

Why are we in a recession?

The Financial Crisis is the Symptom not the Disease!

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Globalization has made it possible for labor in developing countries to augment labor in the developed world, without having to relocate, in ways not thought possible only a few decades ago. We argue that this large increase in the developed world's effective labor supply, triggered by geopolitical events and technological innovations, coupled with the inability of existing institutions in the US and the rest of the world to cope with this shock set the stage for the great recession. The financial crisis in the US was but the first acute symptom that had to be treated.

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1 Introduction

Without doubt we are in the middle of a severe recession, the worst since the great depression. A large part of the wealth we thought we had has evaporated: For example, the value of corporate equities has come down substantially during the past decade, from \$19.4 trillion ($2.1 \times \text{GDP}$) in 1999 to \$15.2 trillion ($1.1 \times \text{GDP}$) in 2008. Household net worth in the US (including nonprofit organizations) has gone from \$42.1 trillion ($4.4 \times \text{GDP}$) to \$51.7 trillion ($3.6 \times \text{GDP}$) in 2008.¹ At the same time, the consumer price index (CPI) increased by 29% from 1999 to 2008, and the number of households in the US increased to 117 million in 2008 from 104 million in 1999. As a result, the net worth per household in real terms (1999 dollars) declined sharply from \$402,000 in 1999 to \$343,000 in 2008, i.e., a 15% drop during the past decade. The unemployment rate captures the difficult times of the average citizen even better: it has gone up from 4.4% in 1999 to 7.2% in 2008 – and is currently estimated to be 9.5% (July 2009.)

This raises the question, why are we in such a great recession? What is the cause? According to folk wisdom, the financial crisis caused the recession. That of course begs the question: what caused the financial crisis? The standard answer is, easy credit and lax regulation led to the crisis. But then, what caused easy credit and lax regulation? According to popular press, it is due to the savings glut in Asia, and the fact that a major part of these savings flow into the US resulting in too much money chasing too few opportunities in the US financial system. Why is there too much saving in Asia and why do those savings flow to the US? Asians just like to save and Americans just like to consume more! According to this logic all that is needed to remedy the situation is to induce Asians to save less and consume more.

In this paper we argue that this logic is misleading. All these phenomena – savings glut, easy credit and lax regulation, and financial crisis – are closely interlinked and there is a deeper driving force. While each piece is well understood, our focus here is to emphasize how a common driving force is linking them all together. Understanding of the deeper driving force is the first step in laying the road to a sustainable recovery and prosperity.

The world has been subjected to several major unanticipated shocks during the last three decades that have led to globalization. President Nixon's historic trip to Beijing gradually opened China to the West and eventually led to the normalization of diplomatic relations between US and China in January 1979. It took China more than a decade to get organized to compete in world markets. India too liberalized during the early nineties which set the stage for opening of trade between India and the rest of the world. The fall of the Soviet Union ended the cold war and helped the developing world focus on economic growth based on trade with the Western world. The innovations in communications and transportation

¹Table F.100 of the Flow of Funds, <http://www.federalreserve.gov/releases/z1/Current/z1r-3.pdf>

during the last two decades of the twentieth century accelerated the globalization process tremendously.

The impact of globalization has been a sharp increase in the developed world's effective labor supply. Labor in developing countries – countries with vast pools of grossly under-employed people – can now compete with labor in the developed world without having to relocate in ways previously not possible.² For example, a hedge fund can hire an analyst in the Philippines to produce research reports on American firms at a fraction of the cost of an analyst living in the US, without sacrificing quality. A radiologist in Nigeria can analyze the X-Ray of a patient taken in Boston over the internet and send her diagnosis back thereby competing with a local radiologist located in Boston. A non emergency call to the doctor's office can be answered by a triage nurse located in India and without noticeable difference to the patient. A snow blower manufacturer in Wisconsin can move a large part of the manufacturing operations to China resulting in substantial savings with little impact on quality. In essence, the internet and innovations in transportation are virtually reshaping the world economy. The productive citizens of less developed countries have increasingly joined the workforce of developed countries, without the need to change their citizenship. China, (and to a lesser extent, India) being well organized with a stable political system, a large trained labor force, and excellent infrastructure facilities within special economic zones, has been the major beneficiary of this recent technological revolution. Even if only 10 percent of the population of India and China are potentially qualified enough to compete in the western world's labor market, that translates into an increase in the western world's labor supply of nearly 200 million people, almost the same size as the U.S. labor force.

In what follows we argue that this huge and rapid increase in the developed world's labor supply, triggered by geo-political events and technological innovations, is the major underlying force that is affecting world events today.³ The inability of existing financial and legal institutions in the US and abroad to cope with the events set off by this force is the reason for the current great recession: The inability of emerging economies to absorb savings through domestic investment and consumption caused by inadequate national financial markets and difficulties in enforcing financial contracts through the legal system; the currency controls motivated by immediate national objectives; the inability of the US economy to adjust to the perverse incentives caused by huge moneys inflow leading to a break down of checks and balances at various financial institutions, set the stage for the great recession. The financial crisis was the first symptom.

²See Blinder (2005) for a comprehensive discussion of this point

³Export driven growth and development has happened before: examples include Japan, Taiwan, S. Korea, Singapore, and Hong Kong. The difference is that the magnitudes are vastly different. China and India have a combined population of 2,500 million which is more than ten times the combined population of Japan, Taiwan, South Korea, Singapore, and Hong Kong.

2 A Global Perspective

The increasing globalization of the last decades has produced significant gains from trade which arguably have increased living standards in much of the world and lifted millions of people out of abject poverty. Globalization has, however, also created an unprecedented degree of interdependence among the major economies of the world through trade links and international capital flows. The current crisis must be understood in this context.

In a closed economy, it is a simple accounting identity that the sum of domestic investment must equal domestic savings in each period. In a world of open economies, this identity (between sources and uses) must still hold, albeit at a global level. What changes in an open economy is that individual countries temporarily can run a current account surplus or current account deficit, due to excess saving or excess consumption/investment. In the absence of transactions costs and other frictions like taxes, entry barriers, governmental intervention in markets etc., and when competitive markets for *all* goods, services and securities exist, this should in general produce global competition for investment flows and lead to more efficient use of resources, with capital flowing to those regions where it is most productive.⁴ In fact, the group of emerging and developing countries ran large current account deficits until the late 90's as a result of extensive investment in infrastructure and industrial capacity. As a result, the emerging economies in Asia as a group consistently experienced real GDP growth rates in excess of 7% over the period 1982-2008, in large part driven by exports.⁵

A major change in capital flows occurred in the aftermath of the 1997 Asian crisis in which a number of countries in the region found that they had been overly reliant on short term dollar denominated financing and possessed insufficient reserves to defend their currencies. In response, many Asian economies tightened capital controls and made a concerted effort at building up substantial dollar reserves as a buffer against future macroeconomic shocks. This, in combination with inadequate domestic financial systems incapable of absorbing the local savings, had the effect of channeling a substantial portion of savings into dollar denominated assets. Whereas the combined current account surplus of the BRIC⁶, NIAC⁷, and ME⁸ countries was \$4Bn in 1996, it increased to +\$149Bn in 2000 and +\$798Bn by 2007 – roughly equal to the US current account deficit of \$788 Bn in 2007. Similar, albeit less extreme, patterns held true for other emerging and developing

⁴However, when markets are incomplete, free trade need not make everyone better off. For example, Newberry and Stiglitz (1984) show that free trade may be Pareto inferior to no trade when insurance markets do not exist.

⁵Until the late 90's, foreign direct investment outstripped the value of exports leading to a negative current account balance.

⁶Brazil, Russia, India, and China

⁷Hong Kong, South Korea, Singapore and Taiwan

⁸Middle Eastern oil exporting countries

economies, leading to a “Global Savings Glut“, as pointed out by Bernanke (2005) and Dooley et al (2005). Almost the entire increase in current account balances from BRIC, NIAC, and ME countries (the latter benefitting from a dramatic rise in oil prices after 1997) has been matched by an increase in the current account deficit of a single country: the US. We argue that this pattern (along with a period of easy US monetary policy) precipitated the stock market and subsequent housing bubbles in the US. The current crisis is therefore best understood in an open economy context as summarized in the flowchart below depicting the basic anatomy of the crisis as laid out in this paper.⁹

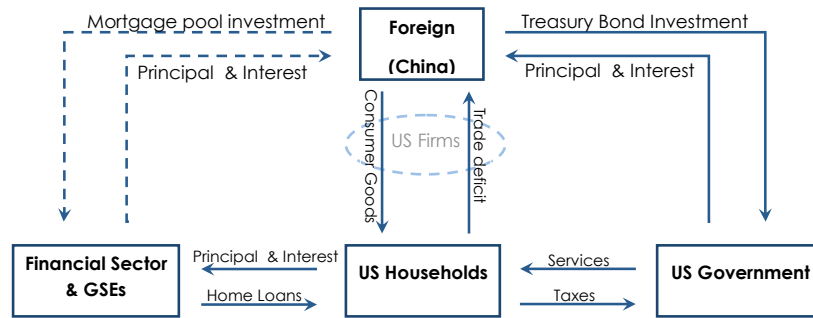


Figure 1: The flowchart shows the developing world (exemplified by China) running (artificially) large current account surpluses which are invested in US treasuries and mortgage pools. The cheap financing of government debt (allowing low taxes) and mortgage debt (leading to rising house prices and cheap home equity loans) make US households feel wealthy spurring increased consumption including imports. Due to the high personal savings rate in the developing world, the income generated by exports to the US is to a large extent plowed back into US mortgage markets leading to a multiplier effect which is only magnified by the high average leverage of household mortgage debt.

⁹Globalization has made the US an open economy, and closed economy general equilibrium models commonly used in macro economic analysis are arguably unsuitable for understanding the current recession. For example, Bernanke and Gertler (2000) examine the implications of asset price volatility for management of monetary policy using a closed economy general equilibrium model and conclude that “central banks should focus on underlying inflationary pressures.” Notably, Alan Greenspan appeared supportive of notion that the Fed should largely ignore asset bubbles and stick to its traditional policy of controlling inflation. In the Bernanke and Gertler (2000) model, asset prices driven by bubbles are almost perfectly correlated with inflation, and so targeting inflation is enough; there is no need to explicitly target asset price bubbles if the objective is to stabilize macro economic variables. Such a conclusion need not in general hold in an open economy. As Jaimovich and Rebelo (2008) demonstrate, the response of real activity to news about the future in open and closed economies can be quite different.

3 The Emergence of China, Labor Supply Shock, Current Account Deficit, and Capital Flows

3.1 The Rise of China

China benefited most due to globalization and emerged as one of the most important creditor nations and trading partners of the US.¹⁰ In 1980, China accounted for less than 1% of world GDP. By 2007 this figure had grown to almost 6%, making China the third largest economy and on track to overtake Japan as the second largest economy as early as 2011. This meteoric rise has facilitated by recent innovations in the communications and transportation areas that have helped open up the services of China's enormous pool of underemployed labor to the western world.

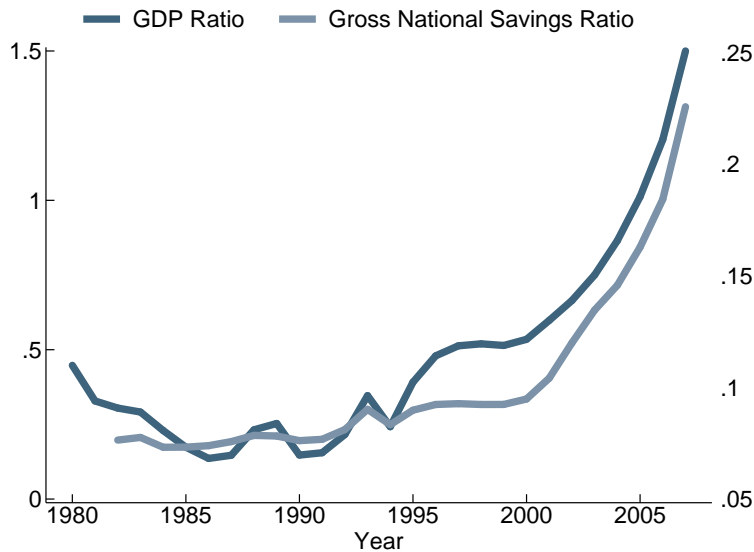


Figure 2: The ratios of China and US gross national savings (left scale) and nominal GDP (right scale). Source: Based on data from China National Bureau of Statistics and the BEA. National savings equals gross domestic investment plus the current-account balance.

As can be seen from Figure 2, China's GDP, which was less than 12% of US GDP till 2000, more than doubled in relative size to 25% of US GDP by 2007. The growth in Chinese savings relative to US savings has been even more dramatic. As can be seen from Figure 2, Chinese savings was less than a third of US savings till 2000 but grew to be 130% of US savings by 2007.¹¹ During the 1980-2007 period China's share of World GDP rose

¹⁰While China arguably benefited the most from globalization, other emerging nations like, for example, Brazil and India benefited greatly as well.

¹¹We computed Savings using the formula, Aggregate Savings = Gross Domestic Investment + Current Account Balance.

dramatically to nearly 12% in 2007 when adjusted for purchasing power parity, from around 2% in 1980 (see Figure 3).

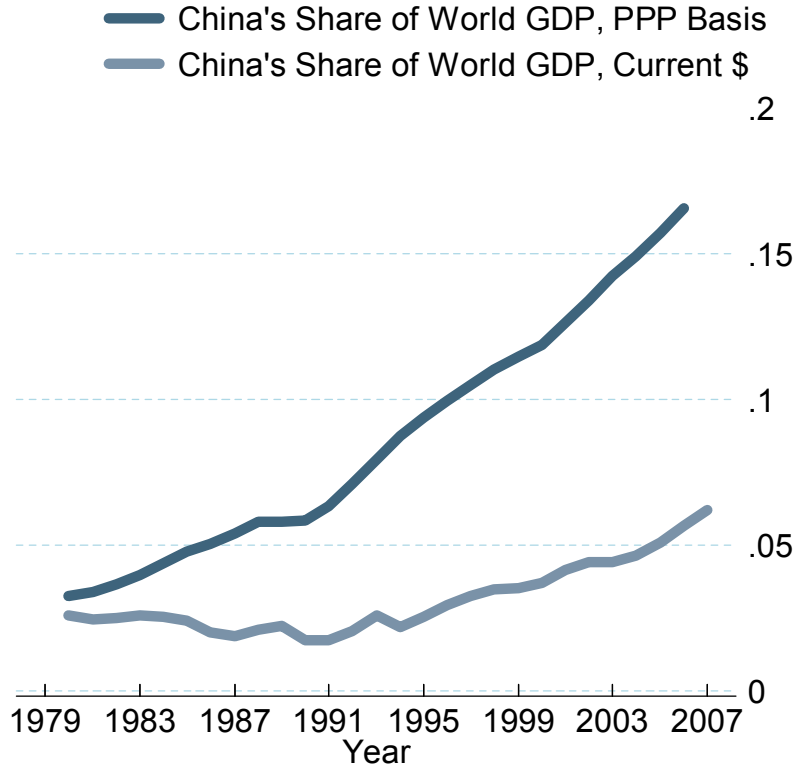


Figure 3: China's Share of World GDP. Source: IMF Data, World Economic Outlook Database

China's export led growth boom has enabled the movement of a large segment of the rural population to coastal cities and special economic zones at the rate of almost 20 million each year. The urban population in China increased by nearly 300 million from 1990 to 2007 and a significant part of those who migrated to urban areas ultimately have become part of the Western world's workforce through working for industries that export to the West.

The share of urban population increased from less than 20% in 1995 to nearly 45% in 2007. While per capita income in urban areas more than tripled from 1995 to 2007, the disparity between urban and rural incomes widened with the ratio of urban to rural per capita income increasing from 3.3 in 1995 to 4.3 in 2007. Surprisingly, as can be seen from Figure 4, the urban consumption rate as a percentage of disposable income dropped dramatically from 83% in 1995 to 73% in 2007. That may in part be due to durable goods and housing becoming more important components of consumption, the need to accumulate enough savings for down payments, and the need to save for retirement. Note that in China consumer credit markets are not as yet as well developed as in the US. Purchase of most

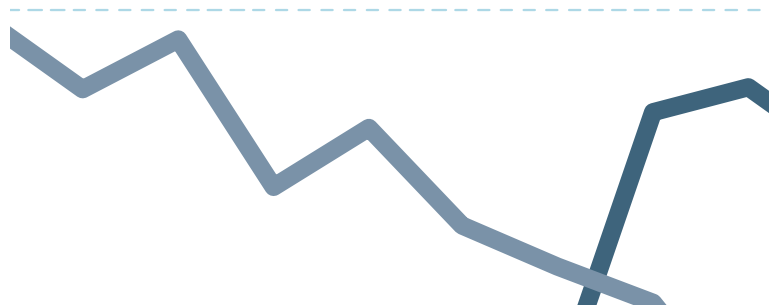


Figure 4: The Ratio of Consumption to GDP in China. Source: Derived from China Statistical Yearbooks (1995-2008), Table 9-7/10-18.

durable items like automobiles involve little credit, and home purchases involve about 30% down payment. According to Bingxi and Lijuan (2007), China's consumer credit market is at an early stage of development, and the main lenders to consumers in China are commercial banks; and consumer loans constituted only about 12.5% of all bank loans in 2007 and 80% of those loans were for housing.¹²

3.2 Labor Supply Shock

To put things in context, the size of the increase in the developed world's labor supply is of a similar order of magnitude as the increase in the western world's access to land and natural resources following the discovery of the Americas. A shock of such a magnitude to the developed world's labor supply is likely to adversely affect some and positively affect others in the short run, even if everyone potentially is made better off in the long run. In the short run, those in the emerging economies who now have new opportunities will flourish. A significant fraction of those in the western world who remain employed will benefit and see their wages go up. Another significant fraction will see their jobs vanish and be forced to take lower paying jobs. In the short run, wages of a significant fraction of the population in the western world could be adversely affected although this effect will be partially offset by the availability of cheaper consumption goods. Our mental model leading to this conclusion is described below. Since our focus is on understanding the short run transitional dynamics of the world economies, we assume that the technology prevents the use of capital or labor in excess of narrow limits.

Consider a one period model of two countries, Rich (R) and Poor (P). R has

¹²In contrast, credit market debt owed by the household sector in the US is comparable in size to credit market debt owed by the financial sector that includes all commercial banks and bank holding companies – the former was \$13.7 trillion and the latter was \$16.5 trillion at the end of the 2nd quarter of 2009 (Table L1, Flow of Funds Accounts of the US). See also Shimek & Wen (2008) <-St Louis Fed

one unit of Labor (L) and one unit of capital (K) while P has one unit of labor but no capital (K). There are two technologies, r and p. Technology r needs 1 unit of K and 1 unit of L and produces 1 unit of output. Capital does not depreciate. Country R can convert consumption good into capital and the other way around without costs. Technology p takes in 0.1 units of K and 0.8 units of L and produces 0.41 units of consumption good. Again, the capital does not depreciate. In this one period economy, technology r can be scaled down but not up; and the same is true for technology p. The technologies however can be off shored – i.e., part of the plant using technology r or p can be moved across the two countries.

Consider the following three cases: (a) No trade; (b) Capital can move across countries; and (c) Off shoring – i.e., technology can move across countries. While several outcomes are possible, we will examine one particular set of outcomes.¹³

Under no trade, for convenience, assume that the rental rate for capital is set exogenously at 0%. Letting the rental rate for capital be determined by market clearing will not change the nature of the conclusions. Country R will use $K = 1$, $L = 1$ (full employment,) produce 1 unit of output all of which will go to labor, i.e., the wage rate will be 1. Country P will not produce any output with 100% unemployment or subsistence level of existence. The output of the two countries together will be 1.0.

Now consider case (b), i.e., capital can move. Country R will convert 0.1 unit of output into 0.1 of capital, export to country P. Country P will use $L = 0.8$ (80% employment) and $K = 0.1$ and produce 0.41 units. Suppose country P pays a rental rate on capital of 10% to induce capital movement from R to P. In that case P will return the capital of 0.1 units plus rental rate of 0.01 units, i.e., 0.11 and will be left with 0.4 units to be given to local 0.8 units of labor hired – a wage rate of 0.5. Total output of consumption and capital goods together by R and P will be 1.41. Country R will have a slight trade deficit of 0.01 units.

Suppose the situation in case (b) prevails *and in addition* off shoring is made possible, i.e., case (c) but labor cannot move. A number of outcomes are possible in this case and we will consider one of these. Suppose country R

¹³The set of outcomes will depend on the rental rates for capital, which in turn will depend on the relative bargaining power of the two countries. For example, country P will have a very small consumption if country R has sufficient market power and sets the rental rate for capital sufficiently high. We consider a set of outcome that is not that extreme.

moves 0.2 of its capital to country P, hires the 0.2 of P's unemployed labor and pays them a wage rate of 0.5. In addition country R lays off 0.2 of labor in R; pays the difference in R's wage rate of 1 and P's wage rate of 0.5 minus P's capital rental rate of 10% on capital moved, i.e., $0.2 \times 0.5 - 0.2 \times 0.10 = 0.08$ to the 0.8 units of labor retained in R (i.e., a wage rate of 1.1 instead of 1). Total capital and consumption good output of R and P together will remain at 1.41. Those who remain employed in R will earn a higher wage; those who own capital in R receive 0.02 more in all; and labor in P will be strictly better off. The 20% unemployed in R will be strictly worse off. Country R will have a much larger trade deficit of 0.1 units.

While off shoring will increase the trade deficit of country R by several folds, the current accounts of both countries will be balanced and remain at zero *in this one period* example. Under (b), current account of R will be credited for export of 0.40 units of capital, interest received of 0.01 units; and debited are for import of 0.40 units of capital back, and import of 0.01 units of consumption good using the interest received. Under (c), current account of R will be credited for the export of 0.20 units of capital and debited for the import that same capital back, i.e., with zero impact. In addition R's current account would have been credited with an interest payment of 0.02 units, a foreign investment dividend of 0.08 units, and a corresponding debit of 0.1 units for import of consumption goods, again with zero impact on current account balance.

In this one period model economy neither country has an incentive to save and hence the current account balance has to be zero. Introducing many periods alone will not help explain the the current account surplus of the poor country (China) and the corresponding current account deficit of the rich country (US). For example, Moore (2007) finds that in a two sector model with linear technologies off shoring leads to a rising skill premium (as in our simple mental model above) but a current account surplus for the rich country and current account deficit for the poor country. As Kohler (2001) observes, this is also the textbook view of the effect of outsourcing on the current account balanced of rich and poor countries in the international trade literature.

China is not the only country with a large current account surplus during its rapid rise that poses a challenge to classical economic models. Japan too experienced a sharp rise in its trade balance when its per capita GDP more than tripled from under \$10,000 in late seventies to equal that of the US by late eighties – see Figure (5). In order to understand this aspect of history, where some the poor country generates a large current account surplus during the

period of development, in addition to introducing many periods, the following features may have to be modeled.

(i) Suppose services from durable goods like automobiles, residential housing, and household equipment like refrigerators and washing machines form a major component of consumption. In that case too, in the initial years of development those in the poor country will have the incentive to save substantial amount of their income towards down payment on purchase of durable goods. In China a typical household will have to pay in full for an automobile, and put 30% down for a house. A typical household in even the ninth income decile may have to save for more than 4 years to have enough for down payment on a modern house¹⁴. Further, there is also the need to save for retirement. Absent financial instruments and legal systems to facilitate inter generational borrowing and lending, the surge in savings of those employed in relatively higher paying jobs in export oriented industries will necessarily have to be absorbed by investment. When a surge in employment causes savings to outpace domestic investment capacity, some of those savings may have to be invested abroad for a while leading to a current account surplus for P and a corresponding deficit for R.

(ii) Most of the foreign direct investment in China came from South Korea, Taiwan, and Japan which took advantage of relatively cheap Chinese labor to produce final goods. That led to the import of large quantities of intermediate goods from those countries into China and export of the assembled final goods mostly to the US, leading to a large Chinese trade surplus with the US¹⁵. The rise of China gave a large competitive manufacturing cost advantage to South Korea, Taiwan and Japan which were already major exporters to the US; were already a part of the US supply chain; and had in depth knowledge of the nature of the US demand for goods and services. Therefore, it may be necessary to allow for the presence of one more rich country and model the interaction among two well developed economies when one of them has access to the pool of cheap labor in a less developed country in order to understand the transitional dynamics of funds and goods flows. When the final stage in the manufacturing process is moved to the poor country from the rich country, the rise in savings due to rising incomes may be more than can be absorbed by local investment opportunities and lead to capital outflows.

¹⁴Assumptions: A modern house is priced at 250,000 yuans; savings of a typical household in the highest income quintile is 18,241 Yuans per year; real interest rate relative to housing price inflation is 0% per year.

¹⁵See page 222, Wu (2005).

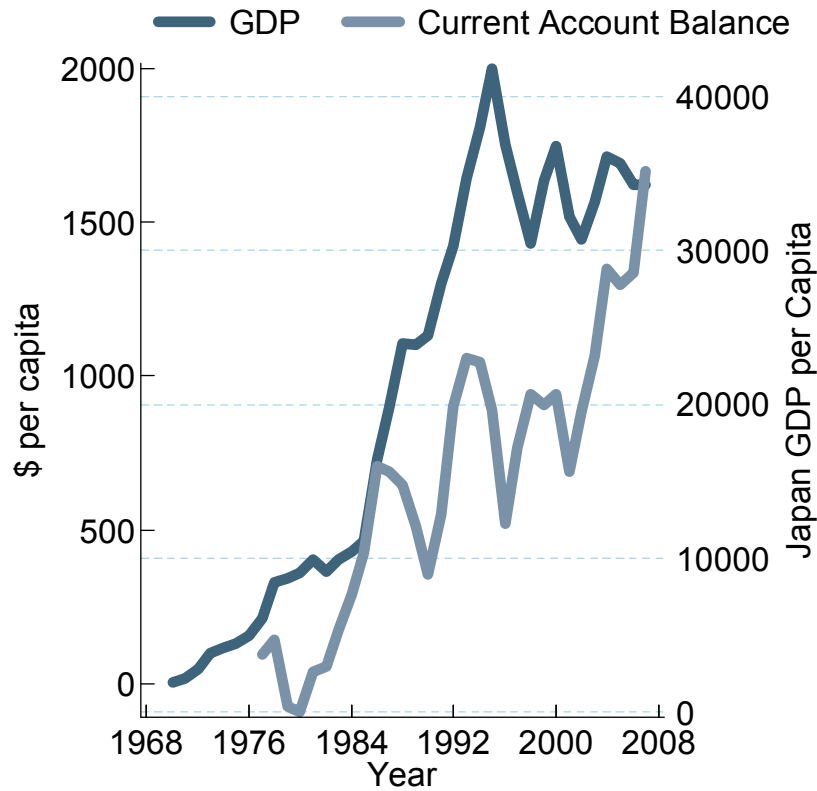


Figure 5: Japanese current account balance (LHS) and GDP (RHS) per capita. Source: United Nations Statistics Division, WB Estimates, IMF

This model does not seem to capture what happened to developed economies of the West when Japan, Taiwan, and Korea developed through exports. Western economies also gained in the process. So, what is wrong with this model? We assumed that the 0.2 of labor in R replaced by 0.2 of labor in P will remain idle. But they can be redeployed in other productive activities. That will increase output in R and can lead to Pareto improvement. But redeployment in R takes time and can become an issue if the magnitude of labor redeployment involved becomes large within a relatively short period of time. We think that that is what is happening now with China's and India's export driven growth drive through off-shoring. For redeployment of labor in R to take place, savings from P's employed has to flow into productive activities in R. As Cabellero and Krishnamurthy (2009) observe, that may not be possible to attain if P insists on investing only in safe assets in R.

This view is supported by the fact that the share of wages and salaries as a percentage of US Gross Domestic Product (GDP) has dropped to 46% in 2007 from 49% in 2000. Wages and salaries plus proprietors income dropped to 54% of GDP in 2007 from 57% of GDP in 2000. With about 117 million households in 2007, that drop in labor share of GDP translates to a drop of \$3,600 per household. However, during the same period, even though income was redistributed from citizen-workers to foreign-workers and owners

of capital, the share of private consumption in the US remained at 70% of GDP. This raises the question as to why annual household consumption did not drop?

3.3 Current Account Deficits and Capital Flows into the US

The export led growth of the emerging economies coincided with a sharp increase in the current account deficit of the US which ballooned from \$124Bn in 1996 (\$1,006 per US household) to \$413Bn in 2000 (\$3,787 per US household) and \$738Bn in 2007 (\$6,194 per US household.) To balance this deficit on the current account, massive capital inflows took place. To understand this pattern in capital flows, one must recall that the Dollar is the effective reserve currency of the world. Moreover most commodities are traded in Dollars. The US is therefore a natural recipient of liquidity from developing and emerging economies wishing to build up their reserves as a buffer against macroeconomic shocks. In a world where the dollar is the de facto reserve currency, a net foreign liquidity demand necessarily implies a commensurate increase in the US current account deficit. This model is sustainable as long as the demand for reserves is not too large relative to the size of the US economy. It ceases to be fiscally sustainable in the long run if the demand for reserves grows at a much faster rate than the US economy and becomes “too large” as this will tend to lead to an ever increasing debt burden as a fraction of GDP.¹⁶ This effect is illustrated in Figure 6 which shows the dollar denominated foreign reserve holdings held by foreign central banks as a fraction of US GDP. The foreign reserve holdings of US dollars, which had been at less than 11% of US GDP prior to 2000, grew rapidly after 2002, in fact it almost doubled over the 5 year period from 2002 and 2007.¹⁷ Much of the demand came from the fast growing emerging economies, especially China, which no longer could be considered small and whose growing demand for dollar liquidity began to have a significant impact on US financial markets.

A large part of the capital flow was initially into US government debt; foreign holding of the US government debt increased from 18 percent of the total government debt of \$5.66 trillion in December 2000 to 28 percent of total government debt of \$9.5 trillion in June 2008. These massive inflows of international reserves from emerging economies like China were largely insensitive to interest rates and put downward pressure on real interest rates across the maturity spectrum despite widening US current account deficits.

Current account deficits in and by themselves are of course not necessarily bad, provided the capital flows that occur to balance those deficits are put to productive use (e.g. infrastructure, R&D, etc.) The flood of liquidity pouring into the US initially flowed into

¹⁶Although this effect in principle could be offset by an increase in the private savings of US households abroad, there is little sign of this on the horizon as of this writing.

¹⁷This is even more remarkable as the annual US GDP growth over that period averaged almost 3%.

3 THE EMERGENCE OF CHINA, LABOR SUPPLY SHOCK, CURRENT ACCOUNT DEFICIT, AND CAPITAL FLOWS

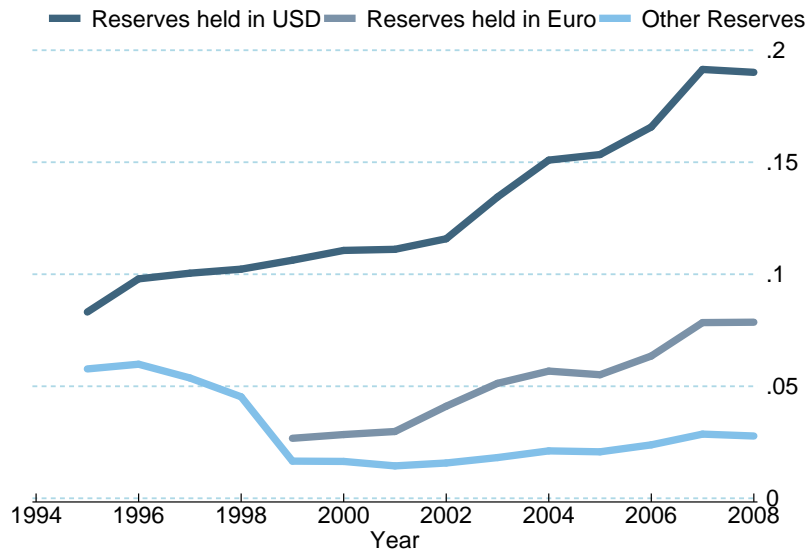


Figure 6: Worldwide foreign reserve holdings as a fraction of US GDP. Source: IMF COFER

Treasuries and the stock market through sovereign wealth funds, fueling the tech bubble.¹⁸ While the capital inflow did help spur innovation in the technology sector, shareholders did not necessarily benefit since they (on average) overpaid for their investments, as borne out by the crash of 2000. Much of the benefit of the technology innovation instead accrued to countries like China and India whose vast labor resources became much more accessible to Western companies seeking to reduce cost by outsourcing of manufacturing and services. China in particular benefitted in this respect due to its vast pool of labor and the greater openness of its special economic zones developed throughout the 1990s with the initial wave of foreign investment, especially from Japan and Germany. During this period China quickly emerged as the US's fastest growing creditor, second only to Japan in size: In 1994 China held \$18Bn in US assets (almost exclusively Treasuries) which grew to \$92Bn in 2000 (roughly \$72Bn Treasury debt and \$20Bn Agency debt) and \$922Bn in 2007 (roughly \$466Bn in Treasuries and \$376 in agencies with the balance in corporate debt and equity), almost 25% of China's GDP.

The dramatic rise in China's trade surplus with the US should have led to a gradual appreciation of the Chinese currency relative to the US dollar which would have served to temper the rate of increase in the US trade deficit. However, as can be seen from Figure (7), the Chinese policy of maintaining the competitiveness of its export sector kept the Yuan

¹⁸In this respect the new inflows were different in nature from the Japanese investments of the 1980's included large investments in real assets (e.g. the Rockefeller Center) and outright acquisitions of US firms that included Universal Studios. Attempts by Dubai Ports World to take over the management of six US ports in 2006 and China National Offshore Oil Corporation's (CNOOC) bid to buy Unocal, the ninth-biggest US oil firm were stifled by political pressures.

from appreciating against the US dollar through a system of strict capital controls. As a byproduct, this policy massively increased China's dollar denominated reserves. While this strategy allowed the Chinese economy to grow almost entirely by riding an export boom, it stifled the growth of domestic household consumption (at least initially). Most economists would agree that China could make better use of its savings by investing in real capital domestically which would lead to an increase in domestic consumption and imports.¹⁹ However, overriding domestic policy priorities, such as "maintaining social harmony and stability", meant that Chinese policy makers were keen to "maintain sound development trends", i.e. weary of maintain spurring rapid consumption growth that would inevitably be concentrated in a few urban costal areas.²⁰ To the extent that this remains a major concern of Chinese policy makers, it may continue to impede the long term return to a sustainable equilibrium.

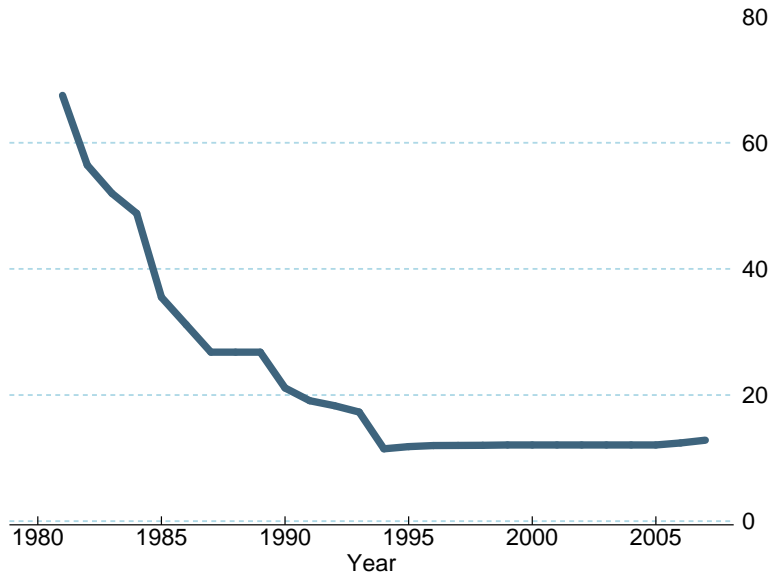


Figure 7: Foreign exchange rate (Yuan/US\$) as of January 1 each year Source: FRB St. Louis

¹⁹"Another factor contributing to our trade imbalance with China is its exchange rate policy and its accumulation of reserves, even though trade impacts may not be the purpose of this policy. China's current account surplus, along with huge capital inflows, has created an immense accumulation of reserves \$130 billion, the second-highest level in the world. While comfortable levels of reserves are essential for every economy, especially in the context of recent financial turbulence, the levels China has reached raise questions as to whether continued reserves growth represents an efficient use of China's savings, a matter I discussed with China's leadership when I was in Beijing. China can earn higher returns by investing in real capital than by money market investments. Such a move would not only bolster Chinese development, it would help increase Chinese imports, helping to moderate China's external imbalances.", Robert E. Rubin, speech to the Council on Foreign Relations, October 27, 1997

²⁰Quotes from Xinhua news agency, President Hu Jintao in speech to factory workers in Hebei province, May 25, 2008.

3 THE EMERGENCE OF CHINA, LABOR SUPPLY SHOCK, CURRENT ACCOUNT DEFICIT, AND CAPITAL FLOWS

After the stock market crash of 2000, capital continued to flow into the US but now increasingly into safer fixed income instruments. The decreasing government financing needs and the low treasury yields made alternative government backed investments, such as GSE mortgage pools, more attractive due to the spreads these investments initially offered. Figure 9 shows the pattern of Chinese net acquisitions of US assets over the period 2001-2008. The largest increases were in corporate (including non-Agency) and Agency debt while equities did not play any significant role until 2007-8. The flow of money into securitized mortgage pools helped drive down the cost of borrowing and created record profits years for Fannie Mae and Freddie Mac as mortgage volumes increased. With the pool of conforming mortgages limited and the secondary mortgage spreads on GSE pools diminishing, investment banks set up their own pools of “private label” (non-conforming) mortgages providing investors the desired higher yields at seemingly trivial additional risk. Thus the flow of capital was ultimately funneled into the US housing market leading to the housing bubble. Figure 10 below shows the close relationship between US current account deficits and household indebtedness.

To summarize, the sudden increase in labor supply from workers in developing countries because of globalization should have resulted in significant sections of the population in developed countries experiencing a decline in their living standards as more and more manufacturing and service jobs are outsourced. However, the flow of cheap liquidity from abroad during this period helped fuel the housing bubble creating the illusion of wealth



Figure 8: Chinese GDP growth and change in real urban wages from previous year. Source: WorldBank

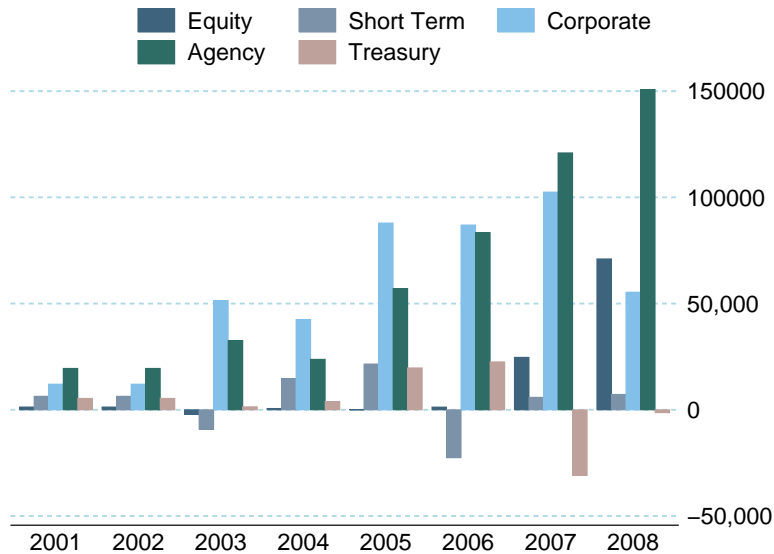


Figure 9: Change in Chinese holdings of US assets by asset class in US \$M.

among households sustaining the high level of consumption.²¹ This had the effect of masking the real structural changes that were taking place in the world economy.²² We will provide support for this view in the sections that follow.

4 US households

It is a striking empirical fact that per capita consumption in the US grew at a steady rate of roughly \$1,994 per year over the period 1980-1999, but jumped abruptly to approximately \$2,849 per year from 2001 through 2007 (see Figure 11) How was this remarkable increase in consumption financed? The increase happened despite the March-November 2001 recession and subsequent jobless recovery which resulted in no significant increase in hourly earnings nor in non-farm employment rates.²³ In fact, per capita consumption in excess of wages and salary accruals and proprietors' income increased by almost 230% from approximately \$2,181 in 2000 to \$7,255 by 2007. The stock market was also roughly flat between 2000

²¹Households may of course simply have reacted in a (bounded) rational fashion given a belief that the housing bubble would last, as predicted by models along the lines of Lettau, Ludvigson & Steindel (2002)

²²According to Krugman (2008), empirical evidence of this phenomenon might be very difficult to capture from the existing data on the trade patterns, and that may explain the why there is not much agreement on this among academics and regulators.

²³Between 2001 and 2003, total non farm employment declined from approximately 132 million to 130 million while the ratio of employed people to population declined from 64 percent to approximately 62 percent. At the same time, the ratio of wages and salary accruals to national income declined from 55 percent to 53.2 percent while the median usual weekly earnings (in constant (1982) USD) remained flat at USD 325.

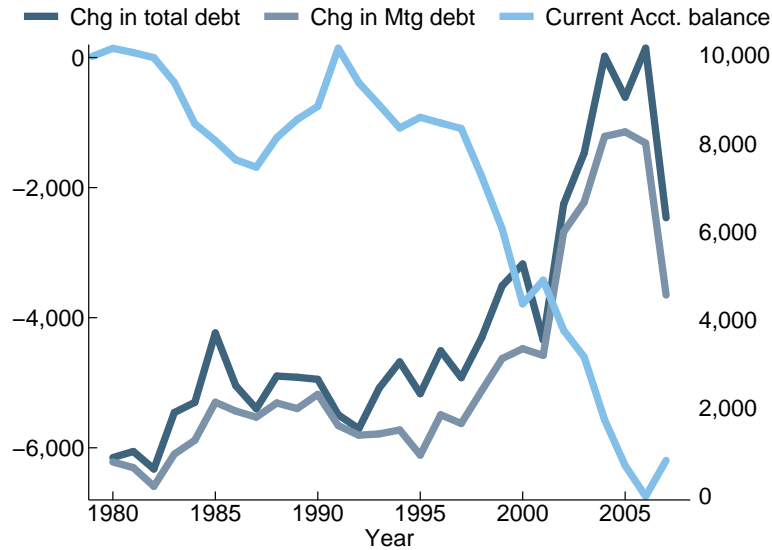


Figure 10: Current account balance and change in household indebtedness. All numbers are in US\$ per household. Source: Treasury

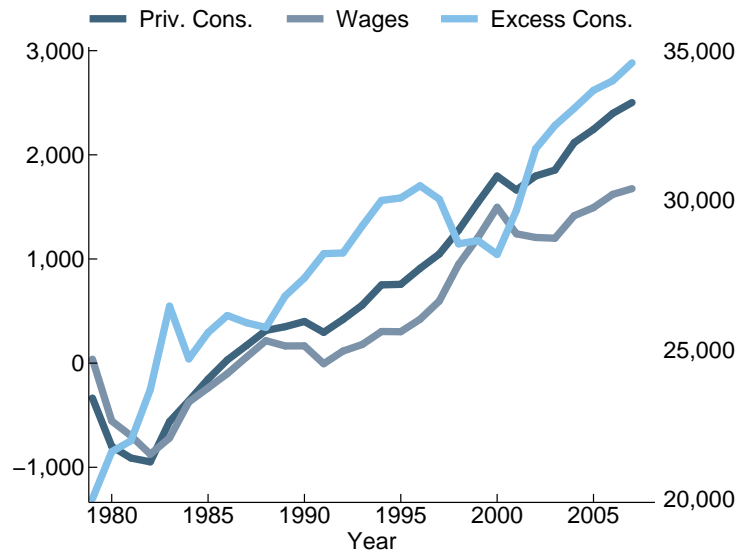


Figure 11: Private consumption and total wages incl. benefits (right axis) along with excess consumption calculated as private consumption less total wages (left axis). All numbers are in 1980 \$ per household.

and 2007 with the S&P500 starting at 1,499 in 2000 Q1 and ending at 1,421 in 2007Q1. The single item in the portfolio of US households which performed spectacularly well during the period was their heavily leveraged position in real state: Home values went through an

unprecedented growth spell, almost doubling in value between 2000 and the peak in early 2007.

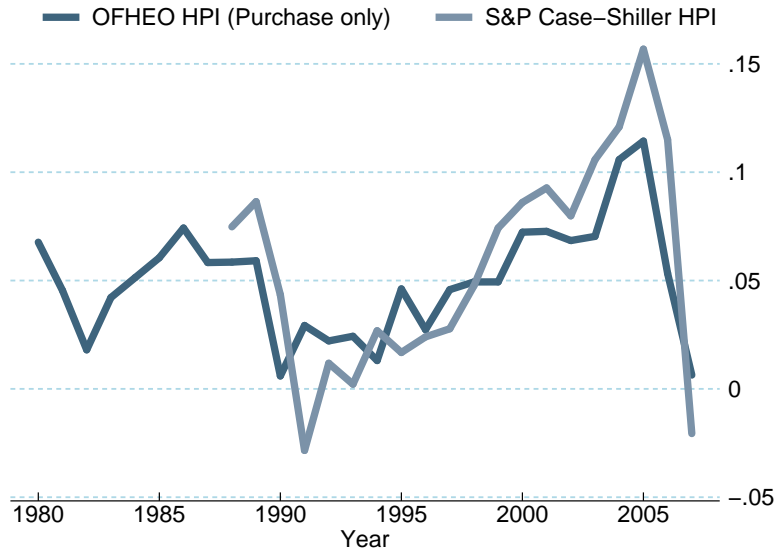


Figure 12: Home price appreciation (Q1 to Q1). Source: FHFA, Standard & Pools

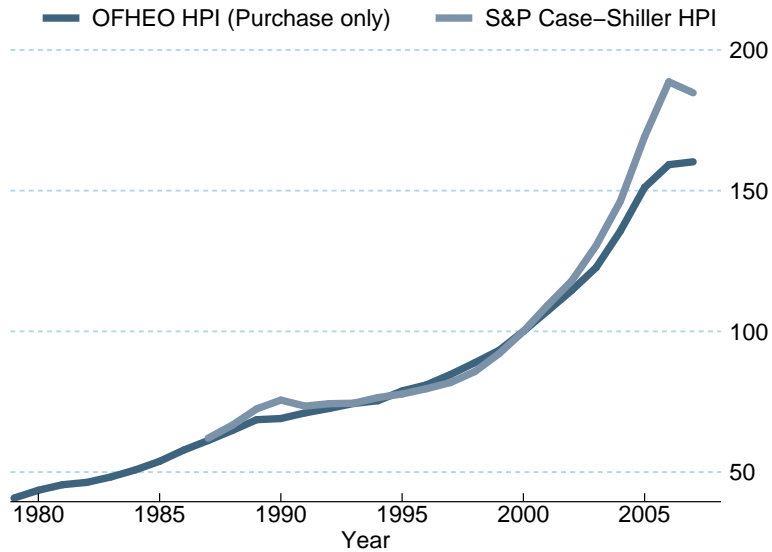


Figure 13: Home Price Indexes. Sources: FHFA and Standard & Pools

Starting in the late 1990's the average national home value appreciation went from around 5% per year to a peak of 15% per year in 2006 before collapsing in late 2007 (see

Figure 12). The S&P/Case-Shiller home price index went from 100.77 in 2000Q1 to 186.07 in 2007Q1 (see Figure 13.)

Despite this dramatic increase in home values, households on average did not increase their home equity much, implying that excess consumption (including consumption of larger homes) absorbed most of the windfall gains. As can be seen from Figure 14, US household residential leverage (residential mortgage debt as a fraction of residential home value) increased from about 0.42 in 2000 to about 0.52 in 2007.

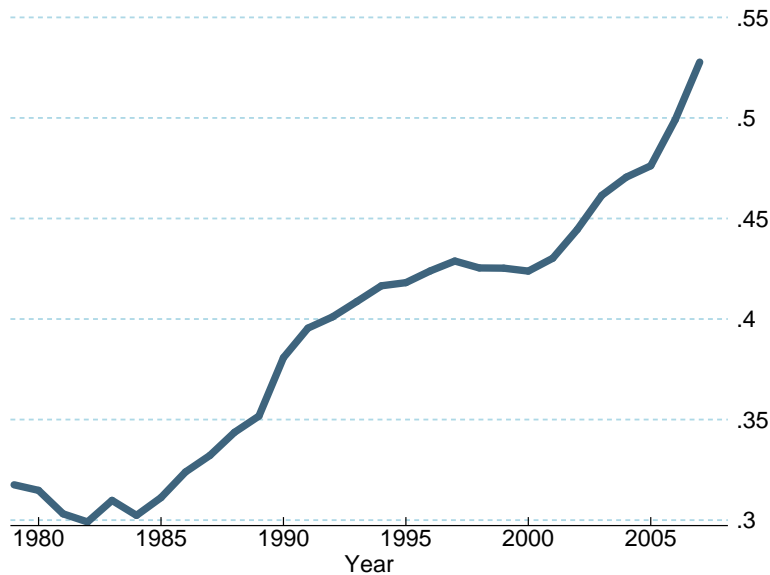


Figure 14: Average US household residential leverage computed as total residential mortgage debt divided by residential home values (primary residence only). Source: FHFA, OFHEO

The sharp increase in leverage becomes transparent when we measure leverage as the ratio of debt to wages as seen in Figure 15. The ratio of mortgage debt to wages almost doubled from about 0.6 to 1.2, with most of the increase occurring during the 2000 - 2007 period²⁴.

Home prices rose sharply during 2000-2007. Whereas it took 20 years for household real estate value to increase by \$72,916 per household – from \$36,437 in 1980 to \$108,633 in 2000 – it took only 7 years for it household real estate value to increase by another \$63,558 to \$172,197 by 2007, i.e., the growth rate in home prices during 2000-2007 was almost three times the growth rate experienced during 1980–2000. While home equity rose by 52 cents for every dollar rise in home value between 1980 and 2000, home equity

²⁴Palumbo and Parker (2009) point out that the System National Accounts for the US by the Bureau of Economic Analysis picks up the increases in the leverage of the household sector, but miss the rise in exposure to the US exposure to the housing market in the financial businesses sector.

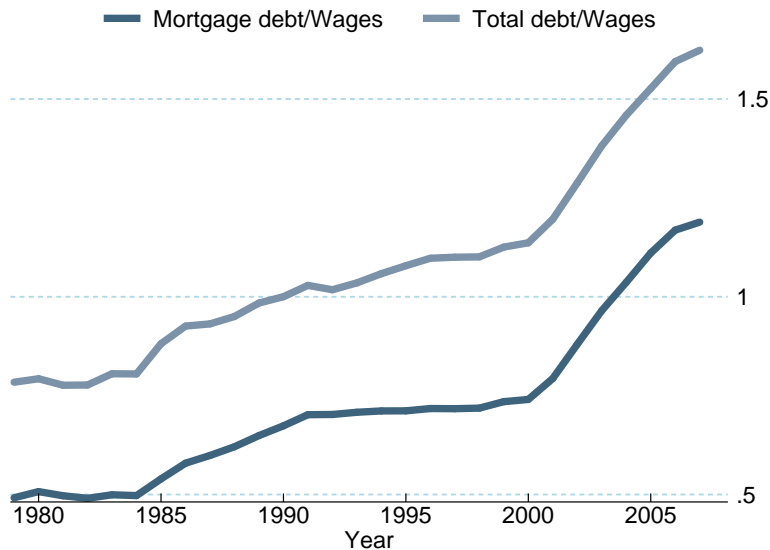


Figure 15: Average US household residential leverage computed as total residential mortgage debt divided by residential home values (primary residence only). Source: FHFA, OFHEO

increased by only 29 cents for every dollar increase in home prices during the 2000-2007 period. This meant that rather than building equity, households withdrew a larger fraction of the increase in their home equity for consumption purposes, by maintaining a huge debt burden and consequently being massively exposed to the risk of falling home values, as subsequent events have borne out.^{25,26}

It is important to note, however, that the behavior of US households during 2000-2007 can be rationalized if households firmly believed that past rates of house price

²⁵“The accessibility of the mortgage market to a wide variety of households has facilitated the extraction of equity in home ownership. Close to a fourth of the wealth of U.S. households, as you know, is in the form of equity in owner-occupied housing. When house prices increase, the level of this wealth—in the form of capital gains—rises, a substantial part of which is extracted as cash, mainly as a consequence of home turnover. We estimate, based on a median period of owning a home of nine years, that each home sale since 1995 has averaged roughly \$35,000 in capital gains, implying a total of \$150 billion annually for the economy as a whole. This is largely in the form of unencumbered cash, since, generally speaking, we find that the mortgage taken out by the buyer exceeds that of the remaining balance of the seller by something close to the realized capital gain. In addition, cash is extracted from unrealized capital gains through the refinancing process. While it is difficult to know precisely, at least a third to half of homeowners took some cash out when they refinanced their mortgages last year,” Greenspan (1999).

²⁶The danger of easy monetary policy leading to a boom and subsequent bust has been studied as one of the causes of the Great Depression. von Hayek (1933) suggests that an abrupt easing of monetary policy in the US starting in 1927 combined with the reluctance to liquidate unsound firms successfully postponed what would have been a mild recession by two years but created the preconditions for the Great Depression. In particular, Hayek argues that the policy of “easy money” led to over-investment through “forced savings” leading to severe real distortions. In the current crisis, this raises the important question: Will the US stimulus package will ease or prevent the efficient process of liquidation, and hence whether it will further deepen the crisis?

appreciation were sustainable, and did not realize that they (or their children) would be liable for paying down the US government external debt eventually.²⁷ Understanding the fundamental forces driving housing prices is not easy and it is reasonable to assume that US households took home price increases to be permanent. Suppose households (on average) simply extrapolated prevailing economic conditions in forecasting the future, and believed that home values would continue to increase and that cheap credit would continue to be available through easy monetary policy and massive foreign capital inflows. Then the *permanent income hypothesis* would in fact suggest that households should increase their consumption by borrowing extensively against their unrealized housing gains. In the next section we show, using a stylized rational model of household consumption portfolio choice, that US households behavior was consistent the belief that the rise in housing prices were permanent.

4.1 A Stylized Model of Households' Consumption Choice

We construct a stylized model of household behavior in order to better understand the response of households' consumption to a perceived increase in real estate wealth. The permanent income hypothesis states that households smooth the consumption of anticipated wealth increases over time while their consumption adjusts contemporaneously to *unanticipated* wealth changes. Consistent with this hypothesis, numerous studies have shown that changes in consumption are positively correlated with labor income and changes in wealth. Although one may think of housing and financial wealth as equivalent, there are a number of reasons to believe that households may respond differently to a \$1 increase in financial assets versus a \$1 increase in house prices. As Campbell and Cocco (2007) point out²⁸, housing is a leveraged asset for the average household and a \$1 increase in housing values will act with a multiplier in relaxing a financially constrained household's borrowing constraint. Financial assets held by households, on the other hand, are typically not highly levered.²⁹

Consider the following the simple model of household behavior where households derive utility $u(C_t, H_t)$ from consumption of non-durables C_t and housing H_t with prices P_t^C and

²⁷The government's debt held by citizens wash out in the aggregate, but the external debt can not grow faster than GDP forever.

²⁸Buiter (2008) argues that there will be no pure wealth effect on consumption from a change in the fundamental value of house prices, but there will be a wealth effect due to a change in the speculative bubble component of house prices.

²⁹"... the equity extracted from housing does not fall unexpectedly into the sellers' laps all of a sudden. People who own a home likely have a sense of the appreciation in its value over the years. These unrealized gains may be factored into their long-term planning, and thus may influence spending on goods and services both well before and after the home is sold, rendering it difficult for models to capture this influence. For example, a middle-aged person who is sitting on a substantial unrealized gain in his or her house, but does not plan to sell for ten years, may still boost consumption today in anticipation of the realization of that gain.", Greenspan speech to the Mortgage Banker's Association, 1999.

P_t^H respectively. Each period, the household is endowed with one unit of labor income worth W_t and is subject to the budget constraint

$$S_{t+1} + P_{t+1}^H H_{t+1} - M_{t+1} = W_t - P_t^C C_t - T_t + \quad (1)$$

$$(1 + r_{t+1}^S)S_t + (1 + r_{t+1}^H)P_t^H H_t - (1 + r_t^M)M_t \quad (2)$$

where T_t are taxes, S_t is household net dollar holdings of financial assets (other than the risk-free), M_t is mortgage debt and r^S, r^H, r^M are the nominal returns on financial assets, housing and mortgage debt respectively. In addition, we follow Campbell and Cocco (2007) in assuming that individual households (denoted here by subscript i) are subject to a financing constraint which must then also hold in aggregate:

$$M_{it} \leq (1 - d)P_t^H H_{it} \quad (3)$$

$$S_t \geq 0$$

where d is the minimum down payment (say, 20%).

The shadow value of the leverage constraint in (3) in the household optimization problem implies that housing wealth, labor income and financial wealth will act very differently when the leverage constraint starts to bind for more households. In particular, the results in Campbell and Cocco (2007) imply that, while we would not expect consumption to react to anticipated changes in either labor income nor financial wealth, anticipated changes in housing wealth should lead to changed consumption behavior for the subset of financially constrained households. Unanticipated changes in all types of wealth, on the other hand, should have the expected immediate effect on consumption. Since we here deal only with macro-level data, we cannot check these implications directly but instead rely on a regression specification relating changes in consumption to changes in the three components of the representative household net-worth: Human capital, financial wealth, and (net) housing wealth (t-stats in brackets below each point estimate).³⁰

$$\Delta(P_t^C C_t) = \underset{(7.74)}{683} + \underset{(7.34)}{0.712}\Delta W_t + \underset{(-0.06)}{-0.001}\Delta S_{t-1} + \underset{(5.68)}{0.084}\Delta(P_{t-1}^H H_{t-1} - M_{t-1}) + \varepsilon_t \quad (4)$$

$$adj.R^2 = 79\%$$

Note that in the specification (4), we use concurrent wage income but lagged wealth changes. This can be motivated by noting that households, when planning this years

³⁰Wages are a flow, but we think here of changes in labor income as a proxy for changes in the unobserved human capital.

consumption, know their wages but do not know what return the stock and housing markets may bring.³¹

Notice that our point estimate 8.4% for the wealth effect on consumption due to a change in real estate net worth is the same as the estimate reported in column I of Table 1 in Case, Quigley and Shiller (2005) obtained using data on a panel of US states observed quarterly during the 1980s and 1990s. Figure 16 shows that (4) does a good job in explaining household consumption growth, consistent with the view that US households in all likelihood were behaving rationally given their belief that the rise in home prices was permanent.

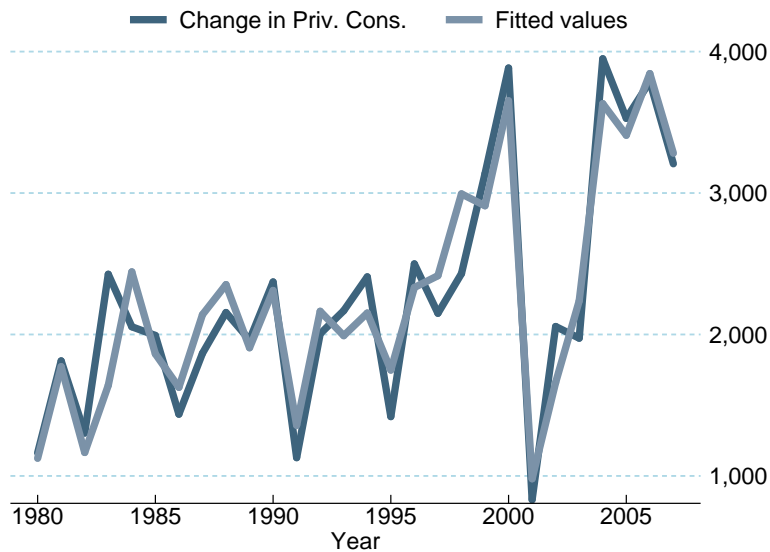


Figure 16: Year on year changes in private consumption are predicted by concurrent wages and lagged returns on housing and other financial assets. All numbers are in US\$ per household.

For every \$1 in wage increase, 71¢ are spent on increased consumption. The corresponding numbers for a \$1 increase in housing wealth is a 8.4¢ increase in consumption spending, while other financial asset returns have little or no impact on consumption. Common practice among institutional endowment funds is to spend 5¢ every year for every dollar of endowment asset. While our estimate of 8.4¢ of consumption per dollar of real estate wealth appears rather large, note that we estimate the wealth effect on consumption for other wealth to be negligible – it may be so because it is difficult to borrow against other wealth, and home mortgage interest is tax deductible³².

³¹Note: What the optimizing agent framework buys us here (beyond the mere budget constraint) is the fact that housing wealth is different from other types of wealth due to the shadow value of the borrowing constraint and the fact that housing is both a consumption good and a store of value.

³²We find that the slope coefficients for the changes in domestic and foreign holdings of government debt

Having established the connection between home prices and excess consumption (leading to current account deficit), we proceed to examine the association between current account deficit and home prices in the next section.

5 House Prices and the Current Account Balance

The reaction of the real estate market (and by implication domestic consumption) to the availability of cheap and easy credit is an important channel we will consider. Denote by B_t^G the level of government debt, by T_{gt} the tax revenue of the government, by T_{ht} the taxes paid by the households, and by G_t government spending including transfers, then the government budget constraint is :

$$0 = B_t^G - B_{t-1}^G - r_t^G B_{t-1}^G + T_t - G_t \quad (5)$$

and the current account surplus is given by

$$CA_t = \underbrace{W_t + r_{dt}^S S_{t-1} - C_t - r_t^M M_{t-1} - T_{ht}}_{\text{household net savings, HHS}} + \underbrace{T_{gt} - G_t - r_t^G B_{t-1}^G}_{\text{Gov't savings, GS}} + CS_t - CI_t - PI_t \quad (6)$$

where r_{dt}^S is the dividend and interest income on financial assets (including mortgages and government bonds), S_{t-1} held by households, and r_t^M is the interest rate on mortgage loans, M_{t-1} taken out by households, CS_t is Corporate Savings, CI_t is Corporate Investments, and PI_t is Private Investments by households.

Since the trade accounts must balance, capital account flows should be equal in magnitude but opposite in sign of the flows in the current account. Therefore, from the two above equations it follows that,

$$-CapitalFlows_t = CA_t = [(HHS_t - PI_t) + (CS_t - CI_t)] - (B_t^G - B_{t-1}^G). \quad (7)$$

We conjecture that to a first order, $(CS_t - CI_t) = 0$, and $(HHS_t - PI_t)$ is negative and invested mostly in housing, contributing to the housing price bubble, i.e., the capital flows into the US helped build up the housing price bubble and finance the increase in government borrowing, $(B_t^G - B_{t-1}^G)$.

are not significantly different from zero (results available upon request,) which is consistent with the view that investors ignore any changes in their financial liabilities due to changes in foreign or domestic holdings of government debt when making consumption decisions.

Taking China as our leading example of a country with large excess savings, the story goes as follows: the Chinese channel their current account surplus into US assets, in particular government bonds and household mortgages. The supply of Treasury securities, however, is limited, so much of the excess liquidity is absorbed in the mortgage market (in our simple model), leading to a positive feedback effect:

If households increase consumption by \$1 today this means roughly 17¢ spent on imports from e.g. China.³³ Due to the high savings rate abroad, roughly 8¢ flow back into the US through capital inflows.³⁴ If the supply of US government bonds is limited, treasury yields will start to drop to the point where foreigners in search of higher yields will find household mortgage debt attractive. That will increase the supply of mortgage debt – and in equilibrium an increase in the holdings of outstanding pool of home mortgages, in part due to reduction in mortgage interest rates and in part due to willingness to relax mortgage lending standards. This in turn has a direct wealth effect (lower payments) and an indirect wealth effect (increased demand for housing leads to house price inflation) which in turn results in higher consumption tomorrow. This effect is further strengthened by the ability of US household to leverage their housing wealth 4:1 for consumption purposes through home equity lines of credit.

To test this feedback from current account deficits to mortgage markets, we consider three regression equations estimated using annual data for the period 1980 - 2007.

First we examine the impact of the current account balance (CA_{t-1}) on the growth (change) on the pool of Agency and private label residential mortgage pools (ΔMP_t). We expect to see the growth in outstanding mortgage pool increase in response to an increase in the current account deficit (i.e., decrease in current account balance) with a one year lag to allow for transactions to take place. We also add the contemporaneous change in treasury issuance since it is exogenous (determined by government funding needs) and, according to our story, may crowd out demand for mortgage backed securities.

$$\Delta MP_t = \underset{(4.90)}{906.79} - \underset{(-12.71)}{1.11} CA_{t-1} + \underset{(0.19)}{0.06} \Delta B_t^G + \varepsilon_t$$

$$adj.R^2 \approx 91\% \quad (8)$$

We find that almost the entire dollar increase in current account balance goes towards increasing the pool of outstanding Agency and private label mortgages. As can be seen

³³US imports were roughly 17% of GDP in 2007.

³⁴China's gross national savings rate was roughly 53% in 2007

from the figure(17), the regression captures some of the turning points in the growth rate in the mortgage pool.

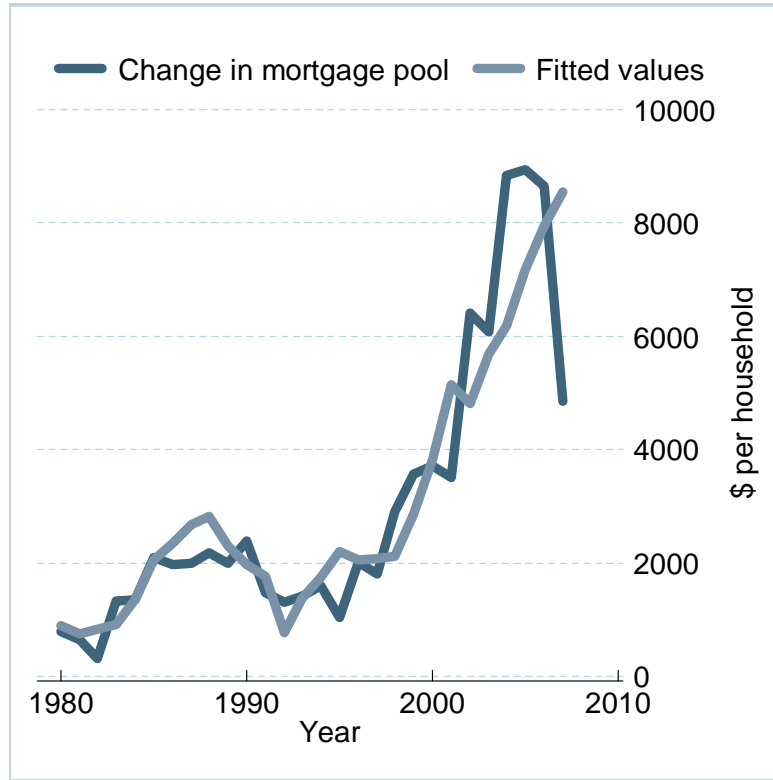


Figure 17: Change in Outstanding Mortgage Pool per HH vs CAB per HH

Second, we examine the change in residential home values ($\Delta P_t^H H_t$) in response to a change in the pool of outstanding Agency and private label mortgages (ΔMP_t) after controlling for the mortgage interest rate (r_t^M). The t-statistics of the estimated parameters using Newy-West standard errors with 6 lags are also provided.:

$$\Delta \left(P_t^H H_t \right) = \underset{(-1.17)}{-1684} + \underset{(2.09)}{227} r_t^M + \underset{(11.34)}{1.49} \Delta MP_t + \varepsilon_t \quad \text{adj.}R^2 \approx 77\% \quad (9)$$

Again, as can be seen from the figure(18), the regression captures some of the turning points in the change in residential real estate values.

To summarize, the evidence is consistent with the view that the capital account flows that offset the current account deficits were channeled into residential housing and that contributed to the housing price bubble³⁵.

³⁵This is not inconsistent with Favilukis, Ludvigson, and Nieuwerburgh (2009) who show that a two

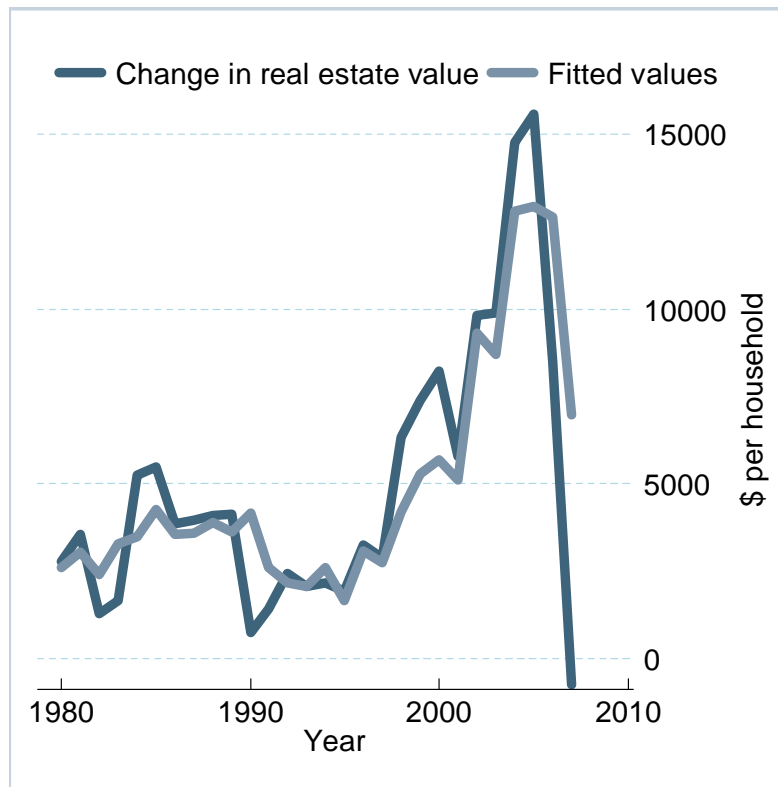


Figure 18: Change in residential real estate value vs change in outstanding mortgage pool and mortgage interest rate

These findings support the feedback effect: US households consumed more than their income because they felt wealthier due to home price appreciation. Excess consumption led to increase in current account deficit. For accounts to balance, there was a corresponding inflow of foreign capital that was channeled into home mortgages leading to a rise in home prices. That fueled continued excess consumption and the cycle continued for a while. We now examine the role of financial engineering in channeling foreign funds flowing into the US into housing.

6 Role of Financial Engineering

Wall Street and financial engineering played an important role in facilitating what was already a crisis in the making. With US current account deficits reaching record levels, foreign savings were flowing into the US and especially fixed income markets lowering yields on Treasuries and mortgage backed securities. This pattern continued after 2001 which

sector general equilibrium model with housing can generate large increase in housing prices when calibrated to match the increased foreign ownership of US Treasury debt due to financial market liberalization can generate large increases in housing prices as observed during the 2000-2007 period in the US.

saw substantial monetary easing in the aftermath of the 9/11 attacks and the suspension of the 30 T-bond as a result of the projected fiscal surpluses (see Figure 19).

Prior to 1990, the Agency mortgage pools, consisting of conforming (e.g. 30 year fixed rate, $\leq \$417K$, $\geq 80\%$ Loan-to-Value) first lien mortgages, were pretty much the only game in town when it came to mortgage backed securities, with private label issues playing only a relatively minor role (see Figure 20).

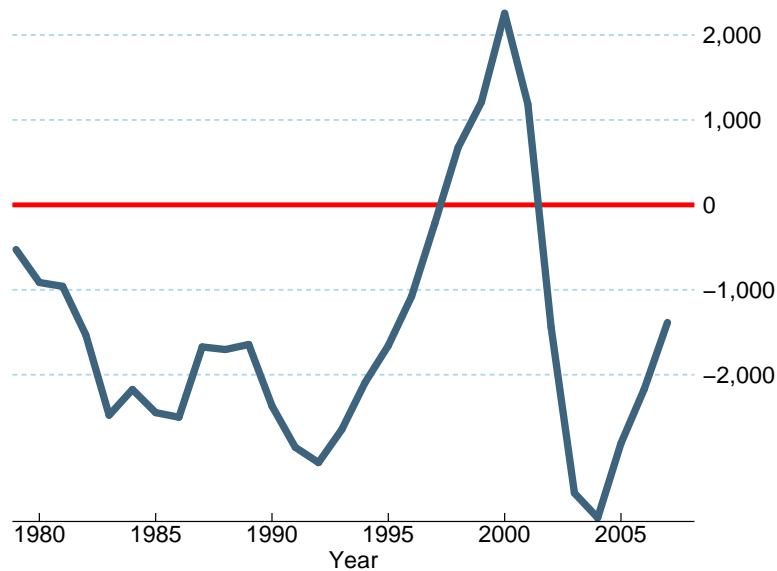


Figure 19: Annual government deficit in US\$ per household. Source: BEA

During the late 1990's a flurry of innovation took place in the mortgage industry, with new mortgage types being created which allowed homeowners to take bets on mortgage rates and enabled otherwise unqualified buyers to qualify for mortgages by deferring payments. These non-conforming mortgages were securitized through so-called "private label" Asset Backed Securities (ABS) sponsored by Wall Street. While the private label ABS market had steadily increased in market share throughout the 1990s and early 2000s, it really took off at the end of the 2001-03 recession reaching a market share of around 50% by the end of 2006.

With rising housing prices and low rates on alternative investments, investors were tempted to view subprime loans as being attractive, ignoring the potential for hitherto unseen levels of delinquencies down the road. The move into subprime was facilitated by Wall Street and credit rating agencies through financial engineering that transformed subprime mortgage loans into new securities through several layers of intermediate structures that made it difficult for investors to fathom the underlying risks. At the same time, investors' appetite for taking on more traditional risks also increased substantially, as witnessed by

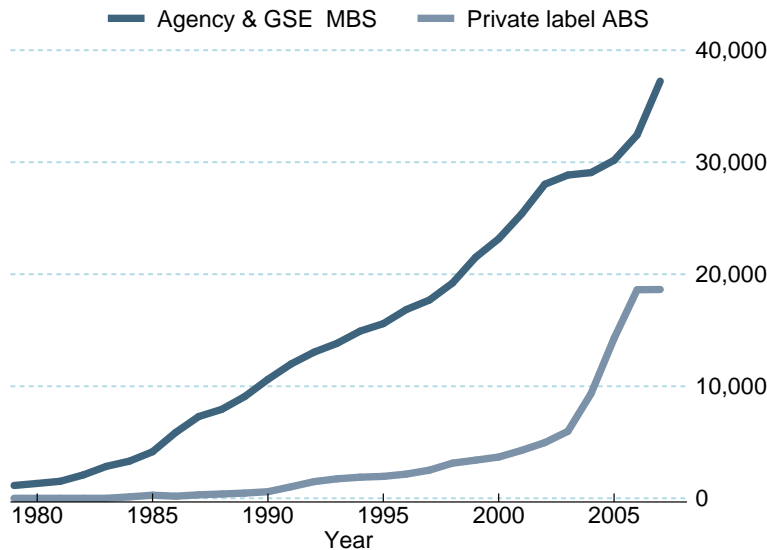


Figure 20: Outstanding mortgage backed securities by issuer in US\$ per household. Source: FHFA
the substantial tightening of high yield bond spreads that reached an all time low of around 258 bps in May of 2007.³⁶

The 2/28 loans - where the interest rate for the first two years is fixed and the interest rate for the remaining 28 years is reset every six months - was common among subprime loans. The initial two-year interest rate on subprime loans was typically much higher than the then prevailing prime ARM rate. For example, Foote, Gerardi, Goette and Willen (2008) find that in their sample the first two-year rate was 7.3% in 2004, rising to 8.5% in 2006. The corresponding prime ARM rates were 3.9% in 2004, rising to 5.5% in 2006. By comparison, the corresponding fully indexed rates were 11.5% and 9.1%. Even the first two-year interest rate on a typical subprime mortgage was 300 bp higher than on the corresponding prime ARM. When housing prices were rising, most subprime mortgages were refinanced within two years of origination so that the higher fully indexed rates never kicked in. According to Foote, Gerardi, Goette and Willen (2008), over 60% of the originations prior to 2004 were refinanced within 2 years, in their sample of subprime mortgages.

Figure 21 shows that the origination of non-prime mortgages increased three-fold between 2001 and 2005, from \$500Bn a year to more than \$1,500Bn a year. At the same time, the Figure shows the marked shift in underwriting after 2003, with a large increase in home equity loans and sub-prime and Alt-A mortgages. The increased popularity of home equity loans is also borne out in Table 1, which shows that, although real estate values went up by \$10,037 per household from 2004-7, the home equity actually fell by \$10,566

³⁶Based on the Merrill Lynch High Yield Master II Index.

over the same period, indicating that households, on average, were cashing out even faster than house prices went up. The reason for the spike in underwriting of high risk mortgages is easy to find: The credit spread for AAA MBS tranches went from 35 bps to 15 bps between 2003 and 2006. For BBB rated tranches, the change was from 375 bps to 175 bps over the same period. In other words, there was money to be made from securitizing pools of high risk mortgages and although sponsors most often would keep the equity tranche, much of this risk could be hedged out in the ABX market.

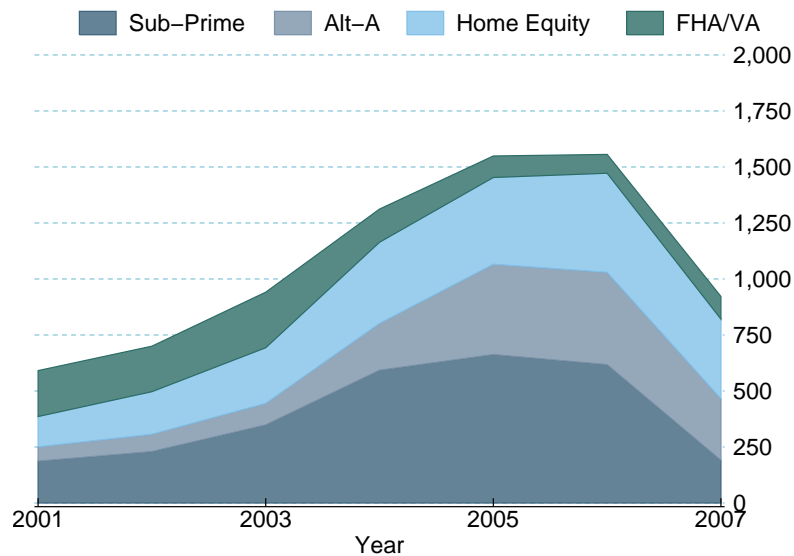


Figure 21: Origination of non-prime mortgages in US\$M. Source: Federal Reserve

Gorton and Metrick (2009) find that, of the about \$2.5 trillion of subprime mortgages that were originated between 2001 and 2006, half of them were 2005 and 2006 vintages. Most subprime mortgages were securitized. 70% of subprime originations in 2005 and 2006 were securitized into residential mortgage backed securities. That typically involved pooling several individual mortgages, selling them to a special purpose vehicle (SPV), which in turn finances those mortgage holdings by issuing different tranches of bonds with credit ratings ranging from AAA to BBB (senior/subordinate structure), and often an excess spread/over collateralization structure (with an XS/OC tranche - i.e., deal assets exceed deal liabilities) and a residual unrated (equity) tranche. These tranches may be sold to investors directly or put into Collateralized Loan Obligations (CDOs) - SPVs that buy various types of debt including subprime mortgage tranches, pool those assets together and finance those assets by issuing liabilities that may also have tranche structures. And then there are Credit Default Swaps (CDS) that are derivative contracts between two parties, where one party insures the other against default of an underlying security (could be a subprime mortgage

backed security tranche.)

All these securities are traded, and often those trades are financed using Repurchase (Repo) agreements. In a typical Repo, the owner of the security (say a bank, borrower) sells the security to the financier (lender) with an agreement to repurchase the same security at a future date at an agreed price above the purchase price. The repurchase price is set below the market value of the security involved by a haircut to provide a cushion against adverse price movements. The haircuts depend on the situation on hand and the security concerned. The repo market is rather large in size. - Hoerdahl and King find that that the notional value of the repo market (involves double counting of repos and reverse repos) in the U.S. exceeded \$10 trillion by mid 2008 based on data provided by 19 primary dealers and over 1000 bank holding companies - almost 70% of U.S. GDP. Figure 22 provides some insight into the increasing use of overnight financing by primary dealers to purchase non-treasury securities and in particular mortgage linked securities. At the peak in 2007, almost \$1Tn in agency MBS was financed overnight and another \$350Bn in "corporate" securities much of which was senior tranches of sub-prime CMOs. While the "rehypothecation" and staggering amounts of leverage available in repo markets arguably played an important role in the propagation and amplification of the housing bubble, it itself was only made possible by the ample supply of "real" money that both bought the mortgages and supplied the leverage.

Money chasing home mortgages is evident from the steep decline in the the spread between the rate at which mortgage loans were advanced to home owners and the yield on securities that were backed by those mortgages during the 2004-2006 period (see Figure 23.) There is evidence that that underwriting standards came down as a result of the money flowing into mortgages. For example, Gerardi, Goette and Willen (2008) find that prime lenders would have rejected most of the loans originated by subprime lenders, and many recent foreclosures involved mortgages with little down payment where the owners lived in their homes for a relatively short period of time, with higher foreclosures stemming from falling home prices.

To summarize, financial engineering greatly expanded the capacity of the US housing market to absorb the money that was flowing into the US at increasing rates, thereby allowing households to achieve record high levels of leverage, as seen in Figure 15. At the end of 2006, subprime and alt-A loans accounted for roughly 72% of ARM debt outstanding - that is roughly \$2.5 trillion in debt, or 25% of the total mortgage debt outstanding. This represents about 9.6 million loans, or roughly 19% of the total number of mortgage loans outstanding. The money flowing into the housing market led to the housing price bubble: The S&P Case- Shiller home price index increased from 100.77 in 2000 Q1 to 186.07 in 2007 Q1, i.e., an increase of 86%.

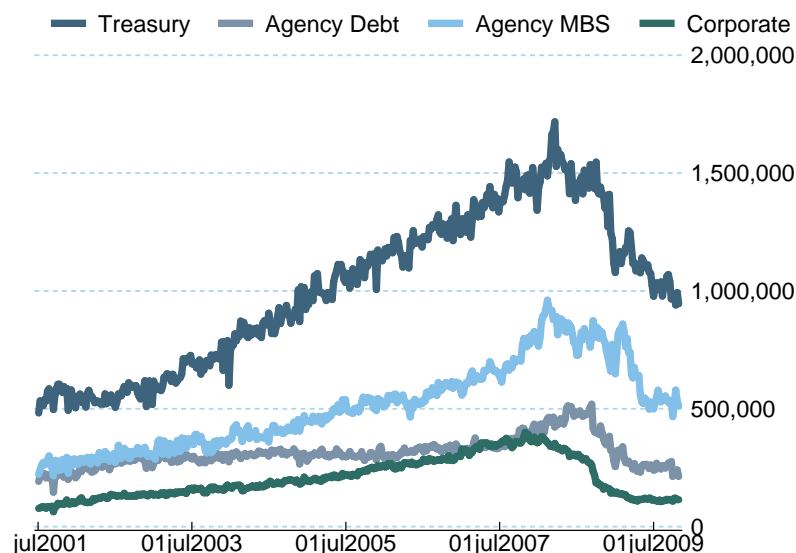


Figure 22: Average daily volume (\$ Millions) by collateral type of transactions in which primary dealers Repo out the underlying security (i.e. the dealer borrows to finance the asset purchase). The definition of “corporate” securities include : bonds, notes, debentures, CMOs and REMICs (including residuals), commercial paper and privately placed securities (e.g., 144a securities). Source: Federal Reserve FR2004

7 Role of Government Deficit

While government deficits played a role, they were less important. During mid 80s, government deficits were around 4.5%, larger than the Balance of Payment deficits which were around 3.25%. Since the capital flows into the country that were needed to offset the current account deficits were smaller than the government deficits, part of the government deficits were offset by net domestic private sector savings, i.e., the private sector accounted for a net surplus of capital flows. This had changed dramatically starting in the late 90's. By 2006, the federal deficit was around 2.5% and dwarfed by the current account deficit of around 6%, the result of a decade of net capital inflows. In other words, while the government deficits are clearly important, they are not necessarily the main driver of capital inflows. The private sector and household behavior played the crucial role.

8 Why Housing Bubbles are Different

In this section we elucidate why even a relatively modest housing bubble may have more severe real effects than other asset price bubbles, e.g. a stock market bubble.



Figure 23: 30 Year Conventional Fixed Mortgage Rate Minus Yield on Corresponding Mortgage Backed Security in the Secondary Market). Source:

8.1 Money Channeled into Housing has a Bigger Price Effect

To understand why money channeled into housing has a bigger price effect, consider the following hypothetical economy with 10 households. Each household has \$100 in housing wealth and \$100 in stocks. Suppose there is a sudden helicopter drop of \$10 per household, that each household has to use in bidding up the prices of stocks or housing.

First, suppose households decide to use the money to bid up the price of stocks. The total value of stocks before the helicopter drop of money was \$1,000. The total value of stocks will go up by \$100, the total amount of money dropped, i.e., an increase in price of 10%. Whether everyone invests their \$10 directly in stocks or nine of the households lend their money drop to the tenth household which in turn invests the \$100 (\$90 borrowed plus \$10 of its own) in stocks does not matter. The price effect on stocks will be the same. There is no leverage effect in the aggregate, since stocks are homogenous.

Next, suppose households decide to invest the money to bid up the price of housing. When there is no leverage allowed, and each household bids up the price of its own house, the price rise will be $\$10/\$100 = 10\%$.

Suppose leverage is allowed. Nine of the households give their money to a bank. The bank lends the \$90 to one household. That household uses that to bid up the price of its house. The price rise will be $\$100/\$100 = 100\%$. Other households will also think their house value has gone up by 100%, since assessors use comparables for home valuation³⁷.

³⁷Unlike stocks, houses are illiquid with few transactions relative to the number of homes in the economy.

Hence there is leverage even in the aggregate in housing and there is a money multiplier effect on housing prices. The same amount of money flowing into housing is likely to cause a bigger price rise. This is consistent with Piazzesi and Schneider (2009) who show that a small number of optimists can drive up the average transaction price of houses without a large increase in trading volume or market share.

Like all bubbles the housing price bubble also collapsed eventually. The wealth effect that kept consumption up vanished. The financial intermediaries that channel money into housing were also highly levered, worsening the situation when the bubble burst. The recession followed.

8.2 A Housing Bubble is Different from a Stock Market Bubble

It is interesting to contrast this experience with the even more dramatic (in percentage terms) stock market collapse in 2000. While the stock market downturn led to the shallow recession of 2001, the collapse of the housing bubble has led to a much more severe recession now³⁸. While the real effects of the recession following the stock market collapse were largely ameliorated by the highly accommodative monetary policy which saw the federal funds rate lowered from 5.31% in March 2001 to 2.09% in November 2001, it can not explain the severity of the recession we are facing now.

A crash in the value of home values has a far more severe impact on the economy than a corresponding decline in the value of stocks for the following reasons.

Residential real estate constitutes a substantial part of household wealth for most households. For the middle three wealth class quintiles of the population, the principal residence constituted 66.1% of the value of the total household assets, whereas corporate stocks and financial securities constituted only 7.9% (cf. Table 7, Wolfe (2007)). In 2004, 48.6% of all families held stocks, with a median value \$24,300. In contrast, 67.7% of all families owned their primary residence, with a median value of \$131,000³⁹

Investment in housing typically involves leverage, whereas there is relatively little leverage in stock investments. For example, mortgage debt was about 47.4% of residential real estate value in 2004 whereas other debt was only 6.8% of the value of the other assets of households. Averages understate the leverage available for investing in residential homes.

As Piazzesi and Schneider (2009) observe, less than 6% of owner occupied houses are traded during a typical year whereas the annual trading volume for stocks in the NYSE is about 120%. In view of that the common practice is to value houses by examining the price at which a similar comparable house transacted recently.

³⁸That the bursting of real estate bubble, unlike the bursting of the stock market bubble, can have disastrous consequences is well recognized by economists. For example, Franklin Allen, in his keynote address at the 8th Asia Pacific Finance Conference held in Bangkok (July 22-25, 2001), cautioned that the bursting of the real estate bubble might lead to a long recession in the US just like that in Japan.

³⁹Recent Changes in U.S. Family Finances: Evidence from the 2001 and 2004 Survey of Consumer Finances.

For example, 51% of all loans that originated in 2006 had a CLTV (combined loan to value ratio) of more than 80%; 29% of originations in 2006 had a CLTV of more than 90%.⁴⁰

Residential real estate being a large fraction of the total assets of households together with the fact that households can and do use real estate as collateral to borrow against implies that a perceived increase in household wealth will result in a large increase in aggregate consumption. That view is consistent with the estimates in equation (3): a \$100 increase in housing wealth is associated with a \$8.40 increase in consumption. In contrast there is hardly any increase in consumption due to increased stock market wealth. The corollary is that bursting of the housing price bubble will have a far severe adverse impact on consumption.

Recovering from a recession often involves households moving to another location so that the skills of agents in the economy are better matched to demands for those skills. However, the recovery will be made more difficult when the recession is associated with a collapse of housing prices. That is because moving involves selling the current home and using the equity released from that sale to buy another home in a different location. When the equity in the home has been lost, selling a home and moving becomes difficult. To understand why, consider a hypothetical open economy with two agents, a and b. Agent a lives and works in location A and b in location B. Each lives in a house valued at \$100 and a mortgage debt of \$80. There is an unanticipated technology shock that makes the skills of each agent not relevant in their respective locations. However, if a moves to B and b moves to A, they can maintain their productivity and their jobs. If the housing values remain the same, each can sell their house to the other (through an intermediary,) payoff the loan, take a new loan for the same amount, and move. Suppose, instead the housing values drop to \$80 and that the banks require a minimum equity of 20%. In that case, if they cannot sell their houses – their equity has been wiped out. Because they cannot relocate, they cannot recover from the adverse impact of the technology shock.

9 Why Did the Bubble Burst?

The export led growth in emerging nations also led to an increase in prices of intermediate goods and especially commodities (see Figure 24). Whereas the Producer Price Index (PPI) for finished consumer goods, crude oil and intermediate has increased dramatically post 2001, the Consumer Price Index (CPI) did not deviate much from trend, and the ratio of PPI to CPI increased sharply between 2005 and 2007. That suggests that there was very limited pass through of higher prices from producers to consumers, even though the economy was possibly overheating, causing pressure on wages in the manufacturing sector.

⁴⁰"Anatomy of a Credit Collapse," Confidential Kellogg Presentation, Amitabh Arora, December 2007.

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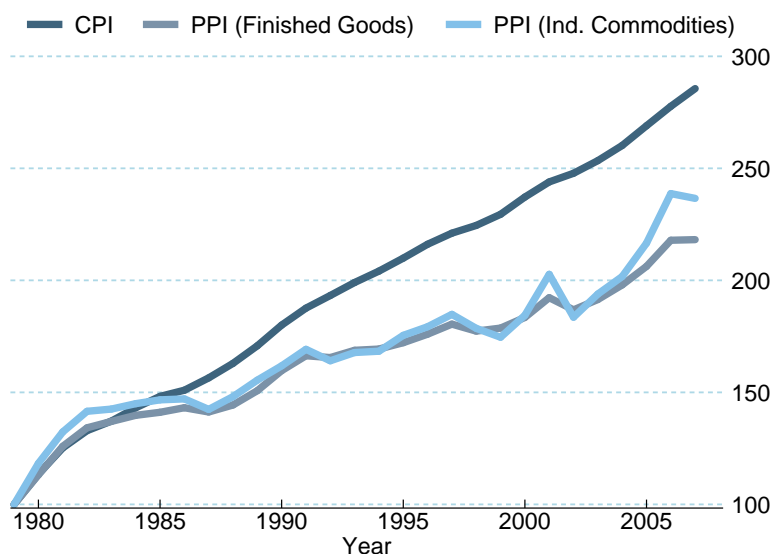


Figure 24: Consumer Price Index (CPI) and the Producer Price Index (PPI) for finished goods and industrial commodities, indexed to 1980 levels. Source: BEA

With pressure on wages, some subprime households defaulted on their loans leading to downward pressure on house prices due to foreclosures. Spreads on MBS tranches started blowing out putting subprime originators in trouble, and leading to the Bear Stearns hedge fund collapse in 2007, and banks being forced to take on more of the MBS exposure on their balance sheets. Repricing of risk in the market dried up availability of teaser rate loans to home owners with ARMs (see Figure 25) and the resulting funding problems at subprime and Alt-A lenders led to an increase in the number of disqualified borrowers due to tightened credit standards and “disintermediation”. This had the effect of dramatically increasing bank inventories of foreclosed properties which was only partially off-set by decrease in housing starts.

10 The US is not Alone: Some International Evidence

A number of countries experienced a period of current account imbalances and anemic personal savings rates similar to the US.

Interestingly, every country running a significant CA deficit also had a housing bubble

⁴¹That is also consistent with the findings of Rotemberg and Woodford (1990), who study the relationship between marks-ups and business cycles. Even though firms are experiencing higher prices in the form of input they are not passing it onto the consumers. They would like to increase market share rather than exploit existing consumers through higher prices.

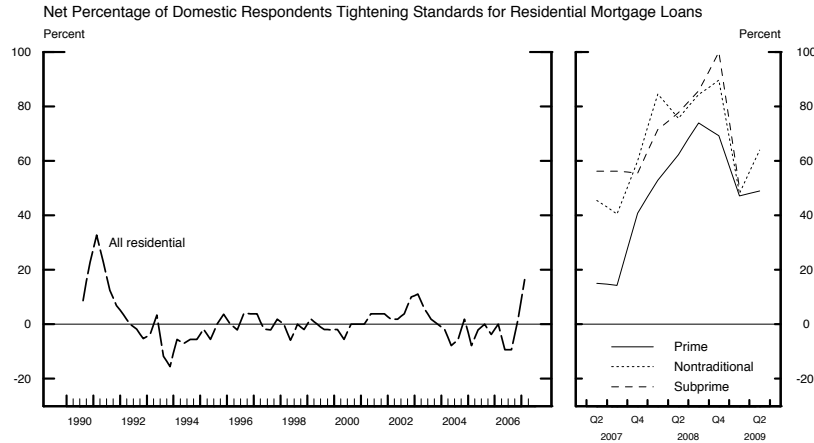


Figure 25: Percentage of loan officers at major US credit institutions reporting tightening of credit standards over prior year for residential mortgage loans. Source: Federal Reserve Survey of Loan Officers

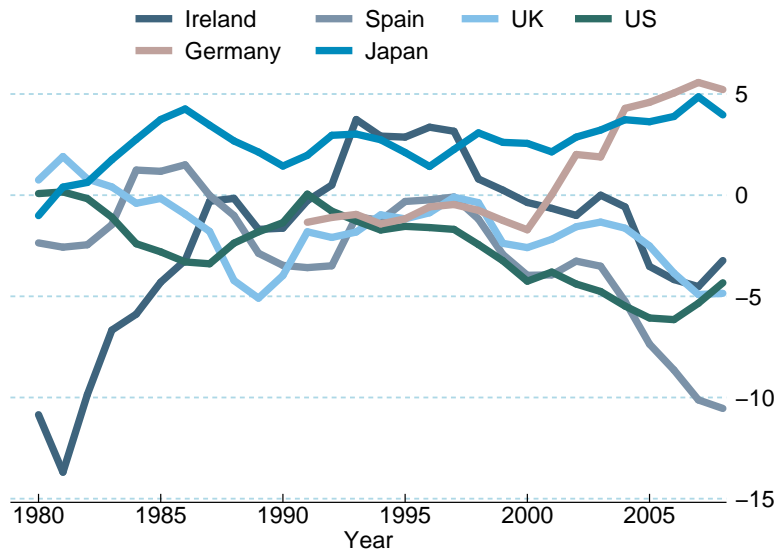


Figure 26: Current account balances as percentage of GDP. Source: OECD Economic Outlook 2008

and a subsequent crash (shown by extending the graph to 2008/9.) By contrast, CA surplus countries did not have housing price bubbles as illustrated by Germany and Japan in Figure 27. Similarly to the US, these countries will now face the task of stimulating their economies while credibly promising to impose the fiscal discipline necessary to paying off their debts in the future. This will be the more challenging without the benefit of having the reserve currency at their disposal. They will not have the option of simply printing money, as the painful runs on the British pound in 1992 is still fresh in memory.

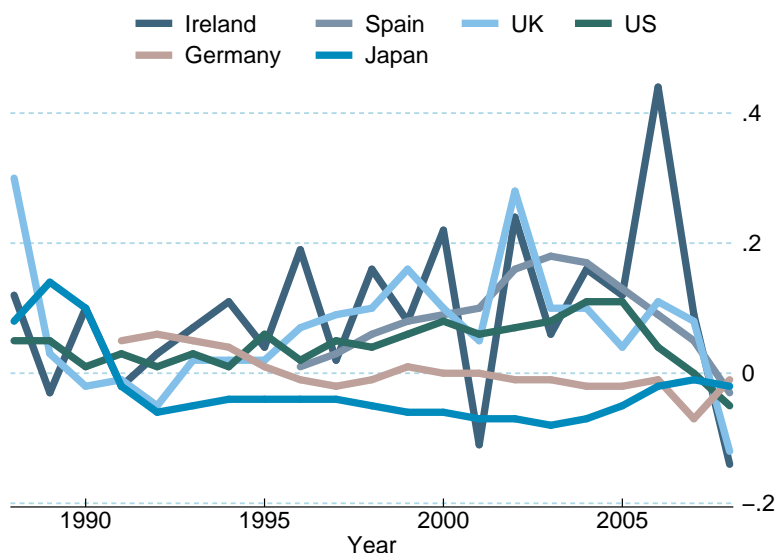


Figure 27: House price index, percentage change from previous year adjusted for consumer price inflation. Source: OECD Economic Outlook 2008

11 Conclusion

The common wisdom is that cheap money and lax supervision of financial institutions led to this financial crisis, and solving that crisis will take us out of the recession. We argue that the financial crisis is just the symptom. The fundamental cause of the crisis is the huge labor supply shock the world has experienced, that led to the glut in liquidity and money supply through the various channels discussed in this paper. In a closely related paper, Obstfeld and Rogoff (2009) argue that global imbalances did not cause the increased leverage and the real estate bubble, but they were important co-determinants. In our view, the need to accommodate the huge labor supply shock led to the economic policies followed by a number of countries in the 2000s that caused the distortions described by Obstfeld and Rogoff (2009).

Our analysis suggests that for recovery to take place the structural imbalances in global capital flows needs correction, in part through policy and institutional changes that promote higher saving in developed countries and capital flows into developing nations. Policies that promote households' understanding of the burden of the public debt in the US would contribute to higher saving. The value of the US dollar may have to decline substantially, and alternative reserve currencies may have to emerge to stop the flood of capital into the US. As we have argued, it is not sustainable in the long run to have the demand for dollar reserves grow much faster than the US economy.

The macro forces triggered by the labor shock is like a tidal wave that needed to wash

ashore no matter what. History might have taken an entirely different path with better risk management controls in place in the US but then again, financial innovation might just have found a different way of getting highly leveraged deals done off-shore or through creative accounting⁴². However, none of these macroeconomic considerations negate the need for the development of improved risk management in the broadest sense in order to ensure financial stability and prosperity going forward.

China and India will continue to need to bring tens of millions of rural laborers into the productive workforce in the coming decades and the world economy must find a sustainable way of dealing with this influx. As China's rapid rate of growth continues, its export led growth strategy of the past cannot go on indefinitely and China's domestic consumption will eventually have to grow as a share of GDP. At the same time, Western economies will necessarily have to adjust to a new equilibrium in which commodities are scarcer and households face stiffer competition for jobs.

When millions of World War II soldiers returned home that increased the US labor force of about 60 million workers by almost 25% within a very short period of time. At that time the Department of labor, which certainly had no cause to accentuate the negative, predicted that 12 to 15 million workers would be unemployed.⁴³ That did not happen! That problem was managed well leading to prosperity instead of doom, thanks in no small part to the GI Bill and other governmental fiscal intervention. We believe that our analysis provides some new insights regarding the causes of the recession that will be helpful in managing this crisis well. The housing bubble created the illusion of wealth. In 2007 residential real estate was 1.45 times GDP. Suppose housing values have to drop by 25% to reach their "fundamental" levels of value. The impact on consumption given our estimate of 8.4% as being the wealth effect will be $1.45 \times 0.25 \times 0.084 = 3\%$. The economy should be able to recover from there and move on its normal growth path with the right policies in place. For example, in the US, institutions that allow households to reduce their debt burden without going through a complex and lengthy bankruptcy process would promote relocation of resources and speed up economic recovery.

⁴²Reminiscent of when Regulation Q gave rise to the Euro dollar market in the 1970s, or how a wide array of investment vehicles are not covered in the Basel II risk accounting.

⁴³Richard Severo and Lewis Milford (1989), "Sweet Wine At Last," *The Quarterly Journal of Military History*, Winter 1989.

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A Data Sources

Data	Source
China GDP Relative to US GDP	China Statistical Yearbook, Bureau of Economic Analysis Table 1.1.5
China Savings Relative to US Savings.	China Statistical Yearbook, Bureau of Economic Analysis Table 5.1
China urban population in millions.	China Statistical Yearbook
Change in Chinese holdings of US assets by asset class in US \$M.	US Treasury Department
Current account balance and change in household indebtedness.	Flow of funds accounts Table B.100, Bureau of Economic Analysis Table 4.1
Private consumption and total wages incl. benefits (right axis) along with excess consumption calculated	Bureau of Economic Analysis Tables 1.12 and 1.1.5
Home price appreciation	Federal Housing Finance Agency, Standard & Poors
S&P Case Shiller Home Price Index	Standard & Poors
Average US household residential leverage computed as total residential mortgage debt	Flow of funds accounts Table B.100
Graph incorrectly titled, should read "Total residential mortgage debt and total household debt divided by wages"	Flow of funds accounts Table B.100 and Bureau of Economic Analysis Table 1.12
Year on year changes in private consumption	Bureau of Economic Analysis Table 1.1.5, Flow of funds accounts B.100
Graph incorrectly titled, should read "Federal Deficit per household"	Congressional Budget Office of Management and Budget
Outstanding mortgage backed securities by issuer in US\$ per household.	Flow of funds accounts Table L.218
Origination of non-prime mortgages in US\$M.	Inside Mortgage Finance, 2007 Mortgage Market Statistical Annual
Consumer Price Index (CPI) and the Producer Price Index (PPI) for finished goods and industrial	Bureau of Labor Statistics
Percentage of loan officers at major US credit institutions reporting tightening of credit standards over	Federal Reserve survey of loan officers
Current account balances as percentage of GDP	IMF -World Economic Outlook Database
House price index	OECD Economic Outlook

Additional data sources:

Data	Source
Number of Households in the US	US Census Bureau
Trade Balance of US with partners	BEA international transaction accounts data 2a and 2b
Foreign holding of US debt	US Treasury Department
Total Public Debt (in the US)	US Treasury Department
Value of Corporate Equities	Flow of funds accounts Table L.4
Household networth	Flow of funds accounts Table B.100
US unemployment rate	Bureau of Labor Statistics
Current account balance for BRIC, NIAC, ME	IMF - World Economic Outlook Database
US Private consumption, wages, GDP data	Bureau of Economic Analysis Tables 1.1.5, 1.12
Central Bank foreign reserves	IMF COFER survey