investment purposes or through interest only lines on the borrowers' side.

Additionally, as it would be challenging to measure the potential borrowing population that decided against taking loans based on these predictions, the question remains as to what portion of prospective borrowers with intention to buy a home decided against it due to uncertainty in regards to the market, the types of loans or the information available at the time.

Herd behavior focuses on borrowers who ultimately realized home acquisition, given that the examples supplied by literature relate to purchases of homes. It would not extend to parties that originated loans that were misleading in regards to the risk that they bore. Given that the latter is what caused the spillover effects upon the crisis and the consequences brought by the mismatch between originators and the final investor purchasing the security, herd behavior is applicable as a partial source for the ignition in house purchases. Moreover, if information cascade and herd behavior were beneficial in creating a housing bubble and its subsequent plunge, then we should need to determine the incentives in achieving such effects and in abandoning such scenario. In that case, we would inevitably enter the realms of moral hazard, the state of regulation and the appropriateness and complexity in the securitization market, rendering herd behavior as one of the many sources that ignited the crisis.

### ***Pricing on derivatives and their assets as market signals***

The ABX were introduced in 2006, for which historical data upon the crisis were limited. For the BBB tranche, for instance, only four semiannual issuances were available, as no new issuances of ABX occurred upon 2007 (Gorton, 2008).

ABX are CDS portfolios with underlying MBS. The distinctive feature as compared to the standard CDS is that the ABX are not extinguished upon the occurrence of the triggering event that they are hedging. If losses are to be paid due to defaults, coverage is not interrupted after the protection seller honors payment to the protection buyer, continuing the security contract under an adjusted notional amount (Gorton, 2008).

Pricing of ABX is based on cash flows, which assess on potential delinquencies, payments and defaults (Fender and Scheicher, 2008). ABX pricing reflects the risk perception on the loans that are being hedged. In this sense, FICO scores, loan-to-value ratios and expectations on the prices of the assets used as collaterals, among other factors, are taken in consideration.

ABX prices are considered as a measure of subprime market stability. Hence, they also work as clearing prices that allow for symmetry of information among market participants by providing trends that may not be readily available to all investors in the form of market reports (Gorton, 2008).

Indeed, upon the crisis, ABX prices were followed closely to monitor market health and forecast on potential outcomes on the mortgage related securities and subprime loans, which was reflected in the sharp decrease in the ABX prices in 2007 (Fender and Scheicher, 2008; Gorton, 2008). Contrarily, ABX related to 2005 originations, when the housing market showed a steep increase in mortgage issuances and in assets prices, reflected better credit quality and expectations (Fender and Scheicher, 2008); hence, their prices were stronger as compared to those tranches of ABX issued at the beginning of the financial market downturn.

However, pricing on the ABX could receive signals other than those related to the subprime market. For instance, between January and March 2008, decreases in LIBOR propelled a fall by the ABX prices, as these are determined on a present value using such rate. Another example is the trading of an interest-only coupon, which was based on a perception of complete writedowns at the beginning of 2008 (Fender and Scheicher, 2008), in which case there was an overestimation of risk and misinformation embedded in the ABX prices for various tranches.

Moreover, changes in interest rates levels and monetary policy impact the pricing of structured finance products. Variations in the LIBOR rate affect present value, as stated, and also U.S. liabilities, the LIBOR-OIS spreads (an indicator of stability in the banking system) and expectations about monetary policy,

among other variables. Additionally, ABX reflects solely 5 percent of the MBS market, which has led to question whether the indexes are representative of the MBS and subprime markets.<sup>27</sup>

Therefore, pricing on hedging may include information that is not directly related to the transaction at hand and the perception of risk on the security. Changes in prices could be triggered by a variety of other drivers, such as capital inflows, investments objectives motivated by policies and trade deficits.

Additionally, as ABX were subject to shorting, the indexes could have impacted the housing market (Gorton, 2008), by propelling higher demand of MBS and consequently leading to a sharp need for new originations of derivatives and loans. Other factors such as risk appetite and liquidity perception influence considerably the prices on some of the ABX vintages, which was reflected particularly during the decline experienced since the second semester of 2007 (Fender and Scheicher, 2008).

As a consequence, the crisis was heightened by a misperception of risks and the propagation of fire sales. Trading on interest-only ABX coupons and the sharp fall in the index price led to forecasts that overestimated defaults and writedowns, contributing to the spiral that began in 2007. Hence, using tradable indexes to assess on market stability and to forecast its outcome is insufficient for the purpose of analysis. As with the VaR model, a single number or amount cannot explain the entire scenario portrayed by such a complex market structure, where different parties interact through intricate interconnections, applying various indicators and yields and engaging in a diversity of complex securitization products.

Moreover, when analyzing the securitization market, other drivers that may not be directly related with the financial market should be taken in consideration. Economic activity, employment, expansion in certain sectors, exchange rates, availability of funds and other macroeconomic indicators should be included to exercise caution and to obtain a complete report that would allow estimating potential trends in the economy and hence, in the securitization sector.

That is, the challenge faced by pricing models is that they may not reflect these influences appropriately, as they account mainly for fluctuations in the housing market and credit stability, rendering them insufficient as measures of the mortgage market (Fender and Scheicher, 2008).

## **5. Lowered Lending Standards**

According to some proponents, reduced credit requirements are either the main reason or a highly influential source of a subsequent housing bubble and the final crisis in the financial system (Tarr, 2010; Whealan, 2010; Kohn, 2010). Lenient underwriting was predominant within the subprime market, while it became apparent once house price appreciation slowed down<sup>28</sup>.

Mortgage credit requirements lowered in the past decades, as policies aimed at granting ownership opportunities to minority groups and to middle and low income individuals and families. Subprime mortgages increased in the years prior to the crisis (Gorton, 2008), as they were propelled by inflows that reached more than a trillion of dollars in capital available for those types of loans (Reinhart and Rogoff, 2008).

Homeownership grew approximately 3.5 times from the early 1990's until the year prior to the crisis. From 2004 through 2006, subprime originations experienced an accelerated increase. Furthermore, according to the 2007 Survey of Consumer Finances<sup>29</sup>, the minority group, composed by nonwhite and Hispanic households, received an increase of 26.1 percent in the median value of primary residence.

On the other hand, the policy objective seems to be distant from having been reached, partially because of the loan features through which lending was granted, which motivated objectives that did not align with home ownership, as explained further in the following sections. Additionally, the overall rate of

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<sup>27</sup> [http://www.bis.org/publ/qtrpdf/r\\_qt0806u.htm](http://www.bis.org/publ/qtrpdf/r_qt0806u.htm)

<sup>28</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>29</sup> Federal Reserve Board, "Survey of Consumer Finances 2007", <http://www.federalreserve.gov/pubs/bulletin/2009/pdf/scf09.pdf>

ownership for all groups of borrowers exceeded the rate for minority groups<sup>30</sup>, which leads to the conclusion that focus on low income individuals and families was shared with other goals in the real estate and financial markets, propelling escalation in ownership for sectors of the population to whom housing was attainable.

### ***Subprime mortgage loans***

The subprime market received greater public attention upon the crisis<sup>31</sup>. It represented 16.1 percent of all mortgages outstanding and 57% of all mortgages in foreclosure as of the third quarter of 2007<sup>32</sup>. Although subprime borrowing was the most affected through the crisis, spillovers impacted other types of loans, the securitization market, credit availability, spending and activity in the rest of the economy.

These implications on areas and sectors other than subprime borrowing are the main reason why correlation analysis between subprime originations and total lending cannot aid to shed light on the crisis. These comparisons are devoid of analysis on systemic risk effects that propelled outcomes and which transcended the mortgage lending scheme.

However, systemic layout could not have been present without one or more drivers that triggered its implications. Relying solely on the risk of spillovers as means to provide explanations for the crisis divests analysis from the root causes that led to such systemic consequences, meaning that spillover from market interconnections did not materialize into a crisis impromptu. As an example, a few major parties in the market could invest in a set of highly diversified risk bearing portfolios, which could add to market sustainability and stability if such connections were reviewed by regulations or if investment objectives were channeled to productive venues in economic activity. The same is true in cases in which connections among intervening financial institutions draw a close network. If portfolio or product default never materializes, the intricate connections are of no consequence. Hence, risk in itself cannot be assigned as a motive for market deterioration, but rather, as a potential or probable scenario that may be combined with other root causes.

In the case of the recent crisis, system risk would have been avoided if the housing boom had continued to remain stable and if features in the mortgage market had been of a different kind, impacting economic activity benignly. In this case, if market demand had driven construction preeminence over existing stock of houses, a period of wealth could have lasted a medium term given the multiplying effect that the construction sector has over other industries. This was indeed the case shown by the increase in house starts evidenced in years prior to the crisis, although this scenario did not occur because of other factors present at the time, which varied depending on the location of a given real estate market.

In searching for root causes, subprime lending features have been considered in combination with systemic risk. Subprime loans are regarded as misleading (Estrada, 2010) because they provide expectations of high returns, while they represent an investment with a high potential of default. This is due to the fact that subprime lending involves loans to creditors with at least any of the following features: low FICO scores (620 or less), insufficient or inexistent credit history, limited down payment and lack of sources of income or absence of information for income verification purposes (Gorton, 2008).

Due to borrowers' high risk profile, subprime lines bear higher rates than those on the prime or jumbo lines. For instance, as of September 2007, a subprime ARM loan was offered at a rate of 8 percent, against a 30-year fixed prime mortgage rate of 6.2 percent<sup>33</sup>. Usually, subprime lines carry interest rates that are 2

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<sup>30</sup> Minority groups were represented by nonwhite households and families from Hispanic origin, households presenting low income, households single headed by a person aged less than 45 years old who is unemployed or retired with less than some college education, as well as those living in the Northeast or the West of the U.S.

<sup>31</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>32</sup> Mortgage Bankers Association, "Delinquencies and Foreclosures Increase in Latest MBA National Delinquency Survey", Press Release National Delinquency Survey, December 6, 2007, <http://www.mbaa.org/NewsandMedia/PressCenter/58758.htm>

<sup>33</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

percent higher as compared to jumbo or prime lines<sup>34</sup> and they are in average 4 points apart from other benchmark rates<sup>35</sup>.

From a credit analysis standpoint, lenders could have thought subprime loans to bear less risk in times of house price increase, as it appeared to be the case in the period from 2005 until the rise of the crisis. About 10 percent of the total subprime loans during the house market boom could have qualified as conventional lines, which as mentioned, present lower expectations of default and carry more favorable terms<sup>36</sup>. Furthermore, because of loan features on ARM loans, which are explained further below, if expectations on home price increase were persistent, subprime borrowers were enabled to refinance at the end of the fixed period, decreasing the risk level associated with the borrower's profile.

However, from a financial institution's standpoint, this view on how to analyze risk is untenable, the main principle being that the principle for granting credit and loans in general is that approvals should not be propelled by covenants as a source of repayment or as an indication of potential payment capability, but rather, as a potential rescue in times of default. As a covenant does not replace a loan but it only better it, a collateral should not improve a decision towards repayment perspectives on a given line. Instead, a borrower's profile is expected to be analyzed beyond the availability of potential covenants and should be based on the mortgagor's capability of repayment.

Focus on the covenant as a mean of repayment instead of on the borrower's income and credit history implies aspirations of default rather than of holding healthy loans in the ultimate bundled securitization portfolios. This seemed to partially represent an incentive behind loan origination as long as the default occurred after the fixed period, mainly because a borrower that did not continue paying their loan under the ARM scheme could opt to cash out the difference between market value and the total owed. Upon such decision, if market value was to increase, as it were the case and expectations prior to the crisis, the mortgagor would achieve a source of cash from the sale of the equity, while loan payment was achieved. However, the downside to this is that no extra revenues would be generated for the institution on that loan, such as the servicing fees. Conversely, if house prices were to decline, as it was the scenario triggered by the crisis, the excess in house inventories would push market prices down, driving institutions with portfolios composed by real estate to an underwater stage<sup>37</sup>. This would lead to the fire sales and other consequences that were triggered upon the financial market turmoil. However, a default during the fixed period rendered a different situation. In that case, the financial institution holding the loan would encounter serious decreases in portfolio ratings, making the securities unviable. These characteristics, combined with the issues mentioned in the credit ratings activities, led financial institutions to an override of focus on the potential risk of default by a borrower during the fixed period.

From a FICO perspective, as of the beginning of 2007, approximately 20 percent of all consumers in the U.S. had credit scores of 620 or less, and therefore would have qualified as subprime borrowers. From these consumers, 13 percent engaged in mortgages, and from the latter, 80 percent did so through ARM loans<sup>38</sup>. About 80 percent of these loans were structured as 2 year ARM (Dodd, 2007).

According to Gorton (2008)<sup>39</sup>, taking into account all originations in the period 2001-2006, approximately 14 percent were subprime, 50 percent of which were issued in the two years prior to the crisis. From the total subprime originations in the years 2001-2006, about 72 percent were securitized, half of which were introduced in 2005 and 2006, showing the latent growth in the securitization market prior to the crisis. Hence, a high percentage of securities included subprime loans, incurring in the risks described earlier.

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<sup>34</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", March 23, 2007, <http://www.npr.org/templates/story/story.php?storyId=9096735>

<sup>35</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>36</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.

<sup>37</sup> This is the case in the real estate market upon the crisis. Real estate prices experienced sharp declines in the years after the crisis, as shown in the housing bubble section. Additionally, an excess of 2.3 million units remain vacant as of 2010 as compared to 2006. "Housing Vacancies and Homeownership", U.S. Census Bureau, <http://www.census.gov/hhes/www/housing/hvs/historic/index.html>

<sup>38</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.

<sup>39</sup> Page 6, Table 4, "Mortgage Originations and Subprime Securitization", <http://www.nber.org/papers/w14398.pdf>

This was heightened by the entangled market connections in regards to products and parties, including systemic risk, along with the OTC method of trading, which prevented knowledge on the parties involved in the transactions.

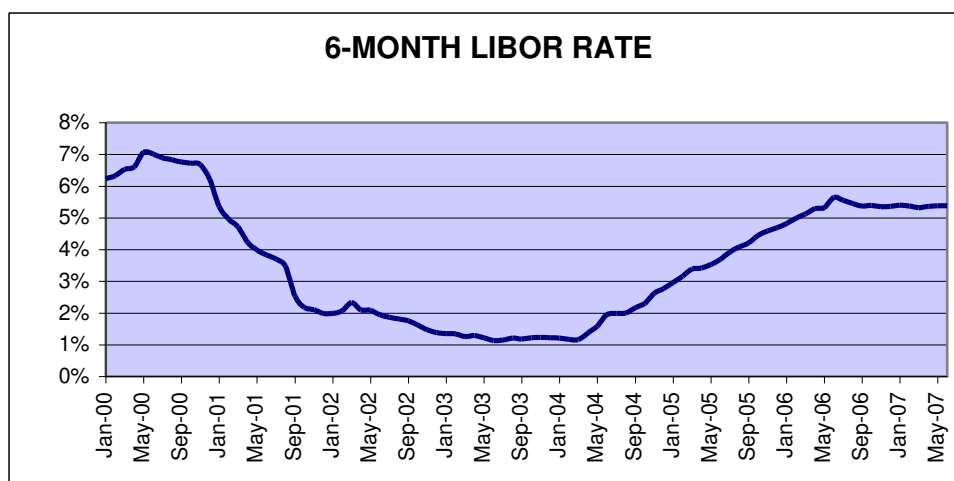
The increase in both, originations and share of total originations for subprime loans started in 2003 and peaked during the years prior to the crisis, which has placed the subprime market as a potential reason for the crisis<sup>40</sup>. In conjunction to subprime lines there were the Alt-A mortgages, which differed from the former mainly in the type of documentation presented at underwriting and the credit scores sought, remaining nonetheless as high risk lines similarly to subprime loans. Despite the risks present in both subprime and Alt-A loans, securities and derivatives that included these loans traded in the primary and secondary markets, with the implications on asymmetry of information explained previously.

Overall, the market for these loans developed in great magnitude during the period 2000-2007, in which subprime outstanding loans increased 800 percent in dollar amount, whereas mortgages issued by the GSE increased only 100 percent. In the years previous to the crisis both subprime and Alt-A reached 30 percent of the total market originations (Gorton, 2008). These statistics paired up with systemic implications rendered a mortgage and financial market lenient to risk taking.

### *Adjustable-mortgage rates*

In the aim to secure refinancing under ARM, which represented the vast majority of loans granted to subprime borrowers, lenders ensured low exposure to risk by scheduling a short fixed period, upon which the refinance feature would follow. Lenders expected borrowers to refinance, a component that was key in subprime mortgages. This was achieved by including prepayment penalties that were onerous to borrowers, which was the case of approximately 70 percent to 80 percent ARM loans (Gorton, 2008). Whether this practice should have been considered predatory lending, as explained in the moral hazard section, or accepted market practice, remains a debate.

ARM gave the appearance of affordable payments in the first 1 to 3 year period, a term that depended on the plan. After the initial fixed period, monthly payments varied and were tied to a rate comprised of LIBOR plus a spread. This feature made honoring the commitment unaffordable to subprime borrowers (Astley et. al, 2009), as payments would increase in at least 40 percent during the variable period<sup>41</sup>. As mentioned in the securitization section, of the total subprime lending as of the beginning of 2007, roughly 80 percent was originated under ARM loans<sup>42</sup>. Given that subprime loans were highly securitized, as described in the section related to MBS, a connection is drawn between ARM features and the securitization market, and through the latter, between the former and the housing bubble, the shortcomings in regulation and the credit rating features on securities and their issuers.



<sup>40</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>41</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.

<sup>42</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op.cit.

As seen from the previous graph, LIBOR rates escalated from 2004 through 2006, leading to higher mortgage payments upon the scheduled fixed period. Moreover, LIBOR increased roughly 100 percent, from approximately 2 to 3 percent, in the second half of 2004, when home prices were on the rise, until 2005, when home prices were at their peak. This reveals the less attractiveness in ARM for subprime borrowers and the subsequent deceleration in subprime loan originations in such period. As discussed further below, this bore an impact on delinquencies, as well.

It is worth considering that the sole offer of ARM loans did not present an issue per se. This type of line can be viable for borrowers who expect an increase in their income upon a certain period, such as employees with programmed salary upgrades. The reason that led ARM to be a one of the root causes for the crisis was the appointment of such loans to borrowers with fixed income and to subprime mortgagors, some of whom were on disability or retirement<sup>44</sup>, and at times by means of a high loan-to-value ratio, which made payments subsequent to the fixed period unbearable. As observed in the following table with different types of ARM, on a loan sample and at an equal initial interest rate, payment increases under ARM would render no equity or even negative equity to the borrower, which defeated the homeownership purpose. Moreover, liability wise, the mortgagor would remain with the same balance or even a higher loan after a 5 year period under an ARM, expanding indebtedness in households. These reasons, along with the features explained previously, prevent ARM from being offered as a mechanism to aid homeownership in the middle and low income groups.

### SAMPLE MORTGAGE COMPARISON

(No actual loans available)

Sample Loan Amount \$200,000 - 30-Year Term - Interest Rates for Example Purposes Only			
	Fixed Rate Mortgage (7%)	5-Year Interest-Only ARM (initial rate 7%; maximum rate 12%)	Payment Option ARM (rate in 1st month 2%; variable after 1st month (starting at 7%; maximum rate 12%)
<b>Required Monthly Payments</b>			
Years 1-5	\$1,331	\$1,167	\$739-\$987 (increasing annually)
Year 6 - if rates don't change	\$1,331	\$1,414	\$1,565
Year 6 - if rates rise 2%	\$1,331	\$1,678	\$1,859
Year 8 - if rates rise 5%	\$1,331	\$2,094	\$2,319
<b>Effect on Loan Balance and Home Equity</b>			
After 5 Years, How Much Will You Owe?	\$188,263	\$200,000	\$221,486
After 5 Years, How Much Home Equity Have Your Loan Payments Built?	\$11,737	\$0	(\$21,486)

Source: Office of the Comptroller of the Currency<sup>45</sup>

Furthermore, liabilities for households did not only worsen because of the types of loans, but also because of the original purpose for which borrowers assumed these loans. Most subprime borrowers engaged in mortgage loans with the aim to refinance consumer spending, as such objective appeared as a potential outcome at the time of loan application<sup>46</sup>. This put a borrower's profile at risk, as it implied consuming beyond income level, which made mortgage lines unaffordable all the more and led credit profiles to become unsuitable for mortgage borrowing.

<sup>43</sup> ARM Index Values – Fannie Mae LIBOR, <https://www.efanniemae.com/sf/refmaterials/libor/index.jsp>

<sup>44</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op.cit.

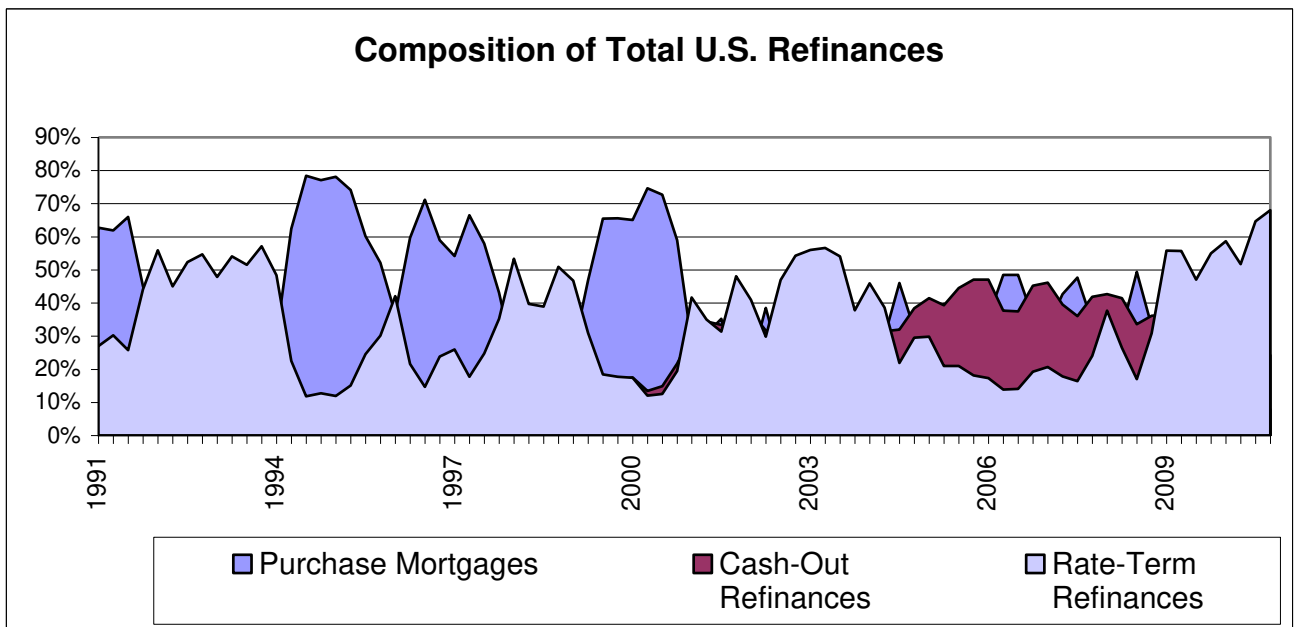
<sup>45</sup> "OCC Makes Available Downloadable Consumer Illustrations of Information on Nontraditional Mortgage Products", July 5, 2007, <http://www.occ.gov/news-issuances/news-releases/2007/nr-occ-2007-68.html>

<sup>46</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.; Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit. The latter calls subprime lines "bridge loans" because they are not intended to be permanent and they are used to finance other purposes, such as rebuilding payment history.



Some authors state that these conditions seem to have been a feature expected by originators (Gorton, 2008). The refinance option, which led to volatility and uncertainty about future mortgage payments and defaults, was a component that combined with expected growth in house prices, allowed for decrease in risk exposure by originators and, subsequently, by loan holders, leading to the expansion of origination and the securitization market. Ultimately, this scenario was deemed to fail as mortgagors' profiles did not bear less risk. Roughly 83 percent of the subprime borrowers as of 2005 performed cash-out refinancing, upon which they applied the liquidity obtained through their mortgages to repay other loans<sup>47</sup>. Furthermore, within a 2 year period, two thirds of the mortgagors' would reload their credit card debt<sup>48</sup>. Hence, mortgage loans were a means of liquidity to further consumer spending and indebtedness.

The following graph reflects the purposes described, as cash-out was the leading type of refinancing option exercised by borrowers in the years prior to the crisis and during the term of house prices escalation in 2005.



Data source: Federal Housing Finance Agency (FHFA)<sup>49</sup>

From a household standpoint, flexibility in lending combined with subprime borrowing led to the escalation of their credit opportunities, which in turn delivered a sense of higher wealth heightened by the increased availability of funds and by global imbalances, as explained in the respective section. This scenario, along with low delinquency rates at the time when real estate prices peaked<sup>50</sup>, that is, between the second half of 2003 and the beginning of 2006 (Taylor, 2008) as seen in the following graph, contributed to a period of confidence in the real estate market.

<sup>47</sup> Newsweek, "Credit we don't deserve", July 29, 2009, <http://www.newsweek.com/2009/07/28/credit-we-don-t-deserve.html>

<sup>48</sup> Center for Responsible Lending, "Risking Homes to Pay Off Credit Cards", November 2005, [http://www.responsiblelending.org/credit-cards/research-analysis/ip012-Risking\\_Homes\\_Credit\\_Cards-1105.pdf](http://www.responsiblelending.org/credit-cards/research-analysis/ip012-Risking_Homes_Credit_Cards-1105.pdf)

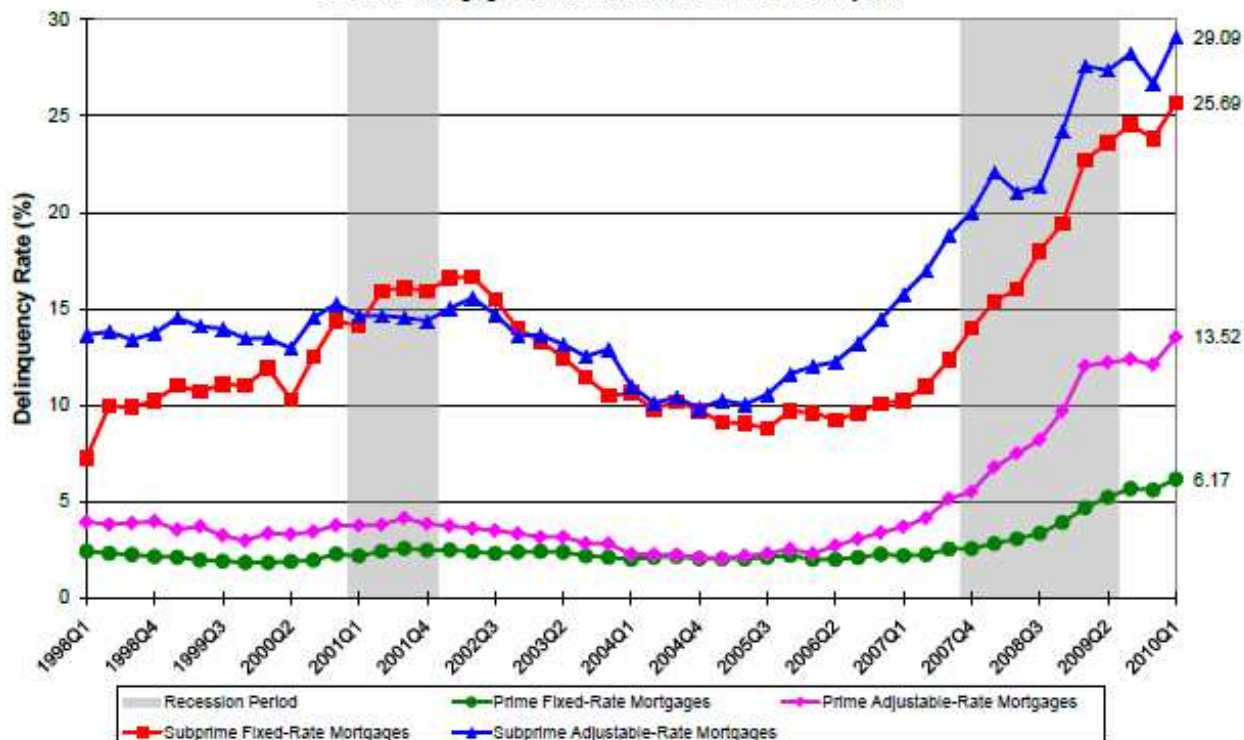
<sup>49</sup> "Loan Purposes for Periods through 2010Q4", <http://www.fhfa.gov/webfiles/19812/loantype.xls>

<sup>50</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

## U.S. Residential Mortgage Delinquency Rates

Seasonally Adjusted Data, 1998Q1 to 2010Q1

Source: Mortgage Bankers Association / Haver Analytics



Source: Federal Reserve Bank of Richmond<sup>51</sup>

Other borrowers were unable to refinance. As explained previously, ARM tied interest rate volatility to monthly payments honored upon the fixed period (usually of 2 to 3 years, although 1 year-ARM were offered), which was combined with high penalties of prepayment during a term exceeding the initial fixed rate period so as to discourage early refinancing. This rendered borrowers in a position in which, if the 6-month LIBOR rate was to increase substantially, as it was the case during the years prior to crisis, they would not be able to afford mortgage payments, upon which the lender could execute the collateral. With the decline in house prices upon the crisis and the raise in LIBOR rates, defaults and foreclosures became unavoidable.

Delinquency rates on ARM issued to prime borrowers remained approximately unchanged from the end of the 1990's and increased at a higher rate than subprime upon the crisis (Demyanyk, 2008). On the contrary, subprime ARM represented roughly twice the delinquency rate as compared to prime loans in the two years prior to the crisis. All delinquencies on ARM rose abruptly upon decline in house prices. In 2006, filing for foreclosures had grown 42 percent as compared to the previous year, which some proponents relate not mainly to housing depreciation, but to the abrupt increase in payments on ARM mortgages due to the reset feature (Dodd, 2007). As of the third quarter of 2007, when the crisis had already realized, ARM foreclosures for both, prime and subprime, represented 61.7 percent of all foreclosures, whereas loans to subprime and low income borrowers reflected 22.4 percent of all loans outstanding.

<sup>51</sup> Federal Reserve Bank of Richmond, "Market, Trends and Statistics", [http://www.richmondfed.org/banking/markets\\_trends\\_and\\_statistics/trends/pdf/delinquency\\_and\\_foreclosure\\_rates.pdf](http://www.richmondfed.org/banking/markets_trends_and_statistics/trends/pdf/delinquency_and_foreclosure_rates.pdf)

## Loans Outstanding and Foreclosures Started

	Percent of Outstanding Loans	Percent of Foreclosures Started
Prime Fixed	63.1%	17.6%
Prime ARM	14.5%	18.7%
Subprime Fixed	6.3%	12.0%
Subprime ARM	6.8%	43.0%
FHA & VA	9.3%	8.7%

*Source: Mortgage Bankers Association<sup>52</sup>*

In the period from 2001 through 2005, the lowest subprime delinquency rate nationwide in the U.S. was approximately 4 percent, whereas as of September 2007 the median rate was 17.4 percent, with a range of 7 to 30 percent, showing a fast-track downturn in the subprime mortgage market<sup>53</sup>.

As it regards to timing, it is important to take into account the lag between mortgage performance and house pricing (Gorton, 2008), another indicator when addressing herd behavior for a variety of reasons. Most borrowers do not act immediately as asset prices vary for different reasons. Firstly, there is lag in information release. Some data, such as the Case-Shiller Index, appear every two months. The House Price Index (HPI) is published quarterly. These are the two main indices, although a third one, the IAS 360 is released monthly. Additionally, as for many households their homes are their most important investments<sup>54</sup>, it may take a certain period to set forth on financial related decisions. Alternatively, perception of a continuous housing boom provided expectations of stable house appreciation, as explained in the housing bubble section, which agrees with the premises aligned by herd behavior. For these reasons, although in the first half of 2006 house prices plunged, it was not until the beginning of 2007 that both, prime and subprime delinquencies, began to peak.

### ***Flexible lending and the ownership objective***

As mentioned, the ARM structure a priori did not pose a disadvantage, but rather it was the combination with high risk profiles, which led to eventual defaults. Some authors (Tarr, 2010; Gorton, 2008) agree that the decline in lending standards was the means to the ownership policy objective. This was especially implemented through the active participation of the GSE, Fannie Mae and Freddie Mac, and by way of revising the Community Reinvestment Act (CRA) in the 1990's.

The amelioration of down payment percentages, which used to be set at the minimum threshold of 20 percent, and the acceptance of lower FICO scores and lenient documentation, resulted in loans with lessened expectations of repayment. In addition, banks were periodically evaluated on their compliance with the CRA, assessing whether lending quotas to minority groups and low income borrowers were met and making them subject to enforcement through potential penalties. Through their lending activities, financial institutions were “encouraged to meet the credit needs of all community members, including residents of low- and moderate-income neighborhoods”<sup>55</sup>. Noncompliance with the CRA could lead to administrative and monetary penalties imposed by the OCC<sup>56</sup>.

Conversely, some authors consider that low FICO scores were not material in creating the crisis because delinquency rates in 2007 show nearly 300 percent increase for mortgagors with high FICO, whereas the group rated low increased approximately 100 percent (Demyanyk, 2008). However, the same data for the

<sup>52</sup> Mortgage Bankers Association, “Delinquencies and Foreclosures Increase in Latest MBA National Delinquency Survey”, op. cit.

<sup>53</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>54</sup> The Homestar Fact Sheet presented by the White House states that “this program will help them [households] save hundreds of dollars a year in energy costs while improving the comfort and value of their most important investment – their homes”, <http://www.whitehouse.gov/the-press-office/fact-sheet-homestar-energy-efficiency-retrofit-program>

<sup>55</sup> Office of the Comptroller of the Currency, “Community Reinvestment Act (CRA)”, <http://www.occ.gov/topics/compliance-bsa/cra/index-cra.html>

<sup>56</sup> Office of the Comptroller of the Currency, “Home Mortgage Disclosure. Comptroller’s Handbook”, February 2010, <http://www.occ.gov/static/publications/handbook/hmda.pdf>; Center for Responsible Lending, “Risking Homes...”, op. cit.

years 2005-2007 show that lower FICO scores present twice the delinquency rate as compared to higher level FICO, placing a build up on delinquencies and foreclosures in anticipation to the crisis.

The aim of extending mortgage lending to households presenting lower income to stimulate homeownership has been challenged by some surveys. Particularly, according to the CRL, 83 percent of subprime borrowers opted for cash-out refinancing as of the end of 2005. In addition, a typical subprime borrower applied to a mortgage as a source of cash inflow to manage credit card debt and other expenses<sup>57</sup>. From 2000 through 2004, equity withdrawals by prime and subprime borrowers increased 270 percent<sup>58</sup>.

Eventually, the ownership objective was not met by the mortgage design that prevailed for subprime borrowers. Mortgage loans appear to have been applied as a source of liquidity for borrowers that did not have the necessary credit background to apply to other types of loans. Features on ARM loans paired up with expectations on higher house prices led the policy goal go astray. Mortgages became a source of higher indebtedness for households and a propeller for the victimization of borrowers into potential predatory lending schemes, as explained in the moral hazard section, which resulted in undermining situations for personal finances and worse FICO scores in the long run.

Flexible loans diversified into other types of lines, such as interest-only, extended and negative amortization lines and pay-option loans. These increased rapidly in the period 2002-2006 among the subprime and Alt-A borrowers, suggesting that mortgagors were inclined to assume loans that considered short-term refinance features, through which they could benefit from the expected increase in house prices. Under this scenario, regulatory oversight that could have prevented this application of mortgage loans should have been considered a priority (Bernanke, 2010).

Subprime flexibility in lending expanded then to the rest of the population. As lenders modified their standards to the low and middle income groups, the effect of lenient underwriting requirements stretched out to other borrowers who were not only allowed employing less cash on down payments, but also could take on multiple loans, including the revolving lines known as Home Equity Lines of Credit (HELOC), which are typically at a variable interest rate. Eventually, the initial appreciation in asset prices, which was sought to hedge high risk mortgages, grew out of proportion (Gorton, 2008), igniting real estate prices.

House price appreciation was caused by a diversity of drivers, as covered by the following section. Lending practices or capital inflows, as well as low domestic interest rates in the U.S. and the expansion of the securitization market are factors that are usually attributed to the cause of house price acceleration and the peak in appreciation in the years prior to the crisis. As the housing boom created a sense of increased wealth (Bernanke, 2005), borrowers appeared to have led speculative decisions<sup>59</sup>, especially as it regards to the management of ARM loans and prepayments in order to obtain liquidity. This is also in line with the mentioned correlation between increasing delinquency rates and decreasing or deceleration in house prices.

Some authors state that other lending incentives could have been offered in order to aid homeownership. A current practice is the deduction of interest from income tax, although this is limited by the fact that most low and middle income tax payers pay little tax or are not required to pay based on the level of their earnings (Tarr, 2010). Therefore, tax deduction rules on housing do not appear to be substantially beneficial in the fulfillment of the ownership objective for the low and middle income population.

Conversely, requiring a larger stake of cash from borrowers could decrease potential defaulting and foreclosures, since an owner that has invested his or her own savings in a particular asset could be encouraged to protect the investment through a sense of belonging to the house that they have purchased (Tarr, 2010). The question about down payments was heightened during the crisis (Aumann, 2010). A raising number of borrowers incurred in strategic defaults, that is, they relinquished their homes although they could afford monthly payments. The decline in house prices led certain borrowers to be underwater.

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<sup>57</sup> Newsweek, "Credit we don't deserve", op. cit.

<sup>58</sup> Center for Responsible Lending, "Risking Homes...", op. cit.

<sup>59</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

As of the end of 2009, estimates showed that approximately 5.3 million households had mortgage debt that exceeded the market value of the underlying assets in at least 20 percent, from which roughly half of the borrowers had 50 percent less home value as compared to the remaining loan balance<sup>60</sup>. The same data show that strategic defaults represented around 18% of all mortgage defaults in 2008, as compared to less than 4% in 2005.

On the other hand, raising a 20 percent down payment could require many households an average of 14 years to be able to apply for a loan, which could be detrimental to the benefits generated by homeownership<sup>61</sup>. Ultimately, homeownership as a first policy priority should encompass consumer protection, as well as supervision adapted to market's design and proportions, taking in consideration the repercussions of the housing market on other indicators of economic activity.

Moreover, other authors (Tarr, 2010) assign the state of the regulatory framework at the time as the leader that provoked the release of constraints to meet the homeownership objective, which was designed as an alternative to avoid regulating the GSE and allowing the ownership objective as their mission to overcome the difference between the unregulated government enterprises and the private sector. Subsequently, some of the ownership initiatives empowered by the GSE were applied to achieve regional acceptance from political parties and were imposed on the financial institutions, which were measured on their compliance.

### ***The housing bubble***

Homeownership is considered a valuable opportunity for households, as it provides stability and financial safety (Dodd, 2007). As mentioned previously, house ownership represents the most important investment achieved by households. In the U.S. alone, house wealth from primary residence represented 31.8 percent of the total household assets in 2007<sup>62</sup>.

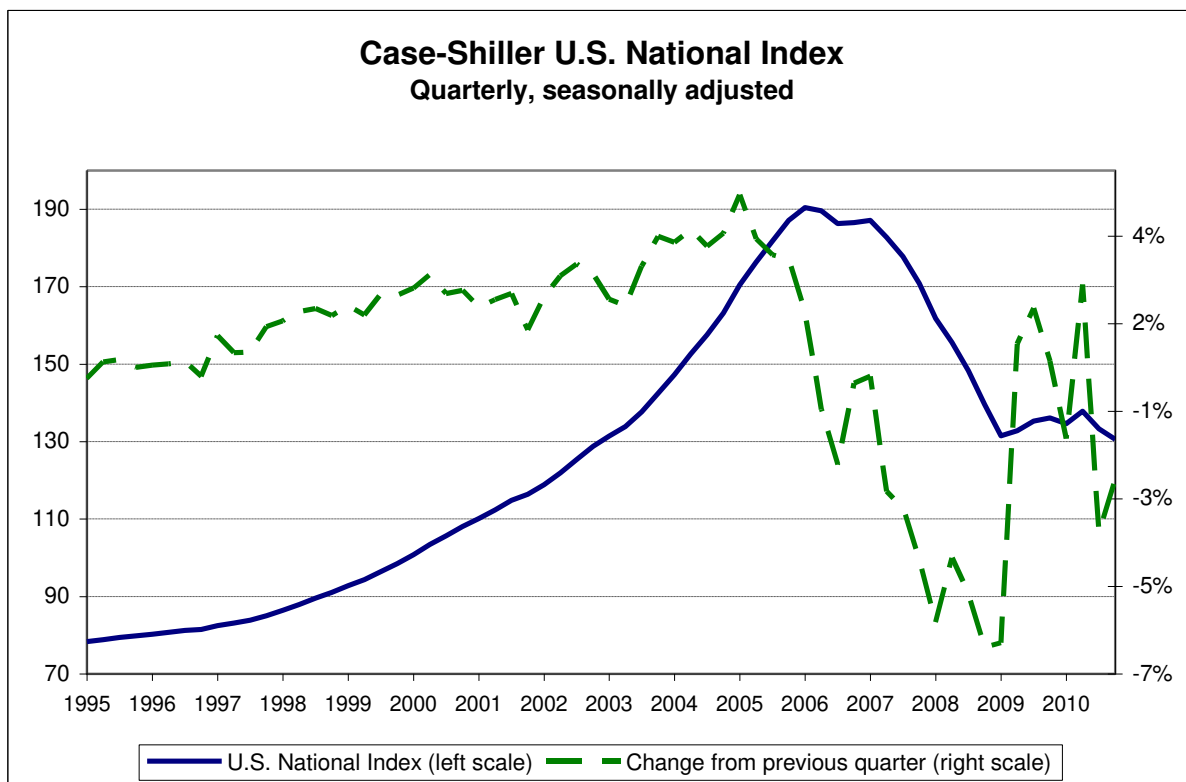
Homeownership as an objective suffered deviations. Lenient underwriting standards, along with availability of funds from inflows to the deficit-bearing economies and decreasing interest rates drove what is known as the housing bubble and also as the housing boom. Consistent increase in demand for housing pushed prices up, resulting in an average price increase of 54.4 percent in the period from 2001 through 2005 (Gorton, 2008), whereas in 2004 and 2005 the growth was 15 and 17 percent, respectively. The ignition of such appreciation is placed in the late 1990's, with increase rates reaching 7 to 8 percent annually (Bernanke, 2010). This scenario can be observed in the following graph, where the Case-Schiller Index is presented on its quarter-over-quarter variation, as well as on the U.S. nationwide index.

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<sup>60</sup> Wall Street Journal, "Debtor's Dilemma: Pay the Mortgage or Walk Away", December 17, 2009, <http://online.wsj.com/article/SB126100260600594531.html>

<sup>61</sup> Center for Responsible Lending, "Don't Mandate Large Down Payments on Home Loans", February 25, 2001, <http://www.responsiblelending.org/mortgage-lending/policy-legislation/regulators/low-downpayment-factsheet-final.pdf>

<sup>62</sup> Federal Reserve Board, "Survey of Consumer Finances 2007", op. cit.



Data source: Standard & Poor's<sup>63</sup>

Despite the initial assessment that the increase in house prices was temporary or regional (Bernanke, 2010), the implications that the persistent asset appreciation had in the financial market and in economic activity upon the crisis led to a recessive state with unwanted consequences. The constant confidence in the housing market and in rising asset prices were contemplated as persistent conditions, heightened by the sense of wealth experienced by households. In addition, interest rates contributed to the development of an optimistic real estate market, although their effect on the housing bubble has been considered in different degrees<sup>64</sup>.

The momentum created upon this sense of permanent wealth impacted the expansion of ARM mortgages, as asset growth and low interest rates made refinancing prospects appealing. Subprime and Alt-A loans became attractive as a means to profit from a chance to homeownership, at the same time that lending standards became more permissive.

Moreover, some mortgagors acquiesced that their mortgage and financial path would not allow them to ultimately acquire the asset, which was shown in the exercise of the cash out option. For a group of households, the virtual assurance that the house under purchase would increase in value created aspirations to sell the asset within a few years in order to make a profit and obtain extra liquidity. This becomes clear when most of the subprime borrowers had entered into ARM mortgages in order to receive funding for their credit card payments and to cover other debts, as shown by surveys from the Center for Responsible Lending. In 2004, 83 percent of the subprime mortgages and 47 percent of prime borrowers refinanced through cash-out<sup>65</sup>.

Then, there were incentives for both, lenders and borrowers, to ignite subprime mortgages. For lenders, and as mentioned previously, subprime borrowers' profiles became less risky as housing appreciation accelerated. Additionally, the refinance feature triggered fees and other sources of revenue for brokers and

<sup>63</sup> Standard & Poor's S&P/Case-Shiller Home Price Indices, <http://www.standardandpoors.com/indices/sp-case-shiller-home-price-indices/en/us/?indexId=spusa-cashpidff--p-us--->

<sup>64</sup> Bernanke (2010) states that the effect was limited, whereas other proponents, such as Taylor (2008), attribute higher emphasis on monetary policy at the time of the housing bubble. These positions are explained in the interest rate section.

<sup>65</sup> Center for Responsible Lending, "Risking Homes...", op. cit.

other participants in the financial market (Dodd, 2007). For a large group of borrowers, instead, the appeal was the ultimate access to prepayments, which led to either refinance or to the sale of the property. The subsequent cash-out provided the opportunity to obtain liquidity for consuming purposes.

Upon house deceleration, the incentive to cash out was deemed disadvantageous, leading to the increase in delinquencies, foreclosures and strategic defaults described previously. Given that most subprime loans were issued under ARM conditions, after a 2 year fixed period 2003 originations would encounter a 2005 house market, when property prices were maxing out their acceleration. Conversely, later originations, such as those commencing in 2006, encountered a property market that was already slowing down, which presented mortgagors with decreasing prospects within a few months into the origination of the loan. This provoked borrowers to be more avid for cash out before prices plunged any further. Therefore, the slowdown in house appreciation was, for some proponents, a predictor of subprime delinquency (Doms et. al, 2007).

However, views that place the reason for the crisis in the ARM cash out feature are not sufficient to explain the ignition of the downturn in the financial market and in the real economy. The source is portrayed through the decline in house prices, or the real estate market slow down, but this rationale does not propose an explanation in regards to the origin of such deceleration in price increase and the eventual fall in property prices.

If cashing out was the major cause for the crisis, borrowers would have had incentives to continue acting similarly if house prices had not declined, which follows that the subprime market would have continued if the housing market had not fluctuated downward. Hence, the subprime mortgage crisis is better related to the decline in house prices (the independent variable) than to loan cash out (the dependent variable). Then, the independent variable, which is considered an exogenous variable under the view that cash outs originated the crisis, is not explained, leaving the model deprived of analysis.

Furthermore, there is lack of correlation in timing between subprime originations and the increase in house prices. The housing market began to witness price escalation in the beginning of the 1990's, whereas subprime mortgage originations did not exceed 8 percent of all originations at the time and began to climb sharply in the year 2004, approximately 14 years later, as shown in previous graphs. Hence, in order to link the subprime market with house price increase, one or more additional factors were present. These variables are represented by lenient underwriting, large availability of capital or interest rates volatility, among the other causes for the crisis as discussed throughout this document. As mentioned, relaxed underwriting requirements are deemed to have been influential in the subprime meltdown, along with other macroeconomic conditions, such as unemployment and the increase in health expenses, in conjunction with high loan-to-value ratios<sup>66</sup>. In consequence, it becomes apparent that the interconnection of these drivers can explain the financial crisis, as opposed to the designation of a particular origin.

Eventually, house prices began to decline rapidly from the second half of 2007, while delinquencies started to increase from the first half of 2006. The slowdown in house appreciation by the end of 2005 caused the market to be less profitable for ARM borrowers, to the point that it was unbearable for them to make payments on mortgages they could not extract equity from.

In fact, the Federal Reserve Bank of San Francisco found correlations between the decline in property prices and fluctuation in delinquency rates in subprime loans. Houses became in many cases less valuable than the loan that mortgagors had entered into, which was paired up with high loan-to-value ratios, meaning that down payments had been scarce. In time, it became a less profitable market for mortgagors to continue making payments on monthly mortgage installments.

## **6. Insufficient Regulation**

The spillovers that affected investors, financial institutions and economic activity heightened discussions over financial regulation and the opportunity to revisit it. Pervasive rules and controls could have avoided

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<sup>66</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

the credit cycles that resulted in the credit collapse (Bean, 2008), as the state of regulation in the financial market was a major cause leading to the crisis according to some proponents (Blanchard et. al, 2010). The supervisory role of some agencies has been questioned mainly in regards to the verification of loan patterns and conditions<sup>67</sup>, as well as to the levels of risk exposure allowed to market participants and to lending and securitization practices aiming at short term revenue generation<sup>68</sup>. In analyzing financial crises historically, little or lack of regulation appear to precede financial market downturns (Reinhart and Rogoff, 2008).

Some authors make a distinction between a housing versus a banking crisis, stating that the current meltdown was originated by the latter due to agency problems and portfolio structure (Kashyap et. al, 2008). Market participants approached high risk securities with a focus on short term results and with reliance on short term funding (Bean, 2008; Kashyap et. al, 2008). This propelled systemic losses once the crisis materialized, while the complexity of the financial system did not allow investors to perceive the risk related to potential spillovers due to the complex interconnections among entities (Gorton, 2008).

As explained under the securitization section, under the OTD model commercial paper issued to fund a CDO would in turn provide financing for warehouse loans, that is, for loans that had been originated but that were awaiting bundling and the subsequent sale in the secondary market. Concomitantly, the commercial paper that funded these loans would receive liquidity from mutual funds. Default by one of these products or by an institution participating in this array of transactions would deem the whole chain unsustainable, leading to the propagation of defaults. The following table shows the implication of this chain of events in the crisis.

**U.S. Financial Sector Writedowns on Residential Mortgages 2007-2010**  
**In Billions of USD**

	Estimated (1)		Banks	Insurers	Others	Total
	2008	2009				
From Loans	\$ 170	\$ 431	\$ 206	\$ 22	\$ 204	\$ 1,033
From Securities	\$ 580	\$ 990	\$ 604	\$ 99	\$ 287	\$ 2,560
<b>Total</b>	<b>\$ 750</b>	<b>\$ 1,421</b>	<b>\$ 810</b>	<b>\$ 121</b>	<b>\$ 491</b>	<b>\$ 3,593</b>

(1) Estimated by the Global Financial Stability Report, International Monetary Fund

*Data source: International Monetary Fund<sup>69</sup>*

For this reason, market supervision should be applied not only to individual institutions, but also across the market and by taking in consideration the interrelation among financial intermediaries (Bernanke, 2010).

On the other hand, regulation should encompass agency problems, explained in the moral hazard section. Because of corporate governance, equity is considered prime financing for a bank's management, at the same time that raising capital is a costly and challenging method of funding (Kashyap et. al, 2008). Moreover, investors that supply equity to a financial institution require higher yields because of the risk involved in corporate governance, which could lead to investment losses.

Conversely, short term investments are able to answer to corporate governance issues, for which a financial institution may be inclined to rely on this type of funding. This scenario, combined with the consequences on financing costs from increasing regulatory requirements on capital, create a dilemma for regulators.

<sup>67</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.

<sup>68</sup> The New York Times, "Merrill's Risk Disclosure Dodges Are Unearthed", August 9, 2010, <http://www.nytimes.com/2010/08/10/business/10merrill.html> ; "How Countrywide Covered The Cracks", October 16, 2010, <http://www.nytimes.com/2010/10/17/business/17trial.html?pagewanted=all>

<sup>69</sup> International Monetary Fund, "Global Financial Stability Report", [http://www.imf.org/external/pubs/ft/gfsr/2009/01/c1/table1\\_3.csv](http://www.imf.org/external/pubs/ft/gfsr/2009/01/c1/table1_3.csv)



These are the predominant reasons behind the contest between opting for more regulation or for more leverage. The risks analyzed are systemic failure and spillovers against higher costs of funds, and some propose to focus on proactively maintaining measures to safeguard the financial system in event of a crisis rather than on preventive standards (Kashyap et. al, 2008) in order to avoid the propagation of writedowns and the impact of downturns on the financial markets and on the rest of the economy.

### *The shadow banking system*<sup>70</sup>

Off-balance-sheet parties transacted actively in the financial market and were able to work with ample leverage and fewer requirements than banks (Blanchard et. al, 2010). These included the SPV, such as the SIV and the REMIC, which were explained previously.

This market feature allowed for lower reserves and unmeasured activity through off-balance sheet entities that were exempted from capital and liquidity requirements. SIV permitted banks and financial institutions to channel certain types of products through venues that would not affect their books, especially as they would not be required to value their portfolios at the mark-to-market method (Mauldin, 2007), which in turn decreased volatility and the recognition of losses. This scenario is known as the shadow banking system.

SIV were created by the end of the 1980's and as of July of 2007 there were 36 of these vehicles rated by Moody's and holding \$395 billion of assets under their management<sup>71</sup>. Upon the crisis, financial institutions decided to incorporate the SIV into their umbrellas by setting up funds of \$80 to \$100 billion to purchase them back (Mauldin, 2007). Some proponents discuss that this action was not compulsory to financial institutions and that it related to an implicit agreement between investors and the parent institutions on their guarantee in regards to agency limitations, creating a contract embedded in transaction prices (Gorton, 2008). However, a further compelling reason may be that legal issues may have pervaded in connection to the banks' relationship with their SIV (Mauldin, 2007). Additionally, disclosures about SIV influenced market perception, as lack of knowledge in regards to the extent of the assets involved and the potential losses associated with them eventually raised concerns regarding the sponsors' financial creditworthiness and stability, which was reflected in their stock prices. Ultimately banks were able to acquire the SIV, whose losses were not significant as compared to the banks' capital levels. Lack of action by the parent institutions would have presented a concern to shareholders, while the mark-to-market valuation on the banks' balance sheets showed transparency on losses and pursued the subsequent capital ratio adjustment (Mauldin, 2007).

Prior to the crisis, liquidity support to the SIV by their sponsors had a considerable impact on the credit ratings pertaining to CDO issued by the off-balance-sheet entities<sup>72</sup>. The SIV depended on obtaining high ratings in order to obtain their own funding at low cost. Moreover, rising from a downgrading action on an SIV would have presented a challenge in obtaining funding.

The SIV raise capital through issuance of notes and commercial paper and from their investment in securities, mostly on subprime assets. For an SIV, liabilities are short and medium term, whereas investment returns are long term<sup>73</sup>, posing timing constrains on their funding and liquidity. As a matter of fact, upon the crisis, all the SIV foregone liquidity issues and by the end of 2008 the remaining SIV had collapsed<sup>74</sup>.

In addition, SIV that issued CDO bore exposure to high risk mortgages, as explained in the securitization section. These risks, combined with short term funding, presented a mismatch against their standard medium and long term investments.

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<sup>70</sup> The name "shadow banking system" was coined by Paul McCuley in 2007.

<sup>71</sup> Reuters, "FACTBOX: Facts about structured investment vehicles", October 14, 2007  
<http://www.reuters.com/article/2007/10/14/us-factbox-sivs-idUSL145069320071014>

<sup>72</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>73</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

<sup>74</sup> Financial Times, "Sigma collapse ends shadow bank project", October 1, 2008, [http://www.ft.com/cms/s/0/19db6e24-8fff-11dd-9890-0000779fd18c.html?nclink\\_check=1#axzz1JcNjDVHd](http://www.ft.com/cms/s/0/19db6e24-8fff-11dd-9890-0000779fd18c.html?nclink_check=1#axzz1JcNjDVHd)

Mainly, the risk about the SIV was their lack of transparency on their holdings (Mauldin, 2007). Eventually, unrestrained market participants may have contributed to the occurrence of shocks (Reinhart and Rogoff, 2008) and to increased market risk, leading to the shadow banking system (Gorton, 2008).

### ***Capital and liquidity reserves***

Focus should be placed on a plan that would aid financial institutions in times of adversity (Kashayp et. al, 2008), while the intrinsic risk is the too big to fail pattern discussed in the moral hazard section.

Credit ratings and issues surrounding their designation affect in turn capital reserves requirements because the latter are calculated based on the weighted average of the risk on an entity's portfolio. This represents a major incentive for institutional investors to obtain high grades on their portfolios (Calomiris, 2009). Securities rated with AAA require 1.6 percent of capital reserves, whereas other products, such as commercial loans, would face a rating 5 times the level for triple A securities. Additionally, lower ratings on securities require higher level of funding, which in turn would be unavailable for potential revenue generation other than the interest honored by the Federal Reserve. Ultimately, tighter capital restrictions combined with independent ratings could have enhanced robustness in the financial market (Tarr, 2010).

Based on Basel II, banks are allowed to apply the standardized framework, which relies on credit ratings supplied by agencies, or on the IRB approach, for which the starting point is the institution's own internal models. These two methodologies face two issues related to the crisis, namely, limitations on credit ratings and on internal modeling.

The following table displays Basel II requirements for securitization, which show that under the IRB approach a triple A rating falling into the B category would have to raise up to 5 times the required weigh on risk.

**Risk Weights for Securitization Exposures**  
Percentages

Rating <sup>(1)</sup>	Standardized Approach	International Ratings-Based Approach		
		Senior Tranches + Internal Assessment Approach	Base Risk Weights	Non-Granular Pool
Aaa	20	7	12	20
Aa	20	8	15	25
A1	50	10	18	35
A2	50	12	20	35
A3	50	20	35	35
Baa1	100	35	50	50
Baa2	100	60	75	75
Baa3	100	100	100	100
Ba1	350	250	250	250
Ba2	350	425	425	425
Ba3	350	650	650	650
Below Ba3 and unrated	Deduction	Deduction	Deduction	Deduction

(1) For example, Moody's

In Baa1, Baa2 and Baa3 Standardized Approach, deduction if held by the originator.

*Source: Deutsche Bundesbank<sup>75</sup>*

Some proponents discuss setting up higher reserve requirements in normal economic times and moderating them during recession periods, as it is the case with Spain (Kashayp et. al, 2008). In 2000,

<sup>75</sup> Monthly Report September 2004,

[http://www.bundesbank.de/download/volkswirtschaft/mba/2004/200409mba\\_en\\_requirements.pdf](http://www.bundesbank.de/download/volkswirtschaft/mba/2004/200409mba_en_requirements.pdf)

Spain implemented a reserve system through which provisions are made based on future losses, as well as on current impairments (Bean, 2008; Kashyap et. al, 2008). This allows institutions to have more capital available when the need to raise funds materializes, as equity investors will consider higher reserves as a cushion for their protection. However, this option would increase the cost of lending during normal times, which could be cumbersome if the economy faces stable conditions for a long period, leading to a high level of immobilized capital at high cost (Kashyap et. al, 2008). This could be circumvented by creating a ceiling of cumulative reserve contributions and by revisiting reserve requirements periodically, assessing on the credit market needs for funding against a risk assessment approach for individual institutions, portfolio and the systemic risk associated to them, as well as forecasting on the basis of projected economic activity.

Ultimately, fire sales and credit crunches will not be avoided by raising reserve requirements, although the latter may be able to lessen the consequences of a financial crisis. As a general tendency, no single regulatory measure will prevent adverse situations (Kashyap et. al, 2008).

### ***Insurance***

Other authors propose that banks and financial institutions should be requested to purchase insurance against potential losses as a palliative to systemic risk, introducing insurance as an institutional option between insurance and higher capital requirements (Kashyap et. al, 2008). Institutions would have to purchase premiums from insurers, who in turn would have to maintain capital to affront losses when systemic defaults arise, in which case they would have to invest their capital as well, participating in a financial market exposed to systemic risk. Although CDS do not conform insurance strictly speaking, the issues related to their defaults should be prevented to avoid future meltdowns. The solution presented to this shortcoming is the purchase of Treasury bills by insurers for the amount of capital held locally and across borders by banks and financial institutions.

A consideration about the insurance strategy is whether insurers would find enticing to assume this role. There were two major banking crises in the past 20 years, along with a recession (2000-2001) and a stock market disruption (2001-2002). Historical data on market behavior could exacerbate losses on a potential due diligence analysis with regards to the viability of this strategy. Additionally, a potential downturn that could spin out of control through the insurance system is the propensity to risk borne by market participants, which could lead to systemic failure. Because the insurance would be paid in form of liquid funds, if a triggering event occurs, financial institutions will have less incentive to decrease their proneness to risk taking, which on the contrary could be exacerbated by the aim of funding further liquidity. This could lead to consequences similar to the too big to fail assurance.

The model presented by Kashyap et. al (2008) assigns the role of insurers potentially to pension and sovereign wealth funds. However, there could be a limit on how much participation these funds could have in the U.S. financial system. Sovereign wealth funds are almost entirely foreign<sup>76</sup> and given that U.S. regulations limit the amount of foreign investment in the country<sup>77</sup>, the implementation could face local restrictions and the results of protectionism, especially as transparency questions may arise<sup>78</sup>. Additionally, the effect of a given spillover could be transferred abroad, which could be undesirable for other economies, especially for those with history of market cycles.

Under the insurance model payout would be triggered based on losses from the group of banks that compose the financial system, by which point in time systemic risk would have triggered if a single

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<sup>76</sup> Only about 2 percent of the total world assets held by Sovereign Wealth Funds as of March 2011 pertain to the Americas. The Sovereign Wealth Fund Institute, <http://www.swfinstitute.org/fund-rankings/>

<sup>77</sup> “Laws Limiting Foreign Investment Affect Certain U.S. Assets and Agencies Have Various Enforcement Processes”, United States Government Accountability Office, page 8, <http://www.swfinstitute.org/research/GAOReport.pdf>

<sup>78</sup> Transparency is monitored by the Sovereign Wealth Funds Institute through the Linaburg-Maduell Transparency Index (LMTI). As of the third quarter of 2010, 28 out of 44 funds presented a rating of 6 or less on transparency, following a grading system of 1 equaling no transparency and 10, perfect transparency, as recommended by the Institute, <http://www.swfinstitute.org/statistics-research/3rd-quarter-2010-lmti/>

institution had significant market share, as it is the case with the U.S. In such case, fear of default could lead to a decline in the net worth belonging to financial institutions, as explained by Woodford (2010) in regards to the recent crisis.

Additionally, the insurance model stipulates that, upon the occurrence of the triggering events take place, payments would be honored based on cumulative losses. This structure includes periods when, although losses have taken place, insurance shall not be payable for not having reached the upper limit. This could lead to increasingly expensive premiums for certain institutions, which in turn would have to establish higher reserves (Kashyap et. al, 2008).

Therefore, the insurance model supplies an alternative in the event of a crisis in which institutions are left with less liquidity. The aim of such model is to decrease the propensity to risk by market participants. However, in the last crises, bailouts have worked in a similar manner, while risk profiles have not weakened. The current crisis serves as an example in addition to the 1987-1988 market failure. The too big to fail instance, along with the complexity of the financial market and the existing regulations related to foreign investment explain the reason why a sole solution may not minimize the repercussions of a financial crisis. Ultimately, the insurance option could achieve an improvement towards the risk associated with systemic failure, though it would not eliminate it (Kashyap et. al, 2008).

### ***A liquidity crisis***

Oppositely to the insurance and liquidity concerns explained previously, some proponents consider that the current crisis does not represent a liquidity issue. Some authors agree that liquidity ratios should be regulated on a permanent basis (Blanchard et. al, 2010; Kashyap et. al, 2008), as a limit on short-term borrowing. Risks associated with liquidity provisions relate to high exposure in the government balance sheet due to the transfer of private assets, as well as the reliance on statistical models to calculate liquidity requirements, although the latter were overridden in the analysis of liquidity risk prior to the crisis<sup>79</sup>.

Surveys to market participants at the time of the financial market downturn revealed that the current crisis is removed from the effects of illiquidity (Taylor, 2008; Gorton, 2008). It had its diagnosis in counterparty risk based on analysis of spreads between secured and unsecured debt. Under this view, the frictions in the financial market were not led by lack of funds, but rather, by the restraint in inter banking loans due to uncertainty and asymmetric information<sup>80</sup>. Fire sales and the consequent decrease in the value of the portfolios held by financial institutions allowed less availability of funds in the credit market. Moreover, the crisis was led by a high perception of risk in 2007, which increased short term borrowings that affected lending connected with MBS, creating a halt in originations and lending activities (Woodford, 2010).

In the end, these viewpoints regard the crisis as beginning with the collapses of major financial firms starting in 2006-2007 timeframe. These views, however, do not include explanations as to the drivers that sparked such uncertainties in the financial market, including the higher defaults on mortgage rates and the decline in house prices, among other indicators of an imminent turmoil and signals that preceded the market decline.

### ***The Glass-Steagall Act***

The Glass-Steagall Act was the response to the conflict of interest in the transactions by commercial and investment banks. When established, the Act separated both branches and implemented tight regulation. These rules were repealed in the 1970s by the removal of rules on stock trading commissions, while further modifications were pursued in 1980 and 1999 through the Depository Institutions Deregulation and Monetary Control Act and the Gramm-Leach-Bliley Act, respectively. As a consequence, banks were allowed to operate their investment and commercial branches under subsidiaries within the same institution, which in turn could operate with a diversity of products in loans, securities and deposits.

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<sup>79</sup> The New York Times, "Risk Mismanagement", op. cit.

<sup>80</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit.

According to Eichengreen (2008), the withdrawal of fixed commissions urged investment banks to compete with brokers, as the former lost their reliance on stock trading fees as a main source of revenues. Eventually, investment banks created new streams of business, such as the Collateralized Bond Obligations (CBO), which failed in the 1987 crisis, and other products, such as the ABS and the MBS. Market competition favored by the prevailing regulatory framework created the compelling need for management to continuously surpass other institutions' short term results. Pressure mounted to generate short term income in exchange for higher stock prices and, consequently, to pursue talent acquisition and retention, while the offer of a high income ceiling to traders became crucial (Kashyap et. al, 2008).

In time, the financial market developed into a complex mixture of sophisticated securities, transcending the regulatory framework, which came to be out of pace with the types of products available, regulation, the systemic interconnections among issuers and investors, the mortgage market and the portfolios transacted by the SIV.

The crisis was heightened by highly leveraged institutions that sought investments that in theory carried low risk of default (Woodford, 2010), and by funding high risk assets with short term funding (Kashyap et. al, 2008). Although some authors advocate that regulation tightening would have been appropriate, this action could have encountered some deterrents, such as the necessary timeframe for regulatory reforms to reach their goals (Eichengreen, 2008).

Other authors place the need for updated and robust regulatory frameworks as a priority before monetary policy (Greenspan, 2009; Bernanke, 2010). Rules should allow for the application of capital inflows to other beneficial investment venues that would be productive for the economy (Greenspan, 2009; Kohn, 2010). The debate remains as to the entity that should embody enforcement. Some proponents analyze whether monetary policy and regulation pertaining to the financial market should be placed under the central bank's umbrella, as separation can lead to conflicting objectives (Blanchard et. al, 2010).

Ultimately, a regulation framework should be designed on a multinational level rather than at the local phase (Bean, 2008), which could avoid massive flows of capital across regions and throughout economies in different stages, being this detrimental to growth and stability.

### ***The Government Sponsored Enterprises***

The GSE were predominant in the securitization market in portraying the ownership objective and in pooling loans supplied to low risk borrowers, as allowed by their charters in regards to loan sizes and limits<sup>81</sup>.

The GSE, represented mainly by Fannie Mae and Freddie Mac, were privatized in 1968 and 1989, respectively<sup>82</sup>. For both organizations, government support may have derived from their government charters. As such, the Secretary of the Treasury is authorized to become involved in cases such as in the sale to purchase companies' obligations with the aim of protecting tax payers<sup>83</sup>. This places an implicit reliance, whereas an insolvency or illiquidity stage would qualify as a situation in which taxpayers could suffer severe losses, allowing government to intervene.

Hence, and in spite of their private nature, the market relied on potential rescue by authorities should controversies arise with regards to Fannie or Freddie (Tarr, 2010). This understanding was ratified through the Troubled Asset Relief Program (TARP), as Fannie Mae and Freddie Mac were among the highest recipients<sup>84</sup>. In addition, the Federal Housing Finance Agency placed both entities in conservatorship

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<sup>81</sup> Federal Reserve Bank of San Francisco, 2007 Annual Report, op. cit. and pursuant to the GSE respective charters.

<sup>82</sup> Fannie Mae, FAQ, <http://www.fanniemae.com/faq/faq8.jhtml?p=FAQ>. Freddie Mac, Investor FAQ, question 6, <http://www.freddie.mac.com/investors/faq.html>.

<sup>83</sup> Fannie Mae, Charter, <http://www.fanniemae.com/global/pdf/aboutfm/understanding/charter.pdf>. Freddie Mac, Charter, <http://www.freddie.mac.com/governance/pdf/charter.pdf>.

<sup>84</sup> Fannie Mae and Freddie Mac together received approximately \$151 billion, according to ProPublica. The second recipient was AIG with \$140 billion, <http://bailout.propublica.org/list/index>

decision in September 2008, which represents another guarantee from the government, that is, a review and oversee of agency issues and of the business method.

Ultimately, a comparison in the mortgage market between the private sector and the GSE may render the latter in better position in regards to certain indicators, such as delinquencies. Past 90-day balances that were late at least once reached 46 percent of total private loans in 2006, whereas the same concept represented 13 percent for Fannie and Freddie<sup>85</sup>.

## 7. Global Imbalances

The subject matter of global imbalances relates to the two components of the current account, which sometimes are analyzed separately to aid understanding of these sources: the balance of trade, or from a crisis perspective trade deficits, and transfer payments or international financial flows. These two components are usually considered concomitantly as they represent accounts that relate to the same identities, and therefore they are at times combined in the treatment of global imbalances with regards to the crisis, whereas a detailed analysis of each perspective can aid to discern the topic as a whole (Bernanke, 2005). Moreover, when addressing the recession of 2001, some authors consider that macroeconomic and financial outcomes should be approached individually (Eichengreen, 2008), hence a separate analysis of trade deficits and the implications of international flows of capital appear advisable.

### *Trade deficits*

In the years prior the crisis, spending increased, which was attributed to the application of a number of policies, such as lowering of taxes and decreasing interest rates as responses to the 2001 recession (Eichengreen, 2008). These measures propelled consuming and the avail of credit. This prominence of consuming over savings was evidenced during the crisis. From the end of 2006 through the second half of 2009, payment of credit card balances were prioritized over honoring mortgage installments<sup>86</sup>. This tendency grew for three consecutive years starting 2007 and was found present across all credit scores and credit profiles<sup>87</sup>.

Based on this consumer behavior, some authors state that the imbalances can better be explained through the divergence in domestic savings among countries, offering a change in consuming pattern as a potential channel to diminish deficits (Astley et al., 2009). Under this view, higher domestic savings would have decreased aggregate demand, with the subsequent impact on imported goods and on the demand of real estate, weakening house prices and, consequently, diminishing the incentives for capital inflows to the U.S. However, other proponents view this explanation as incomplete, as U.S. savings persisted at similar levels with little fluctuation in the past decades<sup>88</sup>.

Other positions conceive little correlation between net domestic savings and the crisis because of the lack of correspondence exhibited between house prices and macroeconomic indicators, such as GDP growth (Whealan, 2010). This standpoint considers that spending in imported goods led indirectly to investments in Treasury bills as means of payment to surplus economies, lessening the impact that could have emerged as a consequence of having those funds available by households to opt for other types of investments, such as the MBS. This scenario, however, assumes that sophisticated financial products would be available and freely exchanged by households and individual investors. In addition, it does not cover the net compensation between potential increase in savings, a decrease in mortgages (and therefore, in MBS availability) and the subsequent increase in the demand for MBS (paired up with lower availability of MBS supply), along with a potential further decrease in lending standards to respond to the higher demand

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<sup>85</sup> The Wall Street Journal, "Views of Life After Fannie, Freddie", February 12, 2011,

<http://online.wsj.com/article/SB10001424052748703786804576137942242796306.html>

<sup>86</sup> TransUnion, "TransUnion Study Finds More Consumers Making Payments on Their Credit Cards Before Their Mortgages", [http://www.easyir.com/easyir/customrel.do?easyirid=DC2167C025A9EA04&version=live&prid=583276&releasejsp=custom\\_144](http://www.easyir.com/easyir/customrel.do?easyirid=DC2167C025A9EA04&version=live&prid=583276&releasejsp=custom_144)

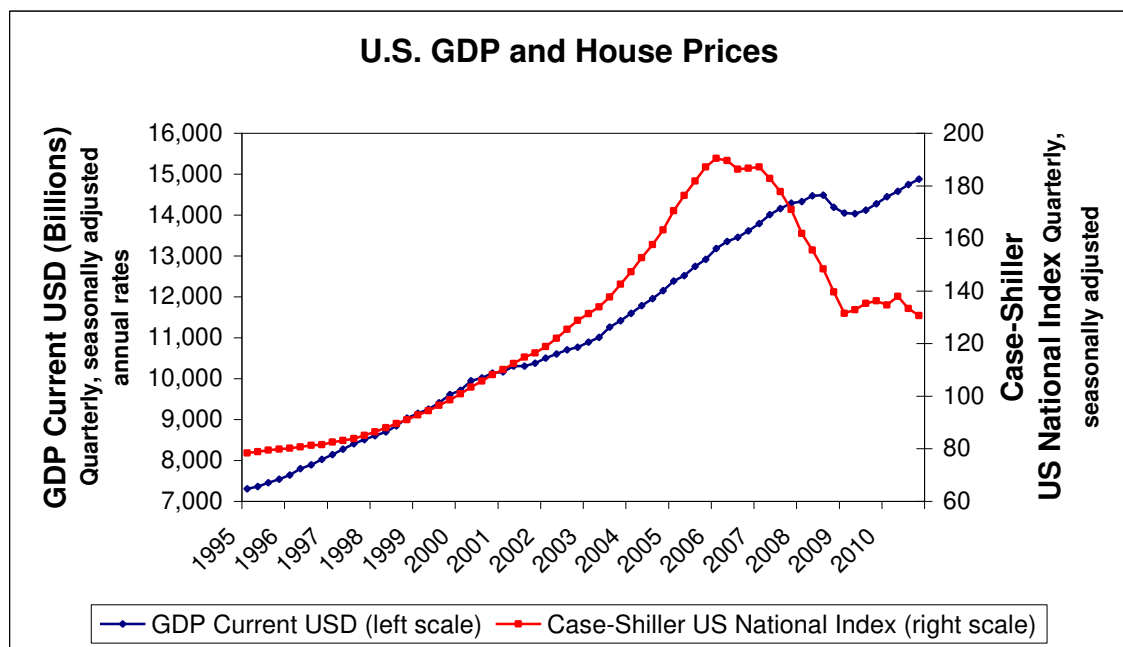
<sup>87</sup> TransUnion, "TransUnion Study Finds Consumers Continue Paying Credit Cards Before Mortgages, Though Change May Be on the Horizon",

[http://www.easyir.com/easyir/customrel.do?easyirid=DC2167C025A9EA04&version=live&prid=737773&releasejsp=custom\\_144](http://www.easyir.com/easyir/customrel.do?easyirid=DC2167C025A9EA04&version=live&prid=737773&releasejsp=custom_144)

<sup>88</sup> U.S. savings decreased from 16 percent of GDP in 1995 to 14 percent of GDP in 2004 (Bernanke, 2005).

on MBS. Hence, the position that availability of financial products to households would have avoided a financial crisis does not encompass dependent variables that may become crucial as policy objectives are enforced and market demand in financial products rises.

On the other hand, the lack of correlation between house prices and GDP may have presented warning signs. As shown in the following graph, during the years prior to the crisis house prices outgrew GDP growth, evidencing that the increase in GDP is insufficient as a sole indicator to explain the housing bubble and that sources outside economic activity and in the financial markets realm, such as capital inflows and interest rates spreads, were at play.



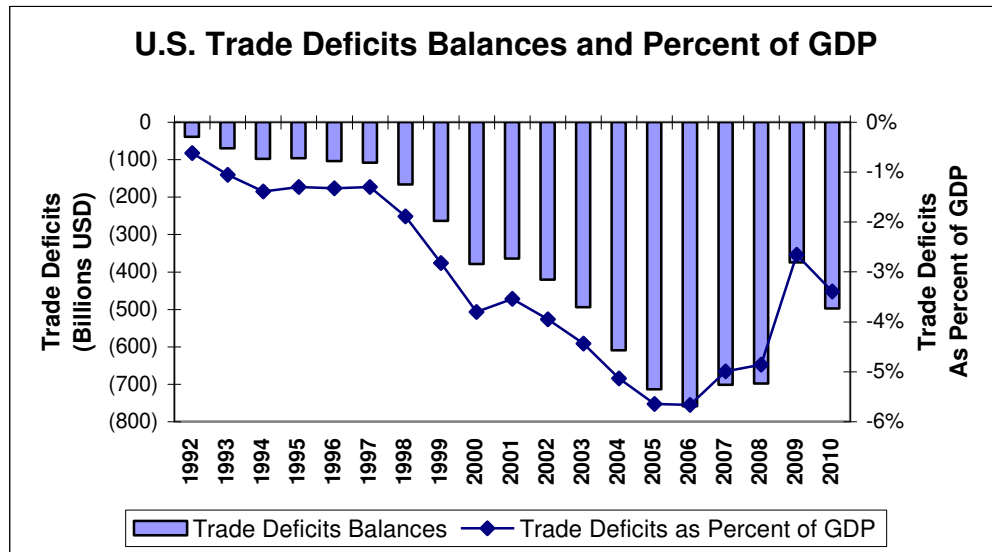
Data sources: Bureau of Economic Analysis<sup>89</sup> and Standard & Poor's<sup>90</sup>

From the 1990's, international investment options became more accessible to investors, increasing the flows of capital across countries (Whealan, 2010). These flows of capital throughout borders contributed to the reliance on the U.S. financial markets by other economies and to the increase of credit availability (Eichengreen, 2008). The growth in activity in surplus countries led to the acquisition of Treasury bills and of obligations issued by the government-sponsored enterprises, tapping into the U.S. mortgage market and boosting the dollar.

This scenario stimulated an unavoidable recession caused by some countries' trade deficits as compared to surpluses held by others (Eichengreen, 2008). Particularly, in the case of the U.S., the highest trade deficits balances represented two thirds of the world's trade surpluses (Reinhart and Rogoff, 2008). Moreover, prior to the crisis, deficit and surplus countries saw their current accounts net positions deepen, whereas the highest change was experienced by the U.S. (Astley et al., 2009).

<sup>89</sup> Bureau of Economic Analysis, National Economic Accounts, <http://www.bea.gov/national/xls/gdplev.xls>

<sup>90</sup> Standard & Poor's S&P/Case-Shiller Home Price Indices, <http://www.standardandpoors.com/indices/sp-case-shiller-home-price-indices/en/us/?indexId=spusa-cashpidff--p-us--->



Data source: Bureau of Economic Analysis, *International Economic Accounts*<sup>91</sup>

Bernanke (2009, in Suomisen 2010) states that the U.S. has undertaken the role of safe currency, which propelled the country to become a deficit nation; therefore, trade deficits are unavoidable. As shown in the previous chart, the first half of the 2000's shows a steep increase in trade deficits. The marked decrease experienced in 2009 refers to the drop in private investment due to the crisis, as well as to the decrease in oil prices, from \$130/barrel in July 2008 to \$70/barrel in June 2009 (Astley et al., 2009).

In the period from 2004 through 2010, top trading partners with the U.S. represented 15 countries, which accounted for 71 percent to 75.2 percent of the total trade. The 4 top nations, Canada, Mexico, China and Japan, accounted for 46.5 percent to 49.3 percent of total trade<sup>92</sup>. From these major traders, the years 2004 and 2005 show a peak increase in balances with China, the partner with the highest balance, and an annual increase with the same country and for the same years of 14 and 11 percent, respectively. For the recently ended year 2010, the increase in trading balance returned to 14 percent, the same level as compared to 2009<sup>93</sup>.

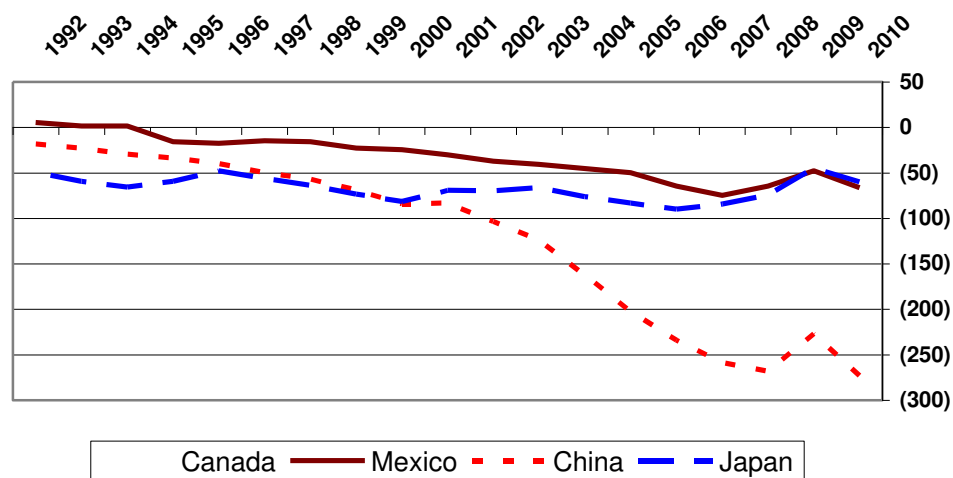
<sup>91</sup> Bureau of Economic Analysis, National Economic Accounts, <http://www.bea.gov/national/index.htm#gdp> ; International Economic Accounts <http://www.bea.gov/international/index.htm>

<sup>92</sup> U.S. Census Bureau, Foreign Trade Statistics, Top Trading Partners – Total Trade, Exports & Imports, <http://www.census.gov/foreign-trade/statistics/highlights/top/index.html>

<sup>93</sup> U.S. Census Bureau, Foreign Trade, U.S. Trade in Goods (Imports, Exports and Balance) by Country, <http://www.census.gov/foreign-trade/balance/>



**U.S. Trade Balances by Partner**  
**Top 4 Since Year 2000**  
 (Billions of dollars)



*Data source: U.S. Census Bureau, Foreign Trade Statistics<sup>94</sup>*

The peak in trade deficits and in balances with surplus bearing countries poses a parallel between spending and the crisis. Potential explanations are studied in this section.

***Addressing the imbalances***

Some of the analysis pursued in regards to imbalances and international streams of capital focuses on the distinction between net and gross financial flows. As most of the U.S. external liabilities relate to the financial markets (about 70 percent) rather than to domestic households (represented by a third of the external liabilities, which increased in the five years prior to the crisis) (Whealan, 2010), net analysis should be considered in conjunction with the composition of the gross position.

If global imbalances are to be considered as the cause for the crisis, financing the deficit would represent to the U.S. increased reliance on international markets to overcome the financial requirements. This is majorly pursued through the sale of Treasury Bills and the consequent fluctuation of the dollar.

Numerous discussions have been conducted on the improvement of global imbalances, either through deliberation within the G20 or the International Monetary Fund’s (IMF’s) consultations, which began in 2006 (Bini Smaghi, 2008). Conclusions placed focus on domestic savings and on fiscal spending in deficit countries, the flexibility in exchange rates and the creation of policies that would lessen the dependency of surplus countries on exports to other nations by programs impacting labor, local demand and financial regulation, among others (Whealan, 2010; Suominen, 2010; Kohn, 2010).

In the global scenario, the deficit bearing group is allocated within the U.S., U.K.<sup>95</sup>, Canada, Australia, India, Turkey, France and the Southern countries in Europe, whereas the surplus economies are led by China and followed by Japan, East Asia, Germany and the oil exporters (Suominen, 2010). Additionally, the World Economic Outlook (WEO) for 2010 produced by the IMF<sup>96</sup> shows that, as a percentage of World GDP, world imbalances are led by the U.S. on the deficit group, whereas surplus positions over GDP are predominant in the oil exporters and in Japan and Germany during the three years prior to the crisis.

<sup>94</sup> U.S. Census Bureau, Top Trading Partners – Total Trade, Exports & Imports, op. cit.

<sup>95</sup> By the first quarter of 2009 the U.K. showed a net external asset position given its currency depreciation. As external assets were denominated in foreign currency and debt was denominated in local currency, the depreciation combined with variations in assets prices showed a favorable net position (Astley et al., 2009).

<sup>96</sup> Page 8, <http://www.imf.org/external/pubs/ft/weo/2010/01/pdf/text.pdf>

Some authors point that the expansion of these balances did not correlate to the downturn in the financial market. Some views focus on the ineffectiveness of addressing imbalances to prevent crises, as other factors, such as banking regulation are more compelling (Whealan, 2010). In this case, the crisis was originated by the failure in the financial system through the trade of MBS, an example of a toxic asset, rather than on the trading of Treasury bills that other nations received as payment for imports by the U.S. Hence, reducing the imbalances would not prevent a future crisis from arising.

Conversely, other proponents conclude that preventive actions with regards to the imbalances would have avoided or diminished the effects of the crisis (Bini Smaghi, 2008). Consorting with this view, Bernanke (2005) agrees that the current account deficit in the U.S. was heightened by lower domestic savings and perhaps by the budgetary deficit, whereas it was the global savings glut the prime motivation for the imbalances and for the housing boom.

### ***The Global Savings Glut***

Under the global savings glut, emerging markets, which run current account surpluses, tend to redirect capital flows to industrialized economies, in special to the U.S. This began in the second half of the 1990's and was due to a variety of reasons, such as the need to avoid a new crisis by the emerging economies, weak local financial systems, the stance of the U.S. dollar as a reserve currency, reliability on the U.S. economy and higher productivity in the U.S., among other incentives. Indeed, the asymmetry in the international financial system (Bini Smaghi, 2008) has directed savings from unregulated markets to those that are more systematized, creating outflows from most of the surplus economies and inflows in the deficit bearing nations.

Some authors, instead, place the initial settings for capital flows to industrialized countries during the 1970's with the petro-dollar pattern, through which the U.S. transferred capital from the oil-exporting economies, which showed trade account surplus at the time, to emerging markets (Reinhart and Rogoff, 2008).

The consequence of these flows led the U.S. economy to an array of stimulus that motivated the current account deficit. From 1996 to 2000, a year before the recession began in the U.S., the dollar increased due to higher international demand. U.S. financial markets were viewed by international investors as competitive and mature, which led to the decrease in U.S. interest rates and the increase in stock prices as a response to a higher demand on U.S. financial products.

The consequences of the global savings glut gave households the perception of greater wealth and higher purchasing power, which led to an expansion of spending and the sense that the existing conditions at the time would continue in the future. Hence, saving by households received less preponderance than consumer spending during the second half of the 1990's<sup>97</sup>.

As a result, the U.S. economy experienced rising asset prices, low interest rates, increased spending, especially in imported goods<sup>98</sup>, and inflows of capital directed to the housing market and to real estate development. In the lenders' economies, dollar reserves and U.S. government bonds accumulated and current account surpluses and exports (as production in excess to domestic demand) grew rapidly (Bernanke, 2005).

In the international markets, low international real interest rates (Bernanke, 2005) motivated the search for venues to which capital flows were directed, leading to the prosper of the real estate market and the

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<sup>97</sup> Households' net savings in the U.S., as defined by the U.S. Census Bureau, decreased from 5.7% in 1995 to 3.4% in 2004. In 2005, when real estate prices were at their peak, the savings rate dropped more than 50% from the previous year, to 1.5% of households' disposable income. "U.S. Census Bureau, Statistical Abstract of the United States: 2011", <http://www.census.gov/compendia/statab/2011/tables/11s1362.pdf>

<sup>98</sup> In 2005 and 2006, imported goods in the U.S. had grown 38 and 44 percent, respectively, as compared to the year 2000. In comparison to 1995, the increase was 126 and 150 percent, respectively. "U.S. International Trade in Goods and Services, 1992 – Present", U.S. Census Bureau, [http://www.census.gov/foreign-trade/statistics/historical/exhibit\\_history.xls](http://www.census.gov/foreign-trade/statistics/historical/exhibit_history.xls)

promotion of increased construction and homeownership, while the latter was partially propelled by tax incentives.

Under this scenario, the question remains as to the reason for which domestic policy did not act in accordance to the international scenario to counterbalance any detrimental effects that caused the crisis, given that the global savings glut had its origins upon the financial crisis in Asia, approximately ten years before the current financial crisis.

Bernanke (2005), who states that global imbalances are unsatisfactory in the long run, considers that domestic policies are innocuous because inflows to the U.S. economy carry international factors that need to be addressed in conjunction with other nations, such as in regards to the flexibility to fluctuate by other currencies and changes in the roles of lenders and exporters assigned to emerging economies. Financial inflows to the U.S. during the first half of the 2000's encountered the 2001 downturn and, therefore, clashes were produced between plenty availability of funds, which were inexpensive, and low interest rates led by the Federal Reserve to avoid deflation, propelling high indebtedness in households and the real estate bubble (Bean, 2008). Households' ratio of debt payments to family income deteriorated, growing in aggregate from 12.9 percent in 2001 to 14.5 percent in 2007<sup>99</sup>.

Therefore, as most countries lead open economies (Bernanke, 2005), domestic policies should interact with the international financial and trade markets (Bini Smaghi, 2008). Fiscal and monetary administration should contemplate global imbalances.

Another issue is the antagonistic courses of actions that are to be faced by central banks, when at times policies have to coordinate inflation and global imbalances with their capital inflows (Bean, 2008).

Such opposed targets place a burden in local policies, which leads to the consideration that, although policies across borders could represent positive externalities, higher cooperation and coordination could lead to undesired consequences, such as vulnerabilities to certain economies or fluctuations in exchange rates (Bini Smaghi, 2008). In this sense, and to adjoin to the current synchronization between the Federal Reserve and the European Central Bank in regards to decisions on interest rates, a further coordination in the realm of global inflation rates should be considered (Taylor, 2008).

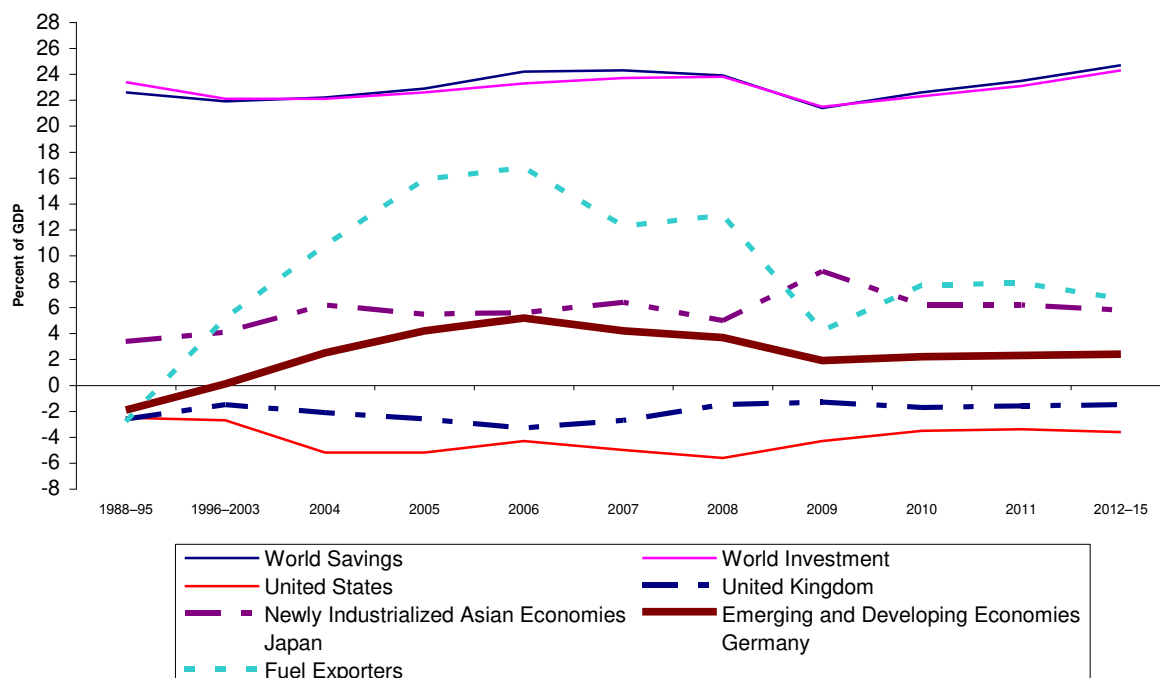
Other positions question whether the global savings glut had a material impact on the ignition of the crisis (Whealan, 2010). Despite the excess of savings over investment options (Bini Smaghi, 2008), statistics made available by the IMF show that the global savings rate increased at a pace that was insufficient to create enough flows that would provoke a deficit in the U.S. current account (Whealan, 2010; Taylor, 2008)<sup>100</sup>. Additionally, as shown by the following graph, world savings and investments did not fluctuate materially since the 1980's. Hence, the sole examination of these trends appears to be insufficient to explain the generation of the crisis.

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<sup>99</sup> Federal Reserve Board, "Survey of Consumer Finances 2007", op. cit.

<sup>100</sup> In the years prior to the crisis, the increase in global savings was 3.8 percent from 2002 through 2007 (Whealan, 2010).

### World Savings and Investment, Net Lending by Country/Group



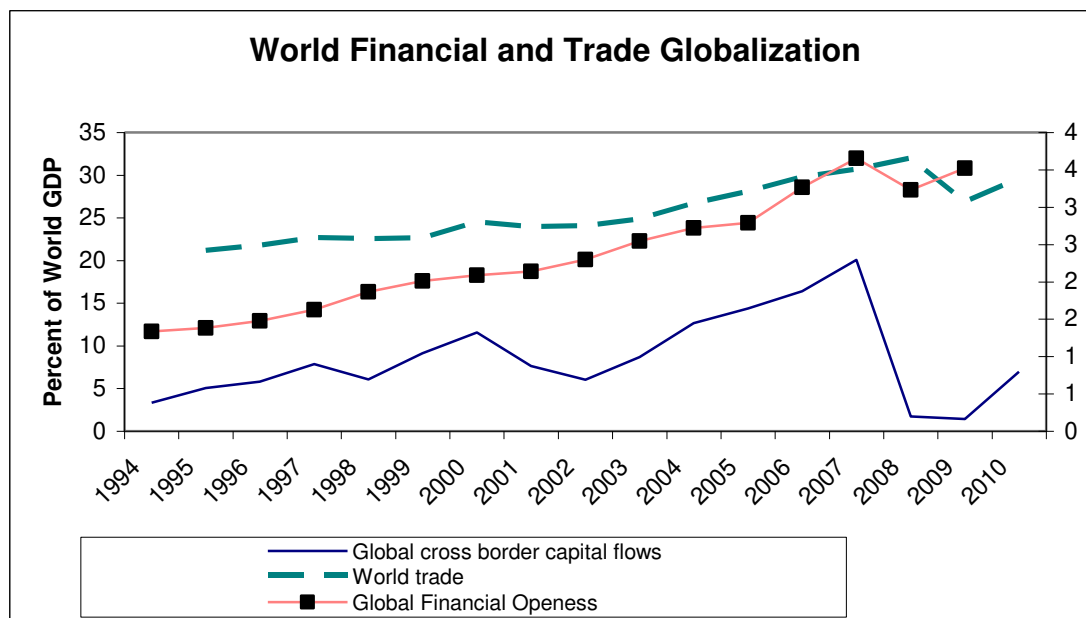
Data source: International Monetary Fund, *World Economic Outlook*, April 2003<sup>101</sup>

The previous graph shows similar levels for world savings and investment, which practically even each other out except for the years during the crisis. The chart also shows the net lending position for the main countries or groups involved with capital flows. Note that the current account surplus bearing countries or groups present excess savings over investment, whereas deficit trade bearers, such as the United Kingdom and the U.S., exhibit negative net lending position, posing a correlation between current account status and flows of capital beyond the global savings glut. That is, international interest rates exhibited a weak role as compared to current account balances when it comes to the flow of capital.

These groups and countries' net positions on savings and investment allow assessing that, although overall world position netted out, capital flows presented a risk to domestic economies, particularly to stability in the real economy, as well as to interest rates, to exchange rates and to the application of excess of flows. The world experienced increased flows of capital and, consequently, growth in funds availability per the acceleration in the years prior to the crisis<sup>102</sup>, as observed in the following graph.

<sup>101</sup> Page 203, <http://www.imf.org/external/pubs/ft/weo/2010/01/pdf/text.pdf>

<sup>102</sup> World Bank, *Prospects for the Global Economy*, <http://go.worldbank.org/3GUX2LBWX0>



Source: OECD<sup>103</sup>

Flows to the U.S. and the United Kingdom show that potential misalignment of funds could have sparked bubbles or created credit environments that were pernicious to the recovery of the economies upon the 2001 crisis.

The mechanism through which the flows referred to as the global savings glut balanced was, according to Bernanke, the international interest rate (Astley et. al, 2009). Lower interest rates sparked by purchases of U.S. government debt, especially by Asia, encouraged higher activity and increased prices in the housing market, as well as an expansion in consumer spending (Whealan, 2010; Kohn, 2010). This situation propelled credit directed to real estate and to consumer lines.

Conversely, Taylor (2008) disagrees with Bernanke (2005) in that the level of international savings did not exceed investment as seen in previous graphs, but rather that total savings approximately matched investment on a global scale. This analysis, although it exerts an explanation as to the low interest rates, it excludes the segregation among surplus and deficit countries explained previously, through which surplus bearing economies directed funds to the deficit countries, while the crisis originated in most economies constituent of the latter group.

Beyond the externalities produced by the interaction throughout economies, the question remains in regards to corrective policy that should have adjusted interest rates and tax incentives, among other criterions, to compensate for any deviation provoked by the inflows (Whealan, 2010), redirecting excess of funds to investment venues that would allow for an increase in productivity and the expansion of real activity and lead macroeconomic sustainability. In response, some agree that such course of action is to be avoided as an objective of monetary policy, whereas it should arise as a consequence of scrutiny and the reinforcement of the regulatory framework (Greenspan, 2009). In this regard, the regulatory framework allowed for inflows of capital in the U.S. to be channeled to real estate pursuits, hence a call should have been made as to the reinforcement of the U.S. financial system and its overseeing functions (Kohn, 2010).

A different perspective regarding global imbalances as the reason for the crisis allows for deficits, as they are not improper insofar they are monitored and manageable (Suominen, 2010; Kohn, 2010), while potential adjustments would be received benignly by the international context as a response to market flexibility (Greenspan 2004, in Suominen 2010). Imbalances could act as a compensation mechanism

<sup>103</sup> Dataset on Furceri, D., Guichard, S., Rusticelli, E. (2011), "Medium-Term Determinants of International Investment Positions: The Role of Structural Policies", Organization for Economic Cooperation and Development (OECD), Economics Department Working Papers, <http://www.oecd.org/dataoecd/30/8/47835062.xls#Contents!A1>

through which capital is allocated among countries, as long as inflows are applied to economic purposes that succeed in addressing risk effectually (Kohn, 2010).

Conversely, imbalances are unattractive because of the consequences that they carry (Astley et. al, 2009), such as variation in asset prices and adjustments in exchange rates, being the latter a result of monetary asymmetries through which some countries have floating rates (particularly, the deficit nations) and the surplus and emerging economies manage a rate pegged to the U.S. dollar, carrying implications on the financial system and on the real economy. This dissimilarity in the management of exchange rates and the effect of global imbalances on asset prices can in turn impact inflation and growth, making imbalances undesirable, in which case improvements of trade deficits could only be achieved in the medium or long term (Freund and Warnock 2007, in Suominen 2010).

Other positions highlight that the point in question would not be the inflows of capital to the U.S., but a misallocation of such funds to financial products that are considered pernicious (Whelan, 2010). Furthermore, financial system inadequacy has been assigned as the major reason for not coping with capital inflows (Portes, in Whelan, 2010). The search for high returns and a disproportionate financial market with an exponential increase in the transactional volume created a system that became difficult to regulate and to manage.

### *A dollar crisis*

When it comes to analyzing the recent market downturn, a dollar crisis is at times mentioned in lieu of global imbalances. The U.S. economy benefits greatly from being the issuer of an international currency, as it disengages the country from foreign shocks. In addition, the role of the dollar renders seigniorage, it projects U.S. shocks and economic policies abroad and decreases transactional and financial costs in international markets. A depreciation of the U.S. currency with the subsequent increase in interest rates would diminish current account deficits. This could happen if investment in U.S. dollars came to a halt suddenly (Whealan, 2010).

To some authors, this instance seems unlikely to occur (Goldberg, 2010), especially because of the reserve value characteristic borne by the U.S. dollar (Astley et al, 2009; Goldberg, 2010). This reserve value was heightened after the crisis, as purchases of U.S. assets continued to be positive. In addition, 89 countries have pegged their local currency to the dollar, a total of 7 nations have dollarized their economies and 65 percent of dollar notes in circulation is located abroad, with concentration in Russia, the nations belonging previously to the Soviet Union and Latin America

The dollar represents 86 percent of the volume of transactions in international trade (Goldberg, 2010). Imports from the U.S. tend to carry low price fluctuations, a characteristic that lessens the potential burden on imports and, therefore, which encourages the use of the dollar for trade. This design of the international markets could render the inclination to a different currency arduous.

However, China, whose foreign reserve holdings as of the first quarter of 2009 represent 46 percent of those of developing countries' (Goldberg, 2010), has encouraged a reform in the currency reserve system, aiming at parting from the U.S. dollar and towards an international currency, such as the Special Drawing Rights (SDR), which could lessen the reliance on a particular economy and its fluctuations<sup>104</sup>. The objective is to isolate the effects of shocks from a country or a given group of economies to the rest of the world's real economy and financial system.

Conversely, the role of the U.S. dollar may not be perceived as detrimental by participants in the international financial market. Upon the crisis, the U.S. dollar experienced volume expansion through swap lines to overseas banks in approximately 800 percent<sup>105</sup>. Therefore, the expansion of shocks across

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<sup>104</sup> Reuters, "China bank chief sees need for systemic monetary reform", February 18, 2011, <http://www.reuters.com/article/2011/02/18/g20-china-forex-idUSPISIDE70620110218> ; "G20 communique takes softer tone on FX policies", February 19, 2011, <http://www.reuters.com/article/2011/02/19/us-g20-fx-idUSTRE71I2YZ20110219>

<sup>105</sup> The swaps increased overseas banks holdings from \$70 billion at the time of the crisis to \$560 billion at the end of 2008 (Goldberg, 2010).

economies cannot be explained solely by the use of a particular currency, despite the currency bearer's role in the crisis. The interconnections among market participants open to the international realm bear a link among monetary policies, the financial markets and global trade.

## **8. Monetary Policy and Low Interest Rate**

In prior crises, reliance was placed on monetary policy to lead recoveries. Such was the case in the oil price increases during the 1970's and the 2000's, the banking crisis of 1987 and the technology bubble in 2000-2001. Paired up with fiscal policy, with predominance over the latter, monetary policy has become a crucial mechanism to achieve financial stability (Blanchard et. al, 2010).

This is not the case with the current crisis. High rates of unemployment, along with a Federal Funds rate almost triggering a zero limit and instances of deflation experienced in past two years deem monetary policy as insufficient to produce recovery. Nonetheless, monetary policy was assigned a prominent role in the creation of the financial markets turmoil prior to the crisis.

### ***The inflation target***

Some proponents argue that targeting inflation leads to financial shortcomings (White, 2006 in Bean, 2008). Despite the risks associated with liquidity traps and the stickiness of prices, most central banks focus primarily on a certain inflation target, usually 2 percent, and consider indirectly other determinants, such as the availability of credit and certain asset prices (housing, exchange rates, stocks, oil, among others) (Blanchard et. al, 2010).

Inflation and output are the main policy tools for long term stability and short term responses to expectations. Pursued through interest rate management by the central bank, the expected inflation rate can be controlled by means of transactions in the open market. This view is based on the hypothesis that interest rates can modify the real economy and that these rates are linked to asset prices. Consequently, monetary policy can be conducted by following a specific model of choice that would encompass inflation and output targets, such as proposed by the Taylor rule, whereas financial intermediation is not contemplated.

However, a sole inflation aim may not be sufficient to conduct monetary policy, to affect the real economy and to avert a crisis. A stable and sought rate of inflation will not guarantee the completion of other macroeconomic objectives (Blanchard et. al, 2010), questioning whether inflation as a sole target will lead to policy completion on areas such as decrease in asset prices and reduction of excessive leverage or risk taking. Inflation targeting (such as set by the United Kingdom and the European Central Bank) and the dual mandate (set by the U.S.) could decrease the slope of the Phillips curve, reducing the consequences of the applied monetary policy (Bean, 2008). For this reason, a higher interest rate could place unwanted strain on activity in the short term, whereas long term results could be unreliable.

This was the case in the period prior to the crisis. Upon the crisis and during the cycles aforementioned, stressed was placed on leading economic indicators to instances of recovery through lower interest rates settings, as explained by Bernanke (2010). Focusing solely on an inflation rate target could have led the economy to cases of further recession, with consequences in unemployment and activity. According to some proponents, these decisions on lowering interest rates combined with global imbalances and low levels of international real interest rates in the years prior to the crisis would have caused local monetary policies to be insufficient in counteracting the credit boom (Bean, 2008; Bernanke, 2010).

On the other hand, it is unclear whether decisions to walk away from the dual mandate should have taken place. If the scenario described led monetary policy to be innocuous, potential additives to the targets applied could have achieved preventive measures that would have avoided a housing bubble, the exponential take off in the securitization market and the eventual credit crunch at the time of the downturn.

In this sense, local monetary policies under the inflation target or the dual mandate should account for changes in the financial market. As discussed in the securitization section, financial intermediaries and their complex connections through sophisticated products lead to a change as to how to treat economic

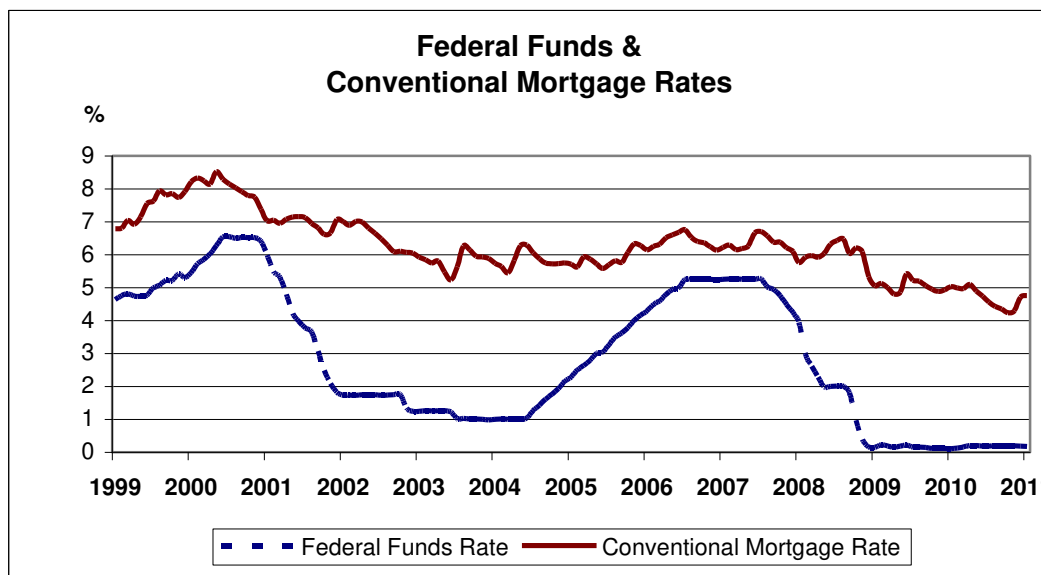
goals. As an example, in the case of the SIV, which transacted most of the CDO, as it appears from the write offs assumed by banks upon the defaults were triggered, the distinction between short and long terms becomes crucial. Recapitulating from previous sections, SIV seek short term funding and invest in long term products, creating shortcomings in liquidity. Given the market concentration in issuers of the products involved with the crisis, monetary policy should encompass short term analysis.

Indeed, some authors consider that developed economies focus on the long term when analyzing their monetary policy targets, leaving out short term fluctuations, such as credit booms, which could in turn affect the long run (Bean, 2008). This is in fact the case analyzed in the Federal Funds rate section that follows. In benchmarking the Federal Funds rate to other types of interest, comparison is focused on the long term scenario, as pursued by Greenspan (2009).

Allowance for short term deviations in inflation from the long term objective would lessen undesired effects of credit booms, although this might pose a difficult decision. Timing on the rate increase, as well as expectations could lead to heightening the crisis rather than to diminishing it (Bean, 2008).

### ***The Federal Funds rate***

The view that interest rates should have been adjusted in consonance with the housing bubble pervades (Whelan, 2010). Capital inflows in deficit countries created availability of funds that, combined with insufficient regulation and the search for higher returns, motivated a real estate burst (Bernanke, 2005; Kohn, 2010). Low mortgage interest rates propelled the risk assumed by households and created the belief that real estate prices would continue to grow. The following graph shows a comparison between the Federal Funds and conventional mortgage rates.



*Data source: Board of Governors of the Federal Reserve System<sup>106</sup>*

The chart displays a pronounced gap between the Federal Funds and conventional mortgage rates, which took place upon the recession that started in 2000-2001 and lasted until the year prior to the housing boom. The close consistency between the Federal Funds rate and the conventional mortgage rate breached out upon the 2001 recession, as the former was decreased as a policy response to avoid deflation. In the three years prior to the crisis, the Federal Funds rate was increased consistently, with lesser effect on conventional mortgage rates.

It appears then that changes in the Federal Funds rate had little effect in the mortgage market during the period. In fact, this is one of the major disadvantages that Greenspan (2009) assigns to the Taylor rule explained in the upcoming section. According to Greenspan, real estate represents a long term investment, for which short term rates, such as the ones analyzed under the Taylor rule, would not be appropriate for

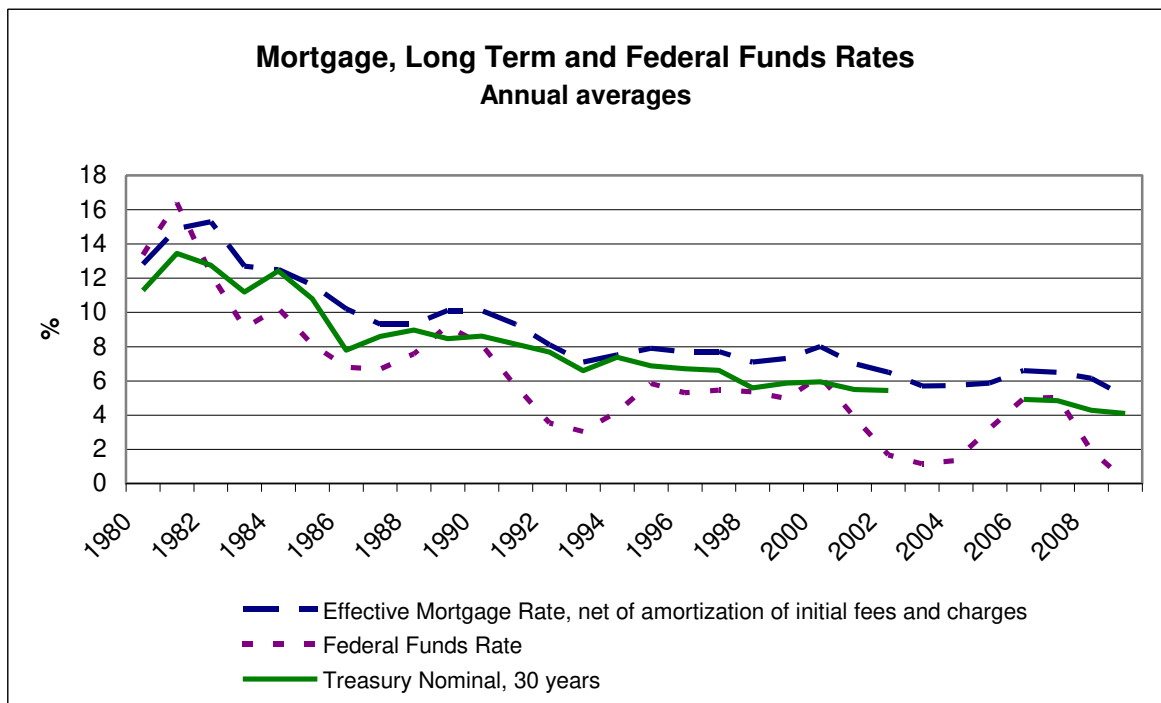
<sup>106</sup> H.15 Selected Interest Rates, Data Download Program, <http://www.federalreserve.gov/releases/h15/data.htm>



the valuation of these assets. Greenspan highlights the lack of response from the mortgage market to decision in monetary policy.

Upon the crisis, the narrow breach between long term and mortgage interest rates decreased to almost nil values, showing that mortgage rates were unyielding to monetary policy. One explanation relates to the impact that inflows of capital had on funds availability for the mortgage industry. As described previously, this view heightens the role by the regulatory framework, as well as by fiscal and monetary policies to channel capital excesses to objectives that would discourage speculative activities and strengthen long term economic growth.

The following graph shows a different scenario. Mortgage rates are shown net of charges and fees, that is, as effective mortgage rates. As compared with the Federal Funds rate, a direct relation can be drawn between the two rates even during the years after the crisis arose, although pace differs depending on the timeframe. The rate on Treasury bills is displayed for comparison purposes, from which it can be observed that the sought relationship between mortgage rates and the Treasury bill is no longer sustainable, especially from the second half of the 1990's. Therefore, the main consequence of raising or decreasing the Federal Funds rate is the subsequent movement on effective mortgage rates. Then, monetary policy imprints upon the mortgage market by means of the Federal Funds rate.



Data source: Federal Reserve and Joint Center for Housing Studies<sup>107</sup>

As seen in the section dedicated to the Taylor rule, timing is of significance in regards to responses from macroeconomic factors and policies that are put into practice. In the case of monetary policy, objectives are announced in advance to the application of mechanisms that will fulfill the desired targets. Moreover, macroeconomic indicators such as unemployment, inflation and interest rates are sought as signals used in forecasting activities by households and market participants<sup>108</sup>.

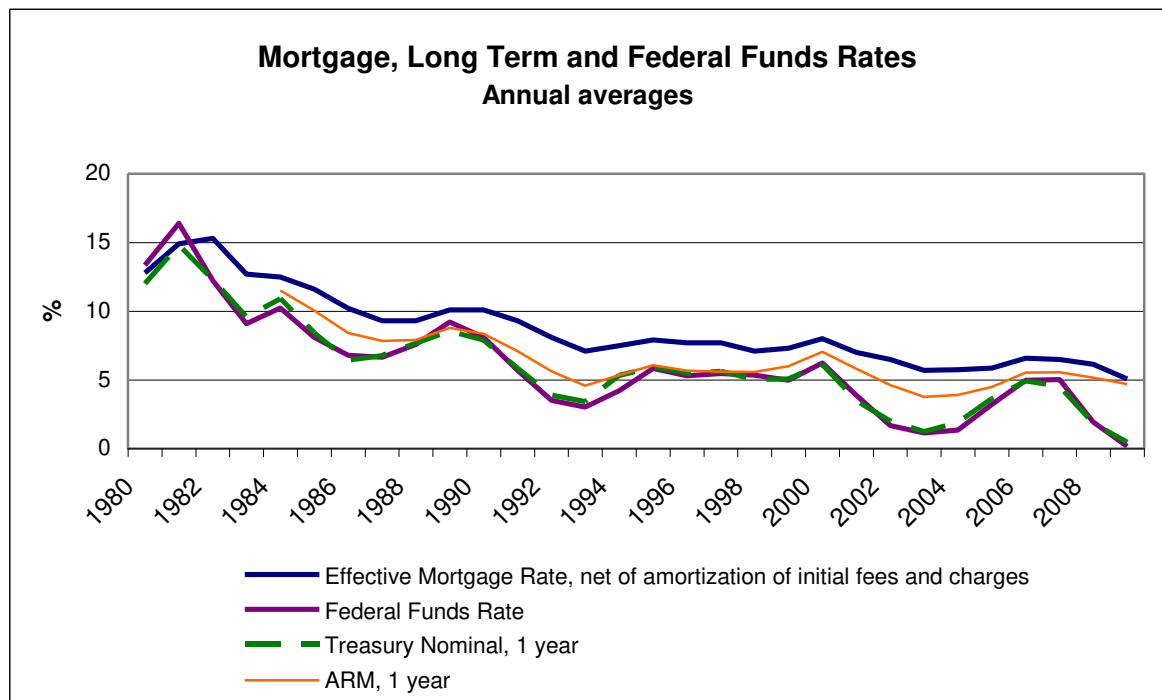
Although the previous explanation provides an account of the impact that monetary policy has on mortgage rates, it does not encompass all features pertaining to the mortgage design. That is, long term rates would be a realistic measure for evaluation purposes if the long lived assets were to be held for the

<sup>107</sup> Federal Reserve Statistical Release, <http://www.federalreserve.gov/releases/h15/data.htm#fn13> . Joint Center for Housing Studies of Harvard University, "The State of the Nation's Housing 2010", <http://www.jchs.harvard.edu/son/index.htm>

<sup>108</sup> There is extensive literature on the subject matter of economic news, especially on their impact on the stock market. This is applicable in view of the sophisticated securitization scheme discussed previously.

life of the mortgage, or alternatively, for a period beyond the short term<sup>109</sup>. As described in the subprime and ARM sections, subprime originations evinced in their vast majority ARM loans that were expected to reset after 2 to 3 years (sometimes 1 year, as some loans had a shorter initial period). Because of the refinancing feature that prevailed in ARM lines, it is more applicable to compare the correlation among rates in shorter periods rather than in the long term when assessing on the implications of monetary policy over the real estate market.

The objective of the following chart is to display such comparison. Note the close relation between 1 year ARM and the Federal Funds rates, as they fluctuate concomitantly. Additionally, as the rate for the Treasury bill and the Federal Funds rate are almost at the same values, and based on the relation between the latter and the 1 year ARM rate, the implication by the Treasury bill rate on the mortgage market is recalled by analyzing the short term.



Data source: Federal Reserve and Joint Center for Housing Studies<sup>110</sup>

Moreover, most of the mortgage originations were bundled under the OTC model and turned into securities, such as the CDO, by off-balance sheet entities, mainly by the SIV, as described previously. These entities showed the pursuit of short term liquidity in exchange for long term investments. Most of the financial market was shared by participants that did not engage in the borrower-lending scheme and where the main source of funding was of a short term nature. In fact, funding from commercial paper exceed that from deposits in the years prior to the crisis (Woodford, 2010).

As a consequence, the mortgage market and monetary policy are closely interconnected in that effects and features are sought on the short term. Although the purchase of a home is the most valuable lifetime investment by many families, the features displayed by loans prior to the crisis reveal the short term nature in the mortgage market. This is in correlation with the exercise of the resetting option by most ARM mortgagors, who were also subprime borrowers in the pursuit of cash out refinancing in order to cover for spending on credit card balances. Short term refinancing at low cost sparked consumer spending and linked monetary policy to the mortgage market.

### *The Taylor rule*

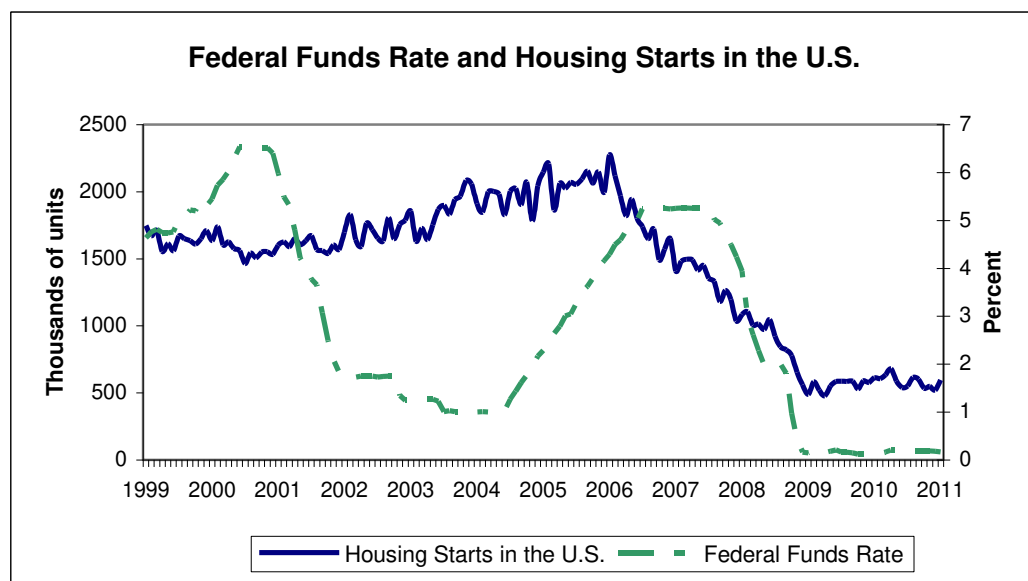
<sup>109</sup> Short and long term concepts are applied here from their macroeconomic definitions.

<sup>110</sup> Federal Reserve Statistical Release, <http://www.federalreserve.gov/releases/h15/data.htm#fn13> . Joint Center for Housing Studies of Harvard University, “The State of the Nation’s Housing 2010”, <http://www.jchs.harvard.edu/son/index.htm>

Under the view supported by the Taylor rule, low interest rates pursued by the Federal Reserve (Tarr, 2010) and by other central banks in the developed economies (Bean, 2008; Taylor, 2008) in the years prior to the financial market downturn led to the crisis.

As a consequence from the dot-com boom, the U.S. economy entered into a recession beginning 2001, which was followed by a series of events that heightened the economic conditions at the time (Bernanke, 2010). Hence, tight monetary policies would have had detrimental consequences in activity, at the same time that they would have been ineffective in constraining the effects from credit booms (Bean, 2008; Eichengreen, 2008). This measure aimed at avoiding a deflation similar to that experienced in Japan during the 1990's, in the called Lost Decade<sup>111</sup>.

However, the Taylor rule shows an opposite conclusion. Between the years 2002 and 2006, the Federal Funds rate should have achieved a higher level (Grosheeny, 2011; Taylor, 2008). In comparing the actual Federal Funds rate with the Taylor rate and computing the housing starts, Taylor (2008) concludes that the housing boom could have been avoided had the rate been lower and computed under the rule. Moreover, analysis of the deviation from the Taylor rule shows that for the OECD members in Europe there is a direct correlation between departure from the rule and impact in housing investment (Taylor, 2008), as shown in the following graph, where it can be observed a build up on housing upon decreases in the Federal Funds rate to almost nominal values.



Data source: Federal Reserve Bank of Philadelphia<sup>112</sup> and Board of Governors of the Federal Reserve System  
H.15 Selected Interest Rates – Data Download Program

The Taylor rule provides guidance in regards to the benchmark level that should be applied in setting the Federal Funds rate. This is achieved based on two inputs: the disparity between target and current inflation rate and the output gap, which is the result of the difference between potential GDP and the current level of output at the time of analysis (Bernanke, 2010). Hence, the two major components, inflation and GDP, should be taken into consideration when determining the rate at which banks lend to each other (Taylor, 2008).

This model complies with the dual mandate at the same time that it solves shortcomings related to lack of correlation between monetary policy and the real economy. However, a limitation to the rule is that,

<sup>111</sup> Since 2009 throughout the beginning of 2011, Japan experienced the effects of deflation, leading to an interest rate decrease by the Bank of Japan to roughly zero percent. Reuters, “Japan deflation eases in Jan on food, fuel spike”, February 24, 2011, <http://www.reuters.com/article/2011/02/24/japan-economy-idUSTOE71N07K20110224> ; The Economist, “Ending deflation in Japan. An old problem”, February 10, 2011, <http://www.economist.com/node/18119075>

<sup>112</sup> Historical Data Files for the Real-Time Set Data, Housing Starts (HSTARTS), <http://www.philadelphiafed.org/research-and-data/real-time-center/real-time-data/data-files/HSTARTS/>

because economic data are produced on a lag, definitions of the funds rate have to be pursued on forecasts at the time of rate set up, which is the current methodology used by the Federal Reserve (Bernanke, 2010). This implies that the limitations surrounding looking-forward data become present. If the rate was set up based on forecasts that deviated considerably from actual inflation and GDP growth, then optimal rate levels would not be achieved.

Additionally, because the Taylor rule takes into account the inflation rate without timeframe distinctions, temporary increases in prices are not incorporated into the rate calculation, making it incomplete for policy determination (Bernanke, 2010). At times an asset may increase in price, partially because of a temporary adjustment on the supply side or events triggering market fluctuations. In these cases, if inflation rate is not computed with adjustments, it could lead to a biased set up for monetary policy.

Furthermore, the sole application of the Taylor rule in the years prior to the crisis would have led to a steep deflation and a short term peak in the unemployment rate higher than 8 percent (Grosheeny, 2011). According to Bernanke (2010), the application of the Taylor rule upon the crisis should have required to raise interest rates during the first three quarters of 2008. In that case, the Federal Funds rate should have been within the 7 percent to 8 percent level, more than twice the actual rate. This could have led to a deeper market downturn and broader recession. Therefore, the rule could be applicable as a benchmark, accompanied by other indicators that would compensate the gaps present in the definition of forecasts, especially in regards to inflation.

Another limitation by the Taylor rule is the exclusion of the role of financial intermediaries. Consequently, the Taylor rule was modified in 2008 to determine the target rates as the Taylor rule and its reduction by the LIBOR-OIS spread (Woodford, 2010), which is a measure of the perception of general risk in the financial market. Despite this variation, the analysis of a single rate eludes the interconnections in market structure, as explained further in the following section.

### *Credit spreads*

A different approach to placing focus on a single interest rate and its impact on the crisis is to observe certain spreads across the financial market. This view acknowledges the changes that took place in financial intermediation and the sophisticated interconnections among market participants, which are ultimate sources of shifts in aggregate demand (Woodford, 2010).

Under the rationale of the IS/MP model, intermediation plays an essential role in the financial market and consequently, in economic activity (Woodford, 2010; Blanchard et. al, 2010), for which the analysis of the recent crisis needs to encompass models that consider financial intermediaries and how they affect the IS curve. Under the conventional LS models, equilibrium is determined through total lending, as well as through the interest rate agreed upon between borrowers (the banks) and savers. Changes in income would make available a higher level of savings and would shift the IS curve, impacting the levels of lending and borrowing. Then the new interest rate of equilibrium would be reached. An implied inflation rate would have an effect on output, either by following the Taylor rule or the Phillips curve, which could be achieved through the response from the central bank. Ultimately, economic activity is led by interest rate policies, along with the inflation rate as it happens with the dual mandate.

According to Woodford (2010), the LS scenario omits the current market behavior through which there are multiple interest rates that do not partake in the same reactions. Banks do not engage solely in transactions priced at the Federal Funds rate, but in a wider set of rates, which delineates a market structure in consonance with the features of the securitization scheme explained previously.

The intermediaries in the current financial market are represented not only by banks, but also by other financial entities. Borrowers receive an interest rate from these intermediaries, who in turn charge a different rate from their lending activities. Therefore, it is the intermediaries who determine the level of funds to lend and their spread by taking into account the marginal cost of lending based on the difference between their borrowing and lending rates.

Specialization is another feature in connection with the financial market. Some financial entities will have specific in house talent for certain types of acquisitions, or the necessary capital or increasing returns to pursue certain types of products and transactions. Because these financial organizations are limited in number, fluctuations in their leverage or in their net worth can drive the market to unbalancing cycles that lead to crises.

### *Leverage*

Under the described scenario, leverage becomes a feature of significance. Departing from the borrowing-lending scheme, financial intermediaries will try to expand their gains by targeting a wide range of products, many of which hold collaterals. Leverage draws in higher risk into the market because losses are expanded upon a faulty collateral or security.

Leverage will be approximately higher when spreads increase, which may be a sign of a drop in lending (Woodford, 2010). For this reason, the analysis of spreads can throw light into a potential expansion of risk and of credit crunches. While these spreads are connected through arbitrage, this link will break if some of the major institutions retire from the market (Blanchard et. al, 2010).

In examining the latest crisis, a sign of market failure was the concentration of leverage, which propagates the losses on reductions of capital in intermediaries with its consequent effect in the entire financial market. Then, a spiral developed through which similar assets needed to be sold at the same time, generating more losses and a continuous decrease in the value of intermediaries' capital. Available lending and aggregate supply were then affected, for which Woodford (2010) suggests that higher volumes of lending chosen to impact the IS curve should be revisited to avoid such leverages and potential financial junctures.

Upon fluctuations in economic activity, the effects on the intermediaries' net worth, which becomes deteriorated by massive sales, will lead to credit crunches due to lack of liquidity. This makes the IS curve more interest inelastic, which will in turn drive the monetary policy or aggregate supply. As a consequence, changes in economic activity could vary intermediaries' availability of capital, with potential enduring effects in economic activity.

This is the reason for which, banking policies that aim at the funding rate for intermediaries will exclude the impacts in economic activity induced by the contraction in the availability of funds in the market propelled by these parties. Policies that target only interest rates will be ineffective, as shown by the policy implication from 2004 until the crisis when higher Federal Funds rates did not affect interest rate spreads substantially, but in fact decreased the cost of corporate borrowing (Woodford, 2010).

If intermediaries draw much of the financial market's activity, then monetary policy decisions, such as interest rates levels, should encompass the indicators that these parties engage in, mainly, the levels of spreads assumed by these entities. It is suggested that the Federal Funds rate should be analyzed by incorporating variations in the interest rates spreads (Woodford, 2010), which are an indication of the activity in the intermediaries sector. This is also true when, due to a decrease in the volume of lending, nominal interest rates reach zero and a liquidity trap becomes effective, leaving no room for monetary policy (Blanchard et. al, 2010), which is the current case of the economic scenario after the crisis. In such cases, further monetary policy would imply a negative nominal rate, for which management of economic activity becomes ineffective.

In such scenarios, some proponents consider that the inflation rate should be kept at lower levels during stability times, to be raised later when shocks are foreseen (Blanchard et. al, 2010). Then the usual 2 percent would be raised to 4 percent, as long as the undesirable effects from inflation, such as the Olivera-Tanzi effect and the inflation tax, are taken in consideration.

A change of model for monetary policy is suggested by Woodford (2010). If the MS standpoint is replaced by analysis on MP, then the IS/MP model will include projected inflation and activity. Therefore, the IS curve should suffice for policy purposes because of the responses in the financial intermediation market generated by the curve's fluctuations. The central bank could also channel its objectives through

purchases of private debt from private parties and the expansion of credit lines, although the former should receive special attention and could be subject to challenges from a policy standpoint. In this case, it could become an inappropriate policy tool when favoring certain organizations. It could also become a target for political manipulation and the uploading of excessive risk, while taking the private sector into the public sphere. Disadvantages connected to the bail out programs applied provide some benchmarking on the potential consequences in this regard.

## 9. Moral Hazard and Academic Economics

Although addressed as the last of the root causes considered in the present paper, moral hazard and academic economics are not of lesser importance than the other sources. However, it appears more fruitful to consider them as a final item, as they encompass significant features present in the topics discussed previously.

### *Lending and spending*

Lending and the ownership objective have at times been assigned as means to political objectives that differed from the initial mission of allowing low and medium income households to satisfy their housing needs. Additionally, lending arrangements have been at times referred to as predatory lending, especially as they pertain to ARM lines (Gorton, 2008; Dodd, 2007). The beginning period is set at low interest rates, which are usually 2 points higher than those of prime borrowers. This initial term is also called the teaser period (Gorton, 2008) because it entices borrowers that are not aware of potential risks to take over highly costly loans with the expectations that house prices will continue to flourish. Another source of questioning has been the marketing practices employed by mortgage brokers and agents in presenting the refinance option as suitable<sup>113</sup>. The loss of equity to afford credit card and spending debt was made as a sensible opportunity by highlighting the primary withdraw of cash in lieu of the warnings pertaining to higher debt accumulation and the payment of unsecured debt with secured lines.

Prepayment penalties were costly and carried incentives against exercising them prior to the initial fixed rate period, in which case mortgagors were discouraged to refinance before the one to three-year period expired, giving room for house appreciation in the two-year rolling period, as documented by Gorton (2008). Some views consider this scenario as forceful and of a deceitful nature.

Furthermore, because they bore higher risk, subprime borrowers were required narrower covenants as compared to prime mortgagors. This, combined with the definition of liar loans, as discussed further below, represented an ethical issue for mortgage brokers and originators. The condition that subprime borrowers should be required higher collaterals in analyzing the repayment capability of a borrower was also considered as predatory lending<sup>114</sup>. In fact, lending approval to subprime borrowers should encompass a credit analysis on repayment under flexible rates as opposed to the fixed interest rate offered in the introductory period<sup>115</sup>. Absence of this verification contributed to default on payments and to the subsequent takeover of the assets by lenders as the LIBOR rate grew.

Indeed, this situation depended on the price of the collaterals and could be sought to provide sources of revenues if asset prices and LIBOR rates were to increase concomitantly, which leads to question lending practices applied until the crisis and the prioritization of short term revenue generation as a business model against the attainment of policy objectives related to ownership, consumer and borrower protections and disclosures required to financial institutions.

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<sup>113</sup> Center for Responsible Lending, “Risking homes...”, op. cit.

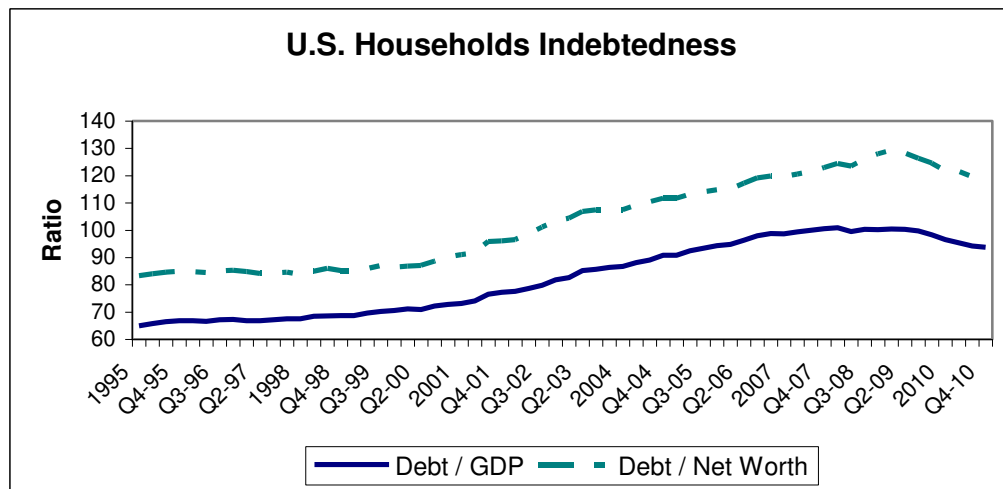
<sup>114</sup> This is the definition by Senator Christopher Dodd on “Senate Panel Studies Subprime Loan Woes”, National Public Radio, March 23, 2007, <http://www.npr.org/templates/story/story.php?storyId=9096735> and on “Hearing on Preserving the American Dream: Predatory Lending Practices and Home Foreclosures”, February 7, 2007 [http://www.opednews.com/articles/genera\\_christop\\_070207\\_chris\\_dodd\\_hearing.htm](http://www.opednews.com/articles/genera_christop_070207_chris_dodd_hearing.htm)

<sup>115</sup> National Public Radio, “Senate Panel Studies Subprime Loan Woes”, op. cit. Additionally, the Board of Governors of the Federal Reserve included legislation in this regard in 2006.

Considering that subprime loans were mainly ARM lines and taking into account the complexity of such deals, it becomes apparent that a certain degree of financial understanding by borrowers should come into play when engaging in mortgage loans<sup>116</sup>. This prerequisite combined with strong incentives for mortgage brokers to underwrite loans that would not reckon them liable in an event of default (Aumann, 2010) assembled a keen setting for subprime mortgage lending to unsuitable risk profiles. This was an enticing opportunity for what is usually referred to as liar loans (Dodd, 2007), which are lines given to high risk borrowers who do not qualify based on loan requirements or who have little or no income verification. In this case, a broker may modify the potential borrower's background so as to provide them with the loan. A survey to 2,000 brokers evidenced that approximately 43 percent of the them had engaged into liar loans in order to make their applicants meet the income criteria, while it is suggested that these actions were motivated by increasing underwriting and therefore, by the collection of higher fees and commissions<sup>117</sup>.

This was heightened by the reliance that financial professionals receive from their clients. During the U.S. Financial Capability Survey conducted by the Financial Industry Regulatory Authority (FINRA), when participants were asked whether they would trust a financial professional and accept their recommendations, 68 percent provided an affirmative or neutral response. Additionally, when asked if they pursued background verification on the financial professional, 84 percent answered in the negative<sup>118</sup>. This reliance renders a broker's ethical behavior crucial.

On the consumer's side, due to the appealing credit market emerging as a result of a stronger dollar and lower taxes and interest rates, consumers were presented with signs that consumption beyond affordable levels was admissible, which led to higher spending and high levels of indebtedness by households and individuals (Eichengreen, 2008). The delinquency and default rates that resulted from the crisis spillover, as well as the increased number of foreclosures, reflect this scenario. The following graph displays the increased levels of debt led by households, accelerating from the beginning of the 2000's.



Data source: International Monetary Fund<sup>119</sup>

Post-crisis questions about moral hazard also arose in regards to strategic defaults. As explained in the lending standards section, some borrowers who were underwater decided to default on their loans, although they could afford their mortgage payments. The evaluation as to the extent in which house payments should be honored split a debate between those who hold the view that mortgages are promises to pay which should be followed, against other views that disapprove courses of action led by financial institutions before and during the crisis and, therefore, find a reason to default.

<sup>116</sup> National Public Radio, "Senate Panel Studies Subprime Loan Woes", op. cit.

<sup>117</sup> Survey included in Dodd (2007).

<sup>118</sup> Data collected through an online survey of 28,146 respondents in the period June to October of 2009, [http://www.usfinancialcapability.org/download/FINRA\\_Survey\\_Data\\_Tables.xls](http://www.usfinancialcapability.org/download/FINRA_Survey_Data_Tables.xls)

<sup>119</sup> International Monetary Fund, Global Financial Stability Report, April 2011, <http://www.imf.org/external/pubs/ft/gfsr/2011/01/index.htm#tablesc10020>

### *Agency problems*

A number of authors (Estrada, 2010; Colander et. al, 2009) agree that there is a moral hazard case in the application of models that do not disclose their risks, potential miscalculation and inherent errors that might deem the entire assessment defective. This represents an ethical limitation, as preventive rules should endorse the disclosure of knowingly low expected rates of return and highly probable defaulting pools (Tarr, 2010).

On the institutional side, the crisis was spurred out by short term leveraging and increased desire for short term and higher returns (Woodford, 2010). Loan originators, financial institutions, asset managers and mortgage brokers, who did not bear the risks on the loans that were issued and securitized, were motivated by incentive structures presented by financial institutions that wanted to attract available talent. VaR models became enticing to tie risk to income, at the same time that portfolio positions with small probabilities of big losses were taken by traders to maintain low levels of VaR. Then, portfolio income was generated impacting the broker's compensation<sup>120</sup>. These income structures, through which management and traders are bound to income generation (Kashyap et. al, 2008), along with agency problems, led institutions to the acquisition of high risk assets (and therefore, highly profitable ex ante), which have low probabilities of default.

Under the current market structure, systemic risk is linked to moral hazard. In the event that the market becomes unstable, the financial institution holding the portfolio and encountering liquidity issues will prefer the prompt sale of assets rather than raising equity, as the latter can be troublesome from a cost standpoint and a market signal perspective (Kashyap et. al, 2008). Hence, a fire sale will begin, with the consequent fall in assets prices, which becomes contagious to other financial institutions. This situation created by a single institution or by a given group, decreases the market value of the net worth belonging to the rest of the parties that constitute the market, impacting all parties involved and creating a case for moral hazard. For this reason, the OTD model has been asserted as a main motor for the generation of agency problems, where risks were transferred to the rest of the system from the originator, although institutions were ultimately exposed to the consequences of the financial crisis (Gorton, 2008).

Moreover, spillovers caused by the financial system are borne by the rest of the economy. Because banks and other financial institutions will try to avoid raising capital, upon the fall of their portfolios' market values other readily sources of liquidity will be affected, such as credit lines. This will affect adversely the credit system (Woodford, 2010; Kashyap et. al, 2008), producing spillover effects on the real economy and output, and hence affecting aggregate demand.

However, some authors state that solving agency problems is a challenging measure lacking a satisfactory outcome (Kashyap et. al, 2008). This in turn raises the question about whether the OTD model is desirable and if it should be pursued upon the systemic defaults and write offs experienced not only in the financial system, but also in the economy as a whole.

Finally, other topics such as the bail out programs and the risk appetite held by investors presented debate upon the application of liquidity lines (Fender and Scheicher, 2008). TARP and other bailout programs are sought by some authors as counterproductive to set up the market discipline that would avoid future crises (Tarr, 2010). The too big to fail scheme gives reliance by major institutions that they have a safe harbor in case of downturn and, hence, their appetite for risk and short term revenues are encouraged (Aumann, 2010).

### *Academic economics*

Other proponents hold the view that economists have a commitment to society, as the latter relies on data and predictions supported by experts, and that not having been able to assess the failure that occurred in 2007 should lead to a reconsideration of economics as a discipline.

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<sup>120</sup> The New York Times, "Risk Mismanagement", op. cit.



Estrada (2010) offers to change the current paradigm, as well as to expand the views of economics taught in university courses. He believes the student should be trained in a wider variety of subjects, such as physics, literature and history, because human relations are influenced by a wider spectrum rather than the rational behavior attributed to the homo economicus. Colander et. al (2009) agree in enhancing the professional's curricula, which could aid to the understanding of other disciplines related to human behavior and which can later be applied in modeling. The aggregation of microeconomics into macro models should also be revisited to improve the gaps revealed by the study of behavioral economics.

Other authors highlight the need to include banking courses in the academic curricula, along with the complex mechanism that prevails in the financial markets, which differs to the currently taught simplified lender-borrower system (Gorton, 2008).

The search of a single and adequate index represents another failure in economics, whereas a variety of targets should be the focus of economic policy (Blanchard et. al, 2010). Goals in both, monetary and fiscal policies should be prioritized as crucial economic mechanisms to prevent and avoid crises.

## 10. All Things Considered

The present paper reviewed the main drivers assigned as roots for the financial crisis, along with their interconnections and array of synergies that played a role in the creation and development of the crisis. There are then two features present in the analysis: the various reasons (objects) and their interconnections (relations), which we will interrelate by means of graph theory.

### *Definition of relations and graph*

The objects are defined as graph vertexes, as the aim is to graph the interconnections among these root causes. The objects emerge from the explanation supplied in all the chapters above. The following table summarizes them by means of vertexes. Each source for the crisis, that is, each vertex, is symbolized by a letter or chain of letters in lower case.

**Analyzed Reasons as Vertexes**

<b>Node</b>	<b>Reference</b>
a	ABS and other structured products
b	Subprime originations
c	Consumer spending
d	Deregulation and insufficient regulation
e	Indebtedness by households
f	Homeownership as a policy objective
g	Agency issues
h	Housing prices and bubble
i	Inflows of capital
j	OTC model
k	Systemic market layout
l	Permissive lending standards
m	Monoline insurance
n	Capital requirements
o	OTD model

p	Non-regulated off-balance sheet entities
q	Monetary policy
r	ARM lines to incompatible borrowing profiles
s	Complex financial market
stf	Short-term funding mismatch with long term investment
str	Short-term revenue aim and generation
t	Toxic assets
u	Credit ratings
v	VaR and other risks models
w	Sense of wealth
x	Hedging, CDS, CBO, ABX
y	Information asymmetry
z	Moral hazard and academic economics

Hence, the vertexes are represented by the following set:

$$V = (a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, stf, str, t, u, v, w, x, y, z) \text{ where } |V| = 28$$

The vertex corresponding to moral hazard (z) encompasses all reasons as described on section 9. Further inquiries shall be made in the realm of moral stance and moral relativism in business and economics behavior, which are not part of the present paper.

The vertexes under analysis compose a finite set and the aim is to draw the interrelations among such vertexes and to delineate the cause-consequence relationships among the reasons for the financial crisis. Hence, unlike a non-directed graph, ordered pairs of vertexes are necessary in this context and a directed graph or digraph are applied

As mentioned, the definitions of the relations among the vertexes emerge from the explanations given in the respective sections dedicated to the causes for the financial crisis. Consequently, the following set of pairs of binary finitary relations describes the interaction of each cause with the rest of the set:

$$\mathfrak{R} = \{ (a, k), (a, s), (a, u), (a, x), (b, o), (b, h), (b, y), (b, a), (b, r), (b, x), (c, e), (c, r), (d, n), (d, t), (d, j), (d, m), (d, o), (d, u), (d, l), (d, v), (d, f), (d, p), (d, s), (d, str), (e, c), (e, w), (f, b), (f, l), (f, r), (g, v), (g, u), (g, z), (h, a), (h, e), (h, z), (h, c), (h, b), (h, w), (h, r), (h, v), (h, l), (h, str), (i, a), (i, c), (i, b), (i, h), (i, l), (i, q), (i, str), (i, v), (i, w), (j, k), (j, x), (j, p), (j, s), (j, y), (j, z), (k, a), (k, j), (k, x), (k, u), (k, v), (k, i), (l, a), (l, e), (l, r), (l, b), (l, h), (l, t), (l, z), (l, x), (l, w), (l, y), (m, k), (m, x), (m, u), (m, s), (m, t), (n, u), (o, z), (o, k), (o, str), (o, x), (o, y), (o, a), (o, s), (p, x), (p, a), (p, d), (p, n), (p, stf), (q, b), (q, r), (q, x), (q, v), (q, n), (r, a), (r, c), (r, s), (r, e), (s, v), (s, a), (s, p), (s, t), (s, k), (s, y), (stf, a), (str, g), (str, l), (str, p), (str, r), (str, u), (str, v), (str, x), (str, t), (str, z), (t, k), (u, a), (u, x), (u, n), (u, m), (u, str), (u, v), (u, y), (v, i), (v, x), (v, n), (v, y), (w, y), (w, x), (w, r), (w, str), (w, v), (x, a), (x, d), (x, h), (x, m), (x, n), (x, z), (x, k), (x, s), (x, str), (x, t), (y, e), (y, k), (y, x), (y, u), (y, v), (z, f), (z, g), (z, o), (z, str), (z, u), (z, x), (z, y) \}$$

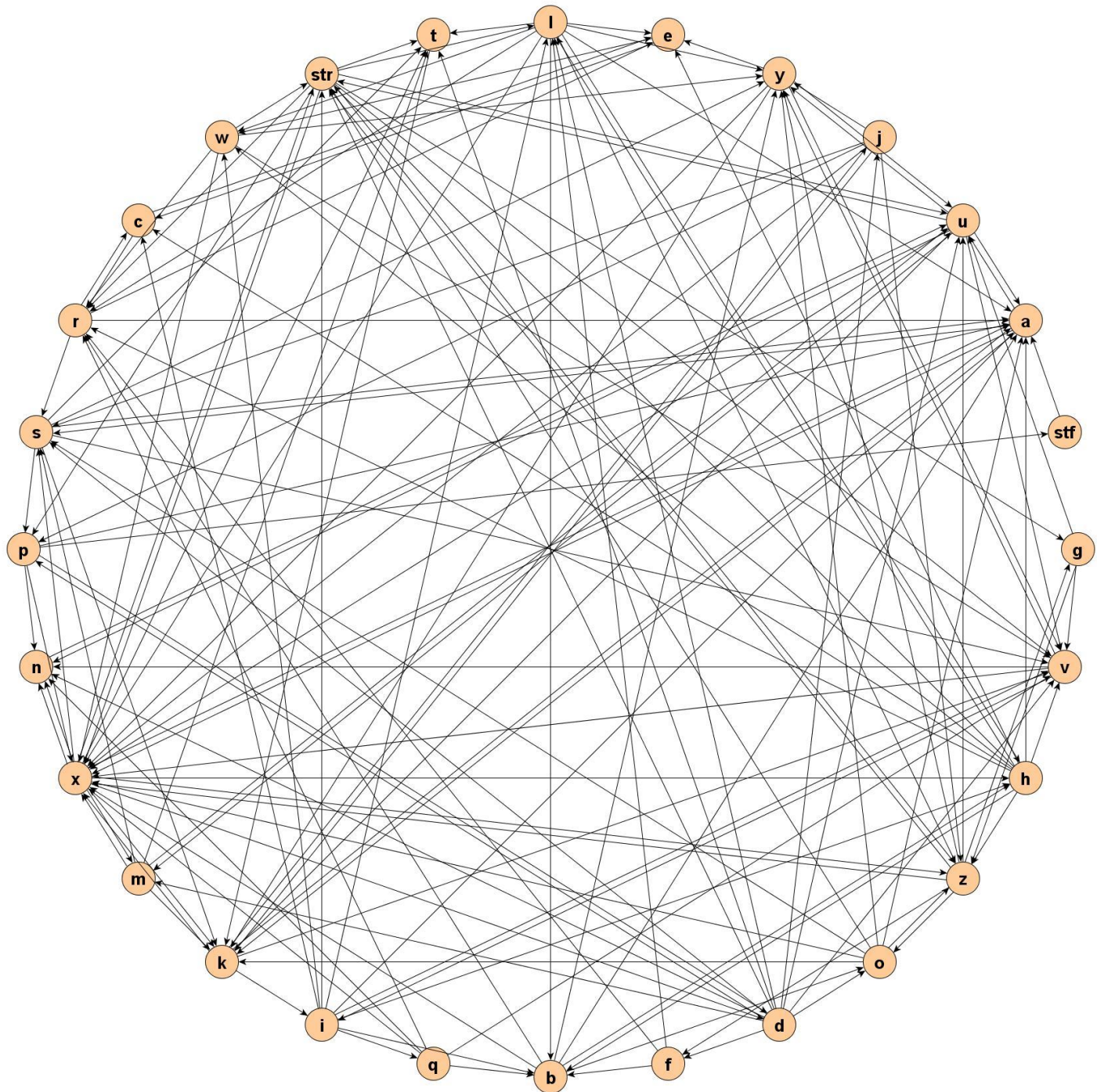
$$\text{where } |\mathfrak{R}| = 155$$

The digraph  $D$  is then defined as

$$D = (V, \mathfrak{R})$$

and it can be represented in an arrow graph as follows:

**Digraph of Relations Among Causes**<sup>121</sup>



***Predecessors and successors of each vertex in  $D$***

The current analysis that the objective of this paper could be achieved by observing the walks or paths that the relations between a vertexes outline, which would allow concluding if a certain reason or set of them propelled the crisis, or if, on the contrary, the design of the crisis was due to the correlation among all causes analyzed.

<sup>121</sup> Prepared with yEd software, Version 3.7.0.2. Copyright 2000-2011 yWorks GmbH, [www.yWorks.com](http://www.yWorks.com)

A walk is defined as a sequence within D that is comprised of an alternation of vertexes and arcs. Presenting an extensional definition of the walks contained in D could lead to cumbersome descriptions. In this case, the analysis of predecessors and successors provide a clearer approach, allowing to achieve the same objective.

The following table details the predecessors and successors for each vertex that belongs to the relationship included in D:

**Predecessor and Successor Table for  $\mathfrak{R}$**

<b>Predecessors</b>	<b>Node</b>	<b>Successors</b>
stf, k, u, s, o, p, x, h, l, i, r, b	a	k, x, s, u
i, f, h, l, q	b	o, h, y, a, r, x
r, e, h, i	c	e, r
p, x	d	t, v, j, m, s, o, u, str, p, l, n, f
c, l, h, r, y	e	w, c
d, z	f	b, l, r
str, z	g	v, u, z
i, x, b, l	h	r, c, a, str, z, b, l, w, v, e
v, k	i	h, c, l, q, w, v, b, str, a
d, k	j	z, y, k, s, x, p
j, s, t, m, a, o, x, y	k	i, x, u, v, a, j
h, i, d, str, f	l	x, h, e, r, w, a, y, b, z, t
x, u, d	m	s, k, u, x, t
q, v, p, u, x, d	n	u
d, z, b	o	x, s, str, z, k, y, a
j, str, d, s	p	x, d, stf, a, n
i	q	v, b, r, x, n
str, h, l, q, b, w, c, f	r	s, a, c, e
d, m, a, x, o, r, j	s	p, v, a, k, y, t
p	stf	a
o, h, w, d, x, i, u, z	str	z, v, u, p, x, t, l, r, g
d, s, x, str, m, l	t	k
g, d, n, m, a, str, z, y, k	u	str, x, n, m, a, y, v
u, k, s, g, q, str, y, h, d, w, i	v	i, x, y, n
e, h, i, l	w	str, y, r, x, v
w, q, b, l, z, str, a, v, u, m, j, o, p, y, k	x	t, m, a, n, k, z, d, s, str, h
w, b, l, z, v, j, o, s, u	y	x, u, v, k, e
j, o, h, str, x, g, l	z	str, g, y, u, x, o, f

Let  $\rho$  be the predecessors. Then, for the purpose of this analysis, it is possible to classify the vertexes in D into two major groups: those that are the origin of a spanning walk and those that are not. A walk is defined as spanning if it contains all the vertexes in a given diagram. Thus, the focus is on walks that hold the following characteristics simultaneously:

- 1) The origin is composed by one single vertex. This vertex lacks predecessors and it can be identified.
- 2) The walk is spanning, that is, from the one given vertex, all other vertexes included in D are part of the walk.

In the case of condition 1), the search is for vertexes that have no predecessors, that is, vertexes that comply with the following requirement:

$$A = \{V \in D : \sum_{\alpha=1}^n \rho_{\alpha} = 0, \forall \rho_{\alpha} \in \mathcal{R}V\}$$

These vertexes may be gathered in a set called A.

In the case of 2), the search is for a walk that begins on the vertex found in 1) and that involves all the vertexes in the graph.

Consequently, focus lays on the set named as A, which contains all the vertexes that lack a predecessor and that, at the same time, have all the other root causes as successors. These are the vertexes that would be deemed as the origin of the crisis, that is, the root cause that provoked a domino effect on the rest of the causes. If such main root cause exists, it will show as a predecessor to all other vertexes in the diagram, in which case the crisis should be assigned to this particular origin.

***Spanning walk of single vertexes with no predecessors***

In designing the set A, it is possible to refer to the table that outlines all predecessors and successors for each vertex. From that table, and by observation, no single vertex can be found that gathers the necessary characteristics in order to belong to the set A. This is shown by the cardinal of each subset of predecessors for each vertex given, whereas no vertex complies with the necessary condition to be included in A:

$\sum_{\alpha=1}^n \rho_{\alpha}$	Node
12	a
5	b
4	c
2	d
5	e
2	f
2	g
4	h
2	i
2	j
8	k
5	l
3	m

6	n
3	o
4	p
1	q
8	r
7	s
1	stf
8	str
6	t
9	u
11	v
4	w
15	x
9	y
8	z

Consequently, the condition in 1) is not met, providing

$$A = \{ \}$$

In conclusion, all vertexes, that is, all the root causes explained throughout this document, led together to the state of affairs that propelled the crisis. Moreover, from the previous analysis, a single vertex or a particular subset of them cannot explain the development and conclusion of the crisis, given that no walks of D can be found that comply with the requirements provided for a vertex or set of vertexes to be included in A.

## 11. Conclusion

The crisis was triggered by a series of reasons acting in conjunction, while it has been demonstrated that by the present paper that assigning a single source or a set of them as the main causes does not represent the actual economic scenario, nor the existing circumstances in the financial market prior to the crisis. For this reason, focusing on partial sources will impair potential actions that could prevent further cycles. Although some proponents assign primary and secondary accountability to different sources, the aim should focus on prevention in all the areas involved and on the definition of their potential outcomes.

This paper revisited each cause assigned by literature as a source to the crisis and it has shown, by means of graph theory, that all these origins propelled jointly the setting that made the crisis possible. Questions surrounding moral hazard, insufficient regulation, lowered lending standards, intricate securitization, the application of partial and unsustainable valuation models, inaccurate credit ratings, asymmetric information, global imbalances and monetary policy furnished a scenario such that approaching these reasons as isolated starting points would ignore the effects of each walk included in digraph that is a consequence of the analysis of these root causes.

Because it encompasses a wide array of origins, disentangling the actual crisis requires the coordination of local with cross borders government bodies. Despite the differences in opinion as to the diagnosis of what went wrong and how it could have been avoided, some of the literature agrees that collective actions are to be expected in order to return the confidence in the financial markets and to promote trade activity and stability in monetary policy.

Furthermore, measures taken should encompass a market structure that will route investment into highly productive areas. The achievement of these objectives rests on incurring in policies that will reconcile all the drivers described hereto as means of aggregation.