

A QUANTIFICATION OF THE 2008-2009 US BAILOUT PACKAGE

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***Abstract:** By examining the credit crunch causes and effects, this paper reflects on the necessity of the banks bailout package and its alternatives and quantifies a maximum non-inflationary bailout amount which is unlikely to cause permanent adjustments in the long term (trade-weighted) exchange rate equilibrium level of the US dollar. Furthermore it determines that the current bailout amounts are less than the maximum non-inflationary bailout amount and determines that to resolve the underlying credit crunch problem, an increase in non-bank bailout M1 and/or a tax reduction is necessary.*

***Keywords:** credit crunch, M1, M3, ISLM equilibrium, demand shock, Keynesian multiplier, monetary policy, fiscal policy, mortgage prepayments changes, MBS, velocity of money supply, long term equilibrium of exchange rates.*

Although formal acceptance of A-rated MBS tranches into the classroom definition of M3 has not yet occurred, Wall St had treated such tranches as money starting in the late nineties, on their liquidity assumption and in view that everyone grew accustomed to the US real estate market growing 10% a year and more until 2007. Until 2007, virtually every new mortgage issuance that met Fannie Mae's standards was sold and refinanced forward through To-Be-Announced (TBA) products.

Enjoying inter-bank liquidity and credit enhancement through their over collateralization through subsenior tranche subordination, the MBS tranches given the availability of subprime mortgage origination to form the subsenior tranches met the voracious appetite of Wall St. for leverage during the equities and real estate boom, which was assumed to continue given the low comparative US ratio of median house price to GDP per capita.

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It is safe to assume that given everyone's acceptance of MBS tranches, the Fed's window for refinanced assets had been used less, thus banks repoed other assets in the inter-bank market against MBSs. Thus in Greenspan's years, the Fed issued a lot less M1 than they would have had in the absence of liquid MBSs, and lacked the exact picture of credit deterioration, relying on the credit ratings agencies as a monitor despite the fact that later the raters got heavy criticism in the media for their MBS ratings methodology and for the fact that they only downgraded issuances a posteriori (i.e. after defaults occurred). This situation surely compounded the credit crunch later.

Due to the fact that bank reserves are required only on M1, except for tranches that did not meet the Fannie Mae criteria, there has been no slowdown on the credit multiplier induced by MBS tranches. Thus the magnitude of velocity induced by mortgage-backed-securities must have been high but formally unknown before the crunch commenced. Thus once the credit crunch commenced the banks bailout plus M1 increase policy and/or plus tax easing response in total should be the drop in mortgage-financed real estate value times the multiplier. Since the Fed does not calculate an actual multiplier but instead a M2 reserves-free velocity measure, which has been reported to be 1.75 in 2008 and 1.5 in first quarter 2009 (Source: Fed Reserve Bank of St. Louis, March 2009 Monetary Trends). The growth rate of velocity has been reported by the same source as at Qtr 1, 2009 to be at -50% so we assume the velocity for the whole 2009 to be 1.35.

$$A: (M1+M2+M3+MBS)_{t-1} * V_{t-1} = P_{t-1} * Q_{t-1}$$

$$B: (M1+M2+M3+MBS)_t * V_t = P_t * Q_t \text{ Assume } M1_{t-1} = M1_t, M2_{t-1} = M2_t \text{ and } M3_{t-1} = M3_t$$

We assume the bailout package to be non-inflationary if there is no real-growth (i.e. velocity-adjusted) in M1, M2, M3 and MBS during the GDP contraction, so the bailout will replace the quasi-M3 (i.e. MtM loss of all mortgages).

Obviously if the bailout package is too low, additional M1 amounts would have to be issued outside of the banking system, for example to buy government debt, in order to keep a GDP-adjusted, velocity-adjusted total monetary mass thus to alleviate the contraction.

The MBS values are not entered at nominal value, but at Market Value, since the multiplier base for MBS is the refinancing value thus the Market Value. The bid values are not used since based on the analyses, the long term market values converge to replacement cost of collateral. By stressing the nominal value by the maximum shock calculated below, we obtain the market values.

$$B-A=0 \Rightarrow (MBS_t + \text{Bailout}) * V_t - MBS_{t-1} * V_{t-1} = P_{t-1} * Q_{t-1} - P_{t-1} * Q_{t-1}$$

$$(MBS_t + \text{Bailout}) * 1.35 - MBS_{t-1} * 1.75 = -0.062 * P_{t-1} * Q_{t-1}$$

Source: Federal Reserve Bank of Saint Louis, 2008 6.2% Y-O-Y contraction in GDP at nominal prices

But as said, MBS_{2009} includes the Max Bailout so by solving for MBS_{2009} and subtracting $MBS_{2009\text{before bailout}}$ available in the Fed data, we find the Maximum non-inflationary bailout.

So let's calculate the bailout and provide further insight about the credit crunch.

The existing criticism to the credit rating agencies with regards to the opaque criteria for awarding A-ratings to MBS tranches made banks question ratings altogether and during the real estate exuberance accept lower rated tranches as collateral, the banks assuming the rating agencies to be biased downwards instead of upwards, making the banks assume a widespread credit improvement instead of a widespread credit deterioration. This conceptual error, whose culprit is indeed the credit raters, cost the banks dearly, since when the subordination attachment points of the senior tranches were bust as the credit crunch commenced and the already impaired subsenior tranches started to make payments to the senior tranche holders, the value of all collateral plummeted.

From 2001 to 2007, the subordination levels required by the credit agencies of subordinate tranches by the super senior tranche decreased by 27% (Source: Morgan Stanley) although real estate prices have gone up double digits every year thus the equity levels of the year estate have been dwindling. Thus at the time the equity left in the houses was depleted, the subordination was reduced instead of enhanced. Actually full backtesting results from older CDOs were not available since most of the older CDOs had a life of 10 years or more so there was no clear evidence of excess credit enhancement. It is actually odd that rating agencies were biased against the senior tranches since it is their investment grade ratings that they build their reputation on, the subordinate tranches were high yield anyway.

As the credit crunch started in mid-2007 with subprime (i.e. subsenior) defaults, which rendered senior MBS tranches with no credit protection, thus making prices of A-rated MBS tranches fall below Fannie Mae new issuance, except for the Fannie Mae issuances the MBS liquidity dropped considerably. As Fannie Mae started to report increasing defaults on their issuances in early 2008, the second mortgage refinancing collapsed, making all credit enhanced MBS suddenly repudiated as M3 collateral in the banking system. Even though the banking system had to deal with a lot of leverage now improperly collateralized, the Fed/SEC did not require additional collateral at once and only became involved in late 2008 through limited bailout and/or refinancing limited senior tranches, allowing the crunch to start violently.

While the Fed eased to below 1% funds rate, high yield credit spreads widened in 2008 to double digits (Source: Wall St Journal 2/19/2009), and the 1st Qtr. 2009 mortgage collateral accounting loss perception to the bubble 2006 levels is skyrocketing due to low bid prices – 10 cents on the dollar on secondary mortgage

pools with the owners still in the house (Source: Bloomberg, also Mark-it) (i.e. poor bids in the market – FAS 157 level 3 observable rules per the new FASB standard issued in 2007).

Of course 10% on second mortgages is an opportunistic bid. Obviously this low bid would assume that all second mortgages were taken at the peak of the bubble, despite the fact that equity lines have 10 year repayment terms, thus the refinanced amount may as well reflect current real estate values for 2004 and before equity lines, since the yearly appreciation from 2000 to 2006 was roughly 10% a year and the drop from 2007 was -18% for 2008 (Source: OFHEO, 2009)

I would introduce the dollar value difference from the 2006 price levels at the peak of the bubble and replacement cost as bounds of our maximum non-inflationary bailout estimation model, and I assumed that there is no excess square footage per capita in the US.

If there were excess square footage per capita in the US, the house prices could drop below replacement cost since there is no incentive to build. Since the houses prices are above replacement cost and there is no excess square footage, in absence of credit barriers to entry new building will in the long term drive the house prices to replacement cost. Indeed sales of new one-family houses in December 2008 were at a seasonally adjusted annual rate of 331,000 (Source: US Census). Sales of new one-family houses in December 2007 were at an annual rate of 604,000, 40.7% less than the 2006 figure of 1,019,000. This is an indication of the fact that although new building continues, it is decreasing and gradually the prices will converge to replacement cost.

The average American home in 1950 was 983 square feet (Source: msn real estate) and, according to Census data, the average American household size was 3.37 people. This means that in 1950 the average American had 292 sfpp (square feet per person).

In the years that followed home size gradually grew and household size gradually fell until, in 2006, the average American household of 2.61 (Source: US Census) shared a house of 2,349 square feet (Source: US Census). So, in 2006, the average American had 900 sfpp, and we assume that that number has stayed constant in the last two years.

Comparison of US with large countries with approximately the same population density per square mile such as Russia, Australia and Canada, where house prices have been quite stable recently, renders numbers in the same ranges (Sources: Rosimushchestvo, SACHA and CMHC).

I have obtained courtesy of Allstate and Liberty Mutual electronic files of 1000 2009 house fire insurance policies in New York Metro area (the policy price was blanked out for corporate pricing confidentiality purposes), for houses bought last in 2006, at the peak of the bubble, mostly Long Island and Brooklyn zip codes.

Having both to replace a lot of properties destroyed by hurricane Katrina in 2006 (I picked the names of the 2 companies from a 2008 list of Katrina hazard loss payers at Insurance Information Institute), I assumed that Allstate and Liberty Mutual by then were expert in cost calculation, and that New York City had been at the peak of the bubble as much as California and Florida were overpriced compared to other states so the difference between their 2006 prices and their replacement cost had been the highest in the country. Thus in the context I considered the sample size was representative for the test. Obviously replacement cost and purchase price were the inputs in the policies I was looking for. I had found an average of 32% between the prices at which the 1000 New York City properties had been bought in 2006 and their replacement cost, with 39% of the purchase price the highest for better school districts and larger backyards and only supported by one insurance company, while the other's highest number was 30%. So the 2 insurance companies had narrowly divergent views across same zip codes. Thus I am going to use the 39% number in my stress tests as the most severe potential drop in price brought by the credit crunch. Of course per actuarial science, convergence to the mean occurs over time. Thus to alleviate the price drop for the repossessed houses the government may want to hold the repossessed houses for a while as to not cause a fire sale, or to not evict at all during the recession.

In 2008 68.5% of US citizens were house owners (US Census) versus 67.8% in 2007 and 68.9% in 2006. Thus the marginal drop from the beginning of the credit crunch 2 years into the credit crunch shows that people did not dump their houses purposely as a result of the credit crunch. The combination of a decreasing percentage of house owners with a decreasing number of new houses built also signals convergence to replacement cost as costlier properties were abandoned to buy newly built properties on a descending overall price trend.

The decreasing from a high base, but stable number of house owners with an insignificant number of new houses built relative to the number of owners shows that the bank losses reported recently reflect payment stops of 6 months and more and not an accelerated exit from the house market, namely sale of house at amount less than mortgage and leaving the bank with losses, which would have changed this analysis. So if the banks do not repossess the houses, which would stir more volatile movements in the prices due to a sudden unexpected positive supply shock, the bailout of the government is in reality a rollover of the mortgage, a handout by the government to banks to make them roll over the mortgages and keep the owners in the house. Thus if we expect the recession to last 4 years which is a normal longer recession cycle, the 4 years or less of non-payments is split between government and banks in exchange for a shareholder stake in the banks. If the mortgage holders eventually find a job and resumes payments, the government makes money. Suppose that out of the bailed outs pool half of the people resume payments and half are

repossessed and the price drop for the repossessed house is 50% (a shock more severe than the assumed most severe price drop of 39%), the government still makes money as for a 16 year duration mortgage, the interest collected is 66.5% of the loaned amount at a 7% average rate. This is supposing that for the bailout amount the government charges the average mortgage rates. Thus to alleviate the price drop for the repossessed houses the government may want to hold the repossessed houses for a while as to not cause a fire sale knowing that it makes money from the employed pool. Jumping in on the bandwagon of previous years' mortgage rates is a good idea for the government from a cost-benefit perspective in a much lower interest rate environment.

It is not clear if the bailout money has a multiplier since the bailout may be used by some banks to meet the 8% Tier 1 reserve ratio, without the banks awarding fresh credit from it. If the banks award fresh credit from it, it saves the government from additional spending prescribed in a recession, so the money would have nevertheless been issued (ISLM model context). We are going to show this in Part II of the paper by building an ISLM model.

However, new loan issuance reversed to negative year on year growth percentages in fourth quarter 2008 (Source: Standard and Poor 2009), after in the first three quarters of the year the year-on-year growth was far below the historical 8-10% yearly growth expectations. According to the same source, new issues of bonds and securitizations collapsed to almost no new issuances in 2008.

To see if the banks' equity is eroded, we assume prepayments to drop suddenly to zero during a long 4 year recession cycle, which is likely to extend the average US mortgage duration for a 30 year mortgage of 12 years (Source: OFHEO) to 16 years, with government's help.

Assuming the cost of funding of the banks stays the same (Fed has hinted that the policy of easing thus is not stopping soon thus the low interest-rate environment is expected to continue), as the internal rate of return in the mortgage context per FAS 91 is positive, extending duration by decreasing prepayments is increasing the accounts receivable while keeping constant the internal rate of return (see table below) thus the profit. Making the same analysis under the opportunity cost scenario, renders the same conclusion as currently the mortgage rates are decreasing and the lowest in 5 years (Source: OFHEO, March 2009).

Table 11 *An analysis of banks government bailout on banks equity. Source: self, hypothetical analysis.*

| Funds advanced USD | Effective Duration | Monthly Payment | IRR= $\sum \text{PMT}/(1+i)^n$ Equals old mortgage rate | Discount rate | PV= $\sum \text{PMT}/(1+DR)^n$ DR=Discount Rate=Opportunity cost same credit risk = new mortgage rate |
|--------------------|--------------------|-----------------|--|---------------|--|
| 100,000 | 12 years | 1,028.38 | 7% | 5% | 109,381.39 |
| 100,000 | 16 years | 867.21 | 7% | 5% | 112,788.67 |

Therefore the bailout package in a low interest rate environment is increasing the equity of the banks.

The total of mortgage-financed real estate loans in 2008 for single and multi-family residential homes was 12,000 billion dollars (Source: Board of Governors of the US Federal Reserve System, 9/18/08). Thus if we assume a 39% shock on this number, the 787 billion proposed rescue package seems minuscule at less than one percent of the total mortgage base.

The 12,000 billion dollars mortgage base does reflect the correct number to apply the maximum shock on, since over 2004-2007, the growth rate of this number is close to the real estate index yearly appreciation, the rough price appreciation of real estate during that time. We want to see if the owners maxed out on their second mortgages/ equity lines thus aggressively monetizing the real estate appreciation. Thus knowing that the new houses sold get new mortgages, we backed out the yearly new homes sold at the average US home price out of the total mortgages number to see a clean refinancing growth trend. The house ownership percentages are quite stable, their increase by 1% in 2004 let's assume bought new homes in 2004 as 1% of the total population of US is close to the new houses built and sold to new owners in that year. As the house owners growth rate is negative starting in 2005, it means that from 2005 through 2007 existing house owners bought more properties gobbling the new homes sold number as the vacancy rates are nil during that time. So most of the existing house owners postponed their sale decision but dynamically maxed out their equity immediately and the bailout base of 12,000 bn dollars stands.

Table 12 *A comparative analysis of mortgage growth in the US Source US Census, various other US Official Statistics Sources and own calculations*

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|--|---------|---------|---------|----------|---------|---------|
| Home | 7232 | 8269 | 9231 | 10456 | 11168 | 11166 |
| Multifamily residential | 544 | 592 | 664 | 718 | 817 | 866 |
| Total | 7776 | 8861 | 9895 | 11174 | 11985 | 12032 |
| Total less new homes sold at average US home price | 7401.25 | 8458.25 | 9466 | 10807.75 | 11723.5 | 11874 |
| Growth rate | | 13.95% | 11.67% | 12.93% | 7.26% | 0.39% |
| New homes sold | 1499000 | 1611000 | 1716000 | 1465000 | 1046000 | 632000 |
| Growth rate new homes | | 7.47% | 6.52% | -14.63% | -28.60% | -39.58% |
| House owners % | 68.30% | 69.00% | 68.90% | 68.80% | 68.10% | 67.80% |
| House owners growth rate | | 1.02% | -0.14% | -0.15% | -1.02% | -0.44% |

If we revert to the equation above, $MBS_{2009} * 1.35 * (1 - MBS_{2008} * 1.3 / MBS_{2009}) + 1.35 * \text{Bailout} = -6.2\% * GDP_{2008}$

And we have as $-6.2\% * GDP_{2008} = -862.71 \text{ bn}$ (Source: US Bureau of Economic Analysis)

$$\text{Bailout} = 4,895 * 0.61 * 1.35 * (1 - 4,464 * 1.3 / 4,895 * 0.61) / 1.35 = 1,452.3 \text{ bn}$$

So the maximum non-inflationary bailout package using this method is 1,452.31 bn dollars, almost double the 787 billion proposed. This number could be slightly reduced by assuming some older mortgages and rental properties in the MBS base whose elasticity to real estate prices being low seems reasonable, but still the 787 billion number seems extremely low.

In view of the low direct bailout amount, let's build an ISLM model which will capture the monetary policy and the easing alternatives for this extreme contraction following the period of financial innovation when MBS tranches became widely accepted as enhancing M3. It is clear that structural changes in the demand for money had made banks accept MBS as quasi-liquid instruments, redefining money supply. Thus it is clear that the abrupt drop in property prices became a supply shock to the US economy.

It was clear that in the years of the bubble, the Fed did not control M3.

The ISLM model assumes equilibrium between the goods market and the money market, in an environment where inflation expectations π^e are exogenous and y (GDP) and i (nominal interest rates) are determined out of the model, and $i - \pi^e$ is the real interest rate. ISLM ($y_0, i_0, \pi^e, i_0 = \pi_0^e, \mu = \pi_0^e$). $\pi = p - p_{-1}$. μ the growth rate of money supply equals the inflation expectations (condition of the construction of the LM curve), $\mu - \pi = m - p - (m - p)_{-1}$. If $\mu > \pi$ money balances are growing. Thus on the demand side, given income and price levels, the demand for money is inversely related to nominal interest-sensitive money supply and the money multiplier cannot be controlled, $k = k_0 + bi$.

$m - p = a_2 y - a_3 i$ is the equation of the LM curve with slope a_2/a_3 and intercept $m - p / a_2$

The points on the LM curve represent equilibrium in the asset markets. Thus we can assume that during the bubble years the mortgage expansion (i.e. expansion not due to expansionary monetary policy) shifted the LM curve to right so $\mu > \pi$ for a period of time, reflecting a structural change in the demand for quasi-money from banks. This increased liquidity in mortgage pools is equivalent to as if the Fed had pumped more money into the economy. The increased real money balances reduced both the nominal and the real interest rates, from 10% mortgage rates in the late nineties to 6%, stimulating investment and increasing aggregate demand (See Shift 1 in Figure 13).

π^e the inflation expectations are independent and constant, irrespective of π_t the realized inflation in the year t . Thus the Fed is presumed to be credible, coherent and inflation-neutral. Indeed the inflation expectations are contained and constant for the past 5 years, and so is the realized inflation around 2% (Source: Board of Governors of the US Federal Reserve System, 9/18/08) Thus the ISLM model can be applied in this context, supposing the Fed continues to apply its anti-inflation policy and be inflation-neutral.

The points on the IS curve represent the environment where aggregate demand equals aggregate supply only for a given rate of expected inflation.

$S(\text{aving})=b_0+b_1y$ where b_0 are inheritances, b_1 is elasticity of savings and taxes with respect to income which equals the marginal propensity to save and tax over the average propensity to save and tax. Both are between 0 and 1 so their ratio can be higher than 1.

$I(\text{nvestment})=b_2+b_3y-b_4(i-\pi^e)$ where b_2 the exogenous government expenditures, b_3 is the interest elasticity of investment expenditures and b_4 is the banks surplus. In the current environment, the banks are decapitalized due to $i=\pi^e$ and except for the tax stimulus there is no incentive to invest for the same reason.

$S=I$ is the budgetary constraint, which renders $y=-b_4(i-\pi^e)-b_0+b_2/(b_1-b_3)$ with slope $(b_3-b_1)/b_4$ and fiscal policy contained in the IS curve with tax effect $(b_2-b_0)/(b_1-b_3)$

So $IS(\pi^e)=LM(\mu)$

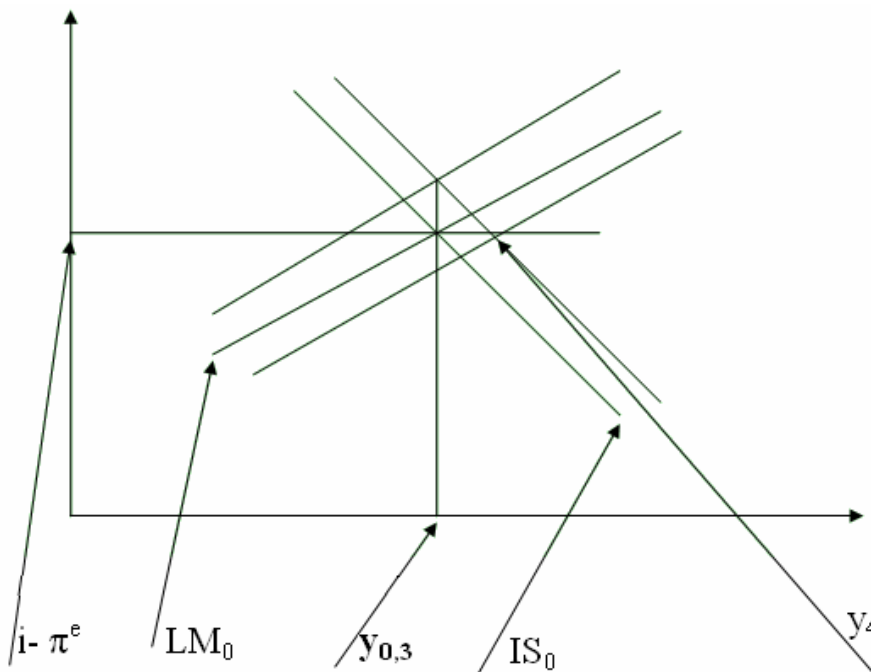


Figure 13 ISLM Equilibrium during the credit crunch

Initial equilibrium is at y_0 , formed by LM_0 and IS_0 . During the bubble years, a permanent shift in the LM curve occurs, creating higher income and lower nominal interest rates. As the mortgages, due to losses, lose liquidity, a contraction reduces income drastically and raises non-investment grade interest rates, crowding out investment. The bailout package restores equilibrium levels to pre-bubble levels y_3 . However, an increase in government expenditures associated with a decrease in lump-sum taxes shifts the IS curve to superior income y_4 above both pre-bubble and bubble levels, at pre-bubble nominal interest rate levels.

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