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Income inequality and wealth concentration as a root cause of the subprime crisis

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Abstract

The crisis that broke out in August 2007 was caused by the fact that the market for collateralised debt obligations (CDOs) had grown to a size sufficient to wreak general havoc when it suddenly collapsed. One of the unresolved questions arising out of the subprime crisis concerns the precise role played by economic inequality. Several authors have argued that income inequality was a root cause of the crisis, but this has remained to date a minority view. This dissertation attempts to show that not only income inequality but also wealth concentration needs to be taken into account to make economic inequality truly prominent in the subprime crisis debate. To fulfil this task, income inequality and wealth concentration trends are shown, and existing Marxian, post-Keynesian, and mainstream crisis theories are discussed. The major contributions of this dissertation are however (i) to provide empirical evidence about the negative impact of investor demand on US long-term bond yields in the pre-crisis period, which gives support to the hypothesis that the increasing global demand for safe assets led to a 'search for yield' by investors; (ii) to present estimates about the specific contribution of high net worth individuals to this negative impact; and (iii) to show that after having helped to cause a yield problem in the major US debt markets, high net worth individuals (via hedge funds) continued to be a major source of the pressure on US banks to resolve this yield problem through the mass production of CDOs.

Key Words: ABS and CDO; bond yield conundrum; crisis theories; income inequality; subprime crisis; wealth concentration

JEL Classification: C22; D31; G01; G12; E43

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List of Abbreviations

ABS	Asset-backed securities
ARDL	Autoregressive distributed lag
AuM	Assets under management
BCG	Boston Consulting Group
BIS	Bank for International Settlements
bp	Basis points
CBO	Congressional Budget Office
CDO	Collateralised debt obligation
CDS	Credit default swaps
CML	Capgemini and Merrill Lynch
CPI	Consumer price index
CS	Credit Suisse
DS	Deininger and Squire
DSGE	Dynamic stochastic general equilibrium
ECB	European Central Bank
EDF	Expected default frequency
EKS	Eltetö-Köves-Szulc
EMC	Emerging market countries
FCIC	Financial Crisis Inquiry Commission
FR	Federal Reserve
FRM	Fixed rate mortgages
GDP	Gross domestic product
GK	Geary-Khamis
HFCE	Household final consumption expenditure
HNWI	High net worth individuals
HS	Household survey
ICP	International comparison programme
ILO	International Labour Organization
IMF	International Monetary Fund
ISM	Institute for Supply Management
LIS	Luxembourg Income Studies

MCI	Marginal cumulative impact
MOVE	Merrill Lynch Option Volatility Estimate Index
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
PCE	Personal consumption expenditure
PPP	Purchasing power parity
PWT	Penn World Tables
ROW	Rest of the world
S&P	Standard and Poor's
SEDLAC	Socio-Economic Database for Latin America and the Caribbean
SIFMA	Securities Industry and Financial Markets Association
SWIID	Standardized World Income Inequality Database
TIC	Treasury International Capital System
UHNWI	Ultra-high net worth individuals
UN	United Nations
UNDP	United Nations Development Programme
VAR	Vector autoregression
VECM	Vector error correction model
VIX	Chicago Board Options Exchange volatility
WDI	World Development Indicators
WIID	Word income inequality database
WYD	World income distribution dataset

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Reference to published material

Parts of my dissertation – mainly Chapter 5 and Chapter 6 – are published as two working papers and are currently under revision (after resubmission) by the *Cambridge Journal of Economics* and the *Journal of International Financial Markets, Institutions & Money*

- "The Contribution of Wealth Concentration to the Subprime Crisis: A Quantitative Estimation" (with Photis Lysandrou), CIBS Working Paper No. 22, 2011
- "The Contribution of US Bond Demand to the US 'Bond Yield Conundrum' of 2004 to 2007: An Empirical Investigation" (with Photis Lysandrou and Chris Stewart), CIBS Working Paper No. 20, 2011

I have furthermore published three conferences papers and presented my work at the following conferences:

- 16th Conference of the Research Network Macroeconomics and Macroeconomic Policies (FMM), Berlin, October 25-27, 2012
- 61st Congrès Association Française de Science Economique (AFSE), Paris, July 2-4, 2012
- CGF PhD Conference in Monetary and Financial Economics, Bristol, May 10, 2012
- 2nd annual Londonmet Postgraduate Research Student Conference, London, November 18, 2011
- CIBS 3rd Annual Conference, London, September 8-9, 2011
- LMBS 4th Annual Research Conference, London, June 29, 2011
- DVPW conference 'Die Globale Finanzkrise in politikwissenschaftlicher Perspektive', Marburg, May 27-28, 2011
- 1st annual Londonmet Postgraduate Research Student Conference, London, November 12, 2010
- 14th Conference of the Research Network Macroeconomics and Macroeconomic Policies (FMM), Berlin, October 29-30, 2010
- LMBS 3rd Annual Research Conference, London, June 30, 2010

1. Introduction

"The outstanding faults of the economic society in which we live are its failure to provide for full-employment and its arbitrary and inequitable distribution of wealth and incomes ... there is social and psychological justification for significant inequalities of incomes and wealth, but not for such large disparities as exist to-day." (John Maynard Keynes, 1936)

On the 9th of August 2007 the French bank BNP Paribas announced that "[t]he complete evaporation of liquidity in certain market segments of the U.S. securitization market had made it impossible to value certain assets fairly regardless of their quality or credit rating" (Bloomberg, 2007). This announcement was followed by the total collapse of the market for collateralised debt obligations (CDOs). This led to uncertainty and panic in the global banking sector. The subsequent breakdown in trust between the large commercial banks (many of whom owned or sponsored investment vehicles that were directly exposed to this market segment) proved to be catastrophic in that it was the catalyst setting in motion a liquidity-solvency crisis spiral, which in September 2008 culminated in the paralysis of the whole financial system when Lehman Brothers (the then fourth largest investment bank in the US) declared bankruptcy and AIG (the then largest US insurance company) collapsed.

The following "flight to safety was so intense that in November and December 2008 the market bid the yield on Treasury bills literally to zero on some days" (Poole, 210, p.423) and interbank lending stopped. The consequence was a credit crunch that made more bank bailouts necessary and that transferred the problems of the financial sector to the real sector. Mishkin (2011, p.49) therefore claims that the "financial crisis of 2007 to 2009 can be divided into two distinctive phases. A first and more limited phase from August 2007 to August 2008", in which global GDP was still rising, and a second "far more virulent phase", which strongly affected the real sector and lead to the Great Recession of 2008-2009. The rescue of the financial sector (US, UK, Spain, Ireland, Iceland, and Belgium) and the recession (Greece) led thereafter even to a third phase: the debt and Euro crisis[1]. This sequence of events shows that the collapse of the CDO market was the immediate trigger for everything that followed. To help resolve the question as to why this market could reach proportions that were sufficiently large as to endanger the global financial system is therefore of utmost importance.

[1] The Euro zone has several structural weaknesses (see Arestis and Sawyer, 2011) which most likely would also have proven unsustainable if the financial crisis and the subsequent global recession would not have occurred. However, without these events a Euro crisis would have taken place in a different form.

1.1. The alchemy of CDOs

The first issue which has to be addressed is why could the collapse of a relatively small market[2] set in motion such a catastrophic chain reaction? The answer is to be found in the complexity of CDOs. The simplest form of a CDO is an asset-backed security (ABS) of an ABS (i.e. an ABS-squared). Both (ABS directly and CDOs indirectly) are securities that bundle different forms of debt from different debtors to create various debt securities (so called tranches), with the aim of selling each of these to third parties (see Figure 1). The debt that is used for the bundling consists mainly of (subprime) mortgages but also includes other forms of loans and bonds[3].

The intention of this bundling is to diversify risk and supposedly made ABS and CDOs safe and it was (wrongly) assumed that the borrowers would have independent default probabilities (see Coval *et al.*, 2009; Shin, 2009). To further protect ABS and CDO holders, various 'credit enhancement' techniques were also used in the production process. To begin with, the tranches have different seniorities relative to each other. The bottom tranche, which gives the highest return, is the riskiest (the so called equity tranche) because the first losses are absorbed by the owner of this tranche, while the tranches at the top are the least risky (the so called super senior tranches). The owners of the latter typically only incur losses if more than 30% of the underlying debt is not repaid, while the owners of the so called mezzanine tranches (the tranches with a BB and BBB-rating) lose their investment if between 3% and 10% of the underlying portfolio defaults (IMF, 2006).

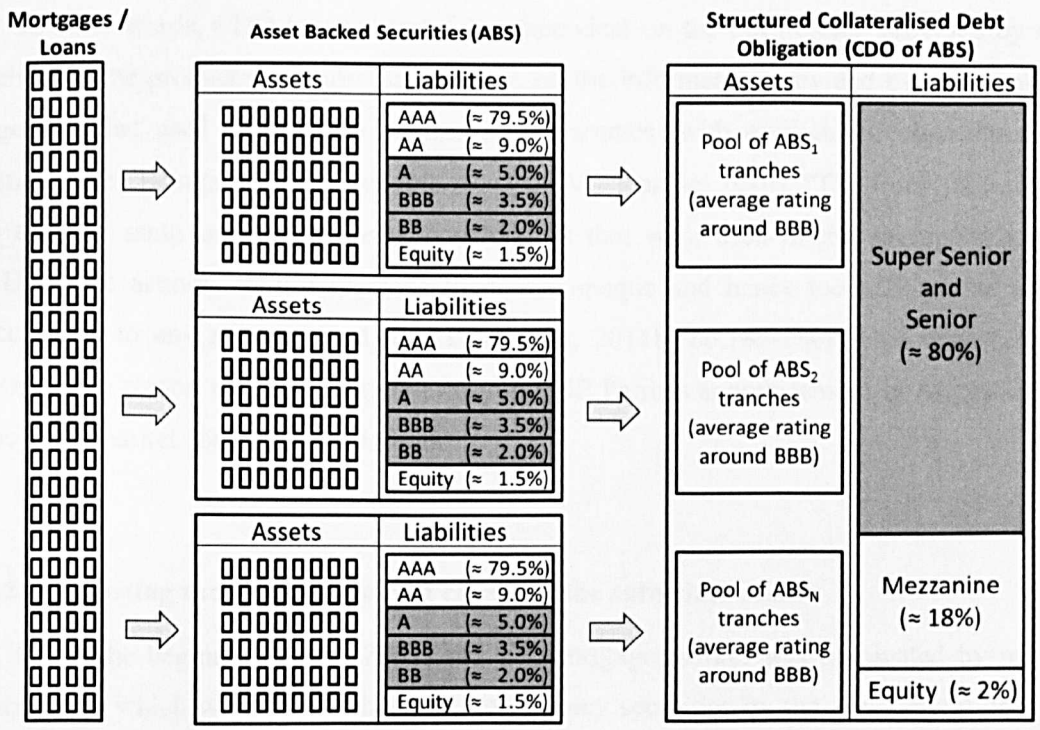
To increase the amount of super senior tranches within the security, many ABS and CDOs are (i) over-collateralised, i.e. their value is smaller than the value of the collateral assets; (ii) have excess servicing, i.e. part of the interest payments is saved as insurance against cash-flow shortages; and (iii) residual tranching, i.e. to cover for possible losses all excess cash-flows are saved (IMF, 2007a). The higher the over-collateralisation, excess servicing and residual tranching, the higher the amount of AAA-rated tranches in an ABS or CDO. Typical ABS consist of around 80% super-senior tranches (see Figure 1).

[2] In mid-2007 the size of the global CDO market was around US$ 3 trillion (Blundell-Wignall, 2007b), while the size of total global financial assets was nearly US$ 200 trillion (McKinsey, 2008).

[3] Sometimes the name of ABS and CDOs is differentiated according to its underlying collateral: ABS that are backed by mortgages are also called MBS, and CDOs are also called collateralised mortgage obligation (CMO), collateralised bond obligation (CBO), collateralised loan obligation (CLO), and multisector CDOs depending on the main underlying portfolio. The structure of all these products is however essentially the same and all CDO segments have been equally affected by the crisis. Therefore, only the terms ABS and CDOs (that comprise all these different portfolio forms), shall be used throughout this dissertation.

However, to produce more highly rated debt securities, banks recycled most of the lowest senior tranches and the mezzanine tranches into structured CDOs. At least 70% of the CDO tranches typically were rated as super-senior and, to make matters more complicated, "[m]ost of the A- and BBB-rated CDO tranches [were further] recycled into CDO of CDO (i.e. CDO-squared) securities, about 85 percent of which are comprised of AAA-rated senior and super-senior tranches. CDOs-squared and structured finance CDOs were created almost solely to resecuritize MBS and CDO mezzanine tranches, for which there was not sufficient demand from investors." (IMF, 2008, p.59). In addition to these cash-CDOs (CDOs whose underlying collateral has scheduled payments), so called synthetic CDOs were also increasingly produced in the pre-crisis years (these have credit default swaps (CDS) as the underlying portfolio)[4].

Figure 1: The creation of ABS and CDOs



Sources: IMF (2006, 2007a), Blundell-Wignall (2007b), Ashcraft and Schuermann (2008)

[4] It is beyond the scope of this dissertation to go into more detail; please see Nomura (2004) for an easy understandable in-depth overview about the different CDO types and their collateral.

The way in which CDOs were produced meant that they were not transparent. An owner of ordinary government and debt securities can easily find out how risky the investment is and in how far the risk of default changes over time. In principle the same is true for ABS investors as the backing collateral normally also consists of a single, homogenous class of assets (e.g. mortgage loans, credit card loans and so on). CDOs, by contrast, do not meet this transparency criterion. CDOs may only be 'second-floor' securities, but the jump in complexity and opacity going from 'first-floor' ABS to CDOs is considerably higher than the jump going from the 'ground-floor' Treasury, municipal and corporate bonds to ABS. Normally, different types of asset classes are mixed together in each CDO so that the collateral assets that back CDOs are very diverse. This means that each CDO is a unique customized product whose price is negotiated over the counter by the seller and the buyer (i.e. CDOs do not have standard prices). Furthermore, it is nearly impossible for investors to find out who exactly are the debtors for each tranche.

In other words, CDO buyers were fully dependent on the information provided by the sellers of the product and, more importantly, on the information provided by credit rating agencies that used complicated computer programmes (with undisclosed algorithms) to establish the ratings for the single tranches (see MacKenzie, 2010). "The irony [therefore] is that the same credit enhancement techniques that were used in the attempt to make CDOs safe actually helped to make them too opaque and hence too difficult to value accurately to any market standard" (Lysandrou, 2011b, pp.185-186). This opacity was exactly the reason that immediately after the BNP Paribas announcement in August 2007 the CDO market completely collapsed.

1.2. Existing theories for the root causes of the subprime crisis

Up to the beginning of the 2000s the US mortgage market was dominated by prime mortgages which were mainly bundled into agency securities by the government backed issuers Fannie Mae and Freddy Mac. This picture started to change dramatically after 2001 when the amount of private-entity originated subprime (see Figure 2a), Jumbo and Alt-A mortgages[5] increased significantly, meaning that "[b]y 2006, the non-agency origination of

[5] Subprime mortgages are loans to borrowers that have a low credit bureau risk score (i.e. a FICO score of less than 660, which means that a borrower has a bad or no credit history), a high debt service-to-income ratio of more than 50%, and/or no proof of income; Alt-A mortgages are loans to borrowers that have a good

$1.480 trillion was more than 45% larger than agency production, and non-agency issuance of $1.033 trillion was 14% larger than agency issuance" (Ashcraft and Schuermann, 2008, p.i). The positive short-term effect of this development was that in the US minority home ownership, especially among the black and Hispanic population, increased significantly between 1995 and 2007 (Gramlich, 2007; Dymski *et al.*, 2011). However, in the longer run this development proved to be problematic because non-prime mortgage loan standards started to deteriorate continuously after 2001, especially after 2005 (Ashcraft *et al.*, 2010; Demyanyk and van Hemert, 2011), i.e. more and more loans were given to households who had a bad credit history and low income or even had no income, no job, and no assets (so called NINJA loans).

Despite these developments, delinquency rates of outstanding subprime mortgages kept relatively stable until mid-2005 (see Figure 2a). This was due to three reasons: (i) between the end of 2001 and mid-2005 interest rates on mortgages were very low because of the exceptionally low short-term interest rate at that time (see Figure 2b), (ii) rising house prices[6] enabled households to service their mortgage debt by Ponzi financing (i.e. they repaid their debt by borrowing more), and (iii) most of the subprime borrowers held so called hybrid mortgages which had low 'teaser' interest rates, often with an interest only option, in the first years of repayment[7]. Delinquency and foreclosure rates on subprime mortgages started to increase dramatically though when house prices started to fall and interest rates started to rise (see Figure 2b). This made the repayment of the mortgages much more difficult for many borrowers. This was especially true for hybrid mortgages holders. While the delinquency rate for fixed rate mortgages (FRM) only started to rise slightly in 2007, hybrid mortgage delinquencies started to grow significantly from mid-2005 onwards (see Figure 2a). The reason for this discrepancy was that many hybrid mortgage holders additionally needed to cope with the reset of their initial low fixed

credit history but no documentation of income and/or high leverage; and Jumbo mortgages are high loans to borrowers that have a good credit history and a documented high income (Ashcraft and Schuermann, 2008).

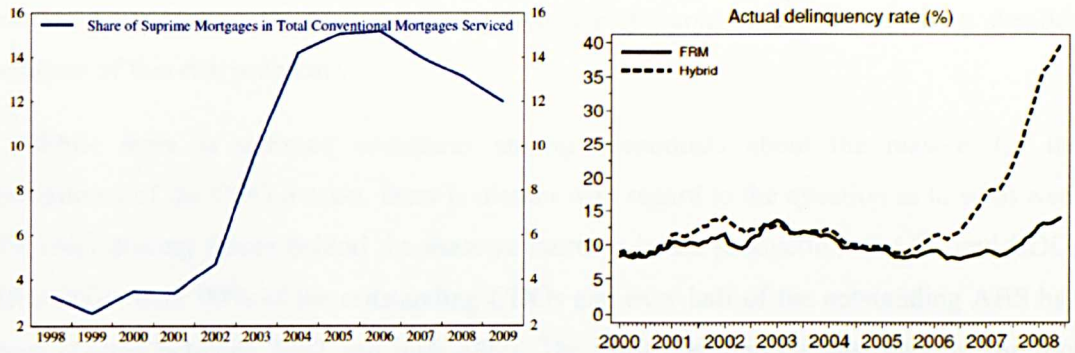
[6] "In the U.S., national average house prices rose between 93% and 137%, depending on the index employed, between 1996 and 2006. Some markets, such as Los Angeles, Phoenix and Las Vegas, had even stronger house price growth." (Sanders, 2008, p.254).

[7] "A hybrid mortgage carries a fixed rate for an initial period (typically 2 or 3 years) and then the rate resets to a reference rate (often the six-month LIBOR) plus a margin. The fixed-rate mortgage contract became less popular in the subprime market over time and accounted for just 20% of the total number of loans in 2006. In contrast, in the prime mortgage market, most mortgage loans were of the fixed-rate type during this period." (Demyanyk and van Hemert, 2011, p.1854).

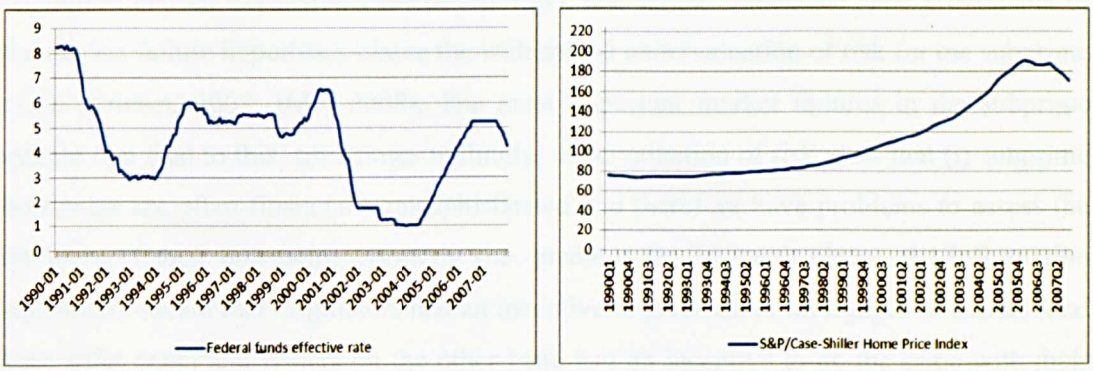
mortgage rate and the phase out of the interest only period (Ashcraft *et al.*, 2010; Demyanyk and van Hemert, 2011).

Figure 2: The US subprime loan problem

a. Share of subprime mortgages on total loans and subprime loan delinquency rate (both in %)



b. Changes in the US federal fund interest rate (in %) and US house prices (Index)



Source: Kumhof and Ranciere (2010); Demyanyk and van Hemert (2011); FR (2012)

The drastic increase in subprime default rates proved to be catastrophic because many of the CDOs were backed partly by mortgage ABS. This meant that many of the AAA-rated CDO and CDO^2 super senior tranches started to suffer losses when the overall default rate of mortgages increased above 12% (Blundell-Wignall, 2007b; Coval *et al.*, 2009). As previously mentioned, the mezzanine ABS tranches are completely wiped out if the default rates of the underlying collateral rises above 10% and those tranches formed an important part of the raw material for structured CDOs (the collateral for $CDOs^2$). The vast increase in mortgage default rates therefore not only negatively affected non-senior mortgage

backed ABS tranches but also exposed AAA-rated CDO tranches as being nowhere near as safe as initially expected. Market participants started to discover this 'surprise' at the beginning of 2007, with the result that the prices of mortgage backed-ABS and the prices of CDO fell continuously until, finally, the market for CDOs completely broke down in August 2007. This collapse led to panic and a liquidity-solvency crisis spiral in the global banking system because the exact extent of the balance sheet risk exposure of financial entities was unclear for market participants (see Acharya *et al.* (2010) for a detailed analysis of this risk problem).

While there is a broad consensus among economists about the reasons for the breakdown of the CDO market, there is dissent with regard to the question as to what were the chief driving forces behind the massive increase in the production of ABS and CDOs after 2001 (over 90% of the outstanding CDOs and over half of the outstanding ABS had been created between 2002 and mid-2007). The most common explanations for the root causes of the crisis are market failures, 'Minskian instability', state failures (wrong regulation and an expansive monetary policy), and global imbalance. The proponents of the market failure hypothesis blame the widespread undervaluation of risk for the subprime crisis (Trichet, 2008; IMF, 2008). The most important market failures in the subprime system that lead to this, sometimes willingly, undervaluation of risk were that (i) subprime borrowers are often financially unsophisticated and therefore have problems to assess the riskiness of their borrowing correctly (i.e. predator lending took place), (ii) information asymmetry meant that originators had an incentive to give riskier mortgages to issuers (and keep safer ones) and issuers on the other hand had an incentive to do the same with their clients, (iii) a badly designed incentive structure and conflict of interest, e.g. rating agencies had an incentive to give the tranches a high rating as a huge proportion of their income was paid by the issuers while they did receive no income from the investors of ABS and CDOs, (iv) principal agent problems, e.g. asset managers are paid by performance and therefore had an incentive to buy structured products as they were giving a higher yield while they had the same rating as traditional debt securities (see Ashcraft and Schuermann (2008) for a detailed discussion of all subprime market's frictions).

Another explanation for the undervaluation of credit risk might be that the housing bubble led to overconfidence and optimism and to a social contagion of boom thinking (Shiller, 2008; Akerlof and Shiller, 2009). This view is somewhat similar to that of the

'Minskian instability' hypothesis proponents, who claim that an initial stability of the system automatically led to 'money manager capitalism'. This was based on speculation, over-indebtedness, and Ponzi-schemes which finally destabilised the system (Kregel, 2007; Wray 2008a, 2008b, 2009). All of these market failure theories normally are accompanied by the view that better financial regulation (Goodhart, 2008; Kregel, 2008, Brunnermeier et al, 2009; Crotty, 2009; Davies, 2010), and a more sustainable monetary policy and less global imbalances (Taylor, 2008; Acharya and Richardson, 2009; Morgan, 2009; Obstfeld and Rogoff, 2009; Wade, 2009) would have prevented the subprime crisis: better government regulation and supervisory policies (and their global co-ordination) would have prevented market participants from taking advantage of the existing frictions, while higher interest rates and lower capital flows into the US would have prevented the build-up of an unsustainable bubble in the housing market.

All of these different 'supply-side' views therefore have in common that their policy proposal is a better regulation of the financial system to increase the stability of the economic system. Some economists argue however that "the crisis should be understood as the interaction of the deregulation of the financial sector (or financialisation, more generally) with the effect of rising inequality" (Stockhammer, 2012a, p.2). To be more precise, Stockhammer (2009, 2012a), UN (2009), Rajan (2010), Reich (2010), Hein (2011), Onaran (2011), van Treeck (2012), Hein and Mundt (2012), Kumhof *et al.* (2012), Stiglitz (2012), and others argue that rising income inequality was a root cause for the rapid growth of the US non-prime mortgage market. Their argument, in a nutshell, is that poor and middle income US households with stagnant wages wanted to keep their social status in relation to richer peers ('keeping up with the Joneses' effect) and that they therefore went into debt to finance this consumption. Inequality in other countries contributed further to the growth inasmuch as those countries tried to circumvent a potential consumption demand shortage by exporting more. The subsequent capital flows to the US contributed to the housing bubble without which the growth of ABS and CDO markets also would not have been possible. However, the increase of income-to-debt ratios in the US was unsustainable in the longer run and ultimately led to high foreclosure rates which triggered the collapse of the CDO market. The proponents of this hypothesis therefore argue, that re-regulation alone will not suffice to stabilise the financial system but that also inequality needs to be reduced.

However, the above mentioned theories do not explain convincingly why it was only after 2001 that the vast majority of (subprime) mortgages were securitised and re-securitised although the techniques to do so had already existed for decades. To overcome this dilemma, greed is often identified as an additional culprit as mortgage originators, banks, and rating agencies handsomely profited from the securitisation process (see e.g. Schechter, 2008; Brummer, 2009). However, it is not quite clear why bankers should have become greedier after 2001 and why in earlier boom phases not such a high proportion of mortgages were securitised. As a consequence of this shortcoming, several studies (see e.g. House of Commons, 2008; Caballero and Krishnamurthy, 2009; Gros, 2009; Lysandrou, 2009, 2011a, 2011b; Caballero, 2010) stress that a 'demand-side' perspective is equally important to explain the growth of ABS and CDOs. Obviously, the newly created securities needed to be sold. Without buyers there would have been no incentive for the financial institutions to create more and more securities. And, anecdotal evidence from market participants strongly suggests that the demand for these new financial products was exceptionally high.

A possible cause for the growth of the ABS and CDO market therefore might have been that it was used by banks to alleviate a global shortage of fixed income securities. Prior to the crisis long-term interest rates in the US were historically low. Although short-term interest rates were rising after June 2004, market participants as well as the monetary authorities were puzzled about this development in the US bond market. Alan Greenspan hence declared in June 2005 that for him the low yields were a conundrum. After this statement several studies tried to 'crack' this conundrum, and the majority (see e.g. Bandholz *et al.*, 2009; Craine and Martin, 2009; Warnock and Cacdac Warnock, 2009; Bertaut *et al.*, 2011) found that an increase in the demand for US Treasuries by foreign governments, who were recycling their increasing export surpluses, was the main reason for the conundrum in the US Treasury market. For this, and other reasons, Bernanke *et al.* (2011) conclude that it was indeed likely that the supply of debt securities could not keep up with the official and private demand and that consequently investors were searching for additional debt securities that had a higher yield than the traditional debt securities, i.e. that a 'search for yield' contributed to the growth of the ABS and CDO market.

One proponent of this 'demand-side' view, Lysandrou (2009, 2011a, 2011b), brought forward the hypothesis that the demand from rich individuals that have more than one

million US dollar net worth, so called high net worth individuals (HNWIs), was especially important in this 'search for yield'. His argument, in a nutshell, is that a vast increase in the assets of these HNWIs meant that they faced a problem of how to store their vast sums of new wealth. Their increasing investment demand thus contributed directly and indirectly to the growth of the ABS and CDO market. Indirectly because they contributed to the low long-term US bond yields, which triggered the 'search for yield' by all investors, and directly because they were increasingly buying ABS and investing in hedge funds who were the main buyers of CDOs. This hypothesis is supported by Milanovic's (2011, p.195) statement that the increase in income inequality led to enormous global wealth holdings. This meant "[h]igh-net-worth individuals and the financial sector were ... keen to find new lending opportunities" to overcome a shortage of investment opportunities. If Lysandrou's and Milanovic's[8] analysis is correct, economic inequality was the central causal role for the subprime crisis and was at least as important as regulatory and policy weaknesses. While stagnant incomes of the bottom 90% were among the 'supply-push' factors in the ABS and CDO growth, inasmuch as US mortgage loans constituted the collateral for many of these securities (and inasmuch as they helped to fuel the housing bubble), wealth concentration was one of the 'demand-pull' factors that created the need to produce more and more of them.

1.3. Research questions and objectives of this dissertation

The aim of this dissertation is to establish if the hypothesis that economic inequality was an important root cause of the subprime crisis is correct. To achieve this aim the following three research questions will be answered:

- *Has an increase in income inequality indeed contributed to the growth and collapse of the US subprime mortgage market?*
- *Has an overspill of demand for yield flowing from the other US debt markets contributed to the rapid expansion of the CDO market?*
- *Was the growing concentration of wealth a crucial factor behind the increasing investor demand for CDOs?*

[8] Milanovic makes this statement merely as a passing note though, without demonstrating empirical evidence and/or developing a deeper theoretical framework about a possible crisis mechanism stemming from increasing wealth holdings at the top.

To answer the former research question, my first research objective is to investigate if income inequality indeed was increasing in the pre-crisis period as the proponents of the income inequality hypothesis claim, while my second research objective is to study if the arguments of the proponents of this hypothesis are convincing and congruent. Both of these objectives will be achieved through an extensive literature review. My third research objective relates to the second research question. Milanovic (2011, p.194) states that "one cannot prove that investable resources eventually exceeded the number of safe and profitable investment opportunities (since nobody knows a priori how many and where there are good investment opportunities)". It is possible however to give at least support to this hypothesis by showing that an increase in investors demand had a significant negative impact on the yield of all traditional US debt securities. I will therefore test empirically if an increase in official and private investor demand contributed to the exceptionally low long-term yields in the US bond markets (i.e. to the 'bond yield conundrum'). My fourth research objective is to establish if the degree of wealth concentration was particularly high prior to the crisis. My fifth research objective is to estimate if the holdings of HNWIs contributed to the 'bond yield conundrum', while my final research objective is to provide a clear explanation as to exactly how the demand pressure was transmitted to the CDO market and in how far HNWIs were involved.

My dissertation provides at least three important original contributions to the existing literature, in addition to the summary and synthesis of established research findings. Firstly, it tests, and confirms, that foreign official investors had a negative impact on Treasury yields – taking into account different explanatory variables and using an alternative model technique. Secondly, it provides evidence showing that an increase in foreign private and domestic private demand contributed to lower yields for AAA-rated US municipal, corporate and agency bonds (to my knowledge, this is the first time that such evidence has been presented, taking into account the demand from all private sources). Thirdly, it estimates for the first time to what extent the increase in HNWIs wealth holdings contributed to the US 'bond yield conundrum' and gives empirical support to Lysandrou's theory that wealth concentration played an absolutely crucial role in the growth of the ABS and CDO market.

1.4. Charting the way

This dissertation is divided into two main parts. The first part (Chapter 2 and Chapter 3) assesses the view that income inequality was a driving force behind the build-up of the crisis and whether it is justifiable on empirical and theoretical grounds. To achieve this aim, Chapter 2 discusses trends in income inequality on a global level to ascertain whether these trends were showing a significant increase and whether the level of inequality was particularly high prior to the crisis. Chapter 3 looks at the role that inequality plays in Marxian, post-Keynesian and mainstream crisis theories and at the particular ways in which these theories identify income inequality as a root cause of the crisis.

The second part (Chapter 4 – Chapter 6) aims to verify the accuracy of the hypothesis that global wealth concentration also played an important role in the build-up of the crisis. The two first sections of Chapter 4 lay the foundations of the argument by establishing whether the degree of global wealth concentration was high in historical terms, while the two last sections of this chapter outline the reasons why wealth concentration potentially was a root cause behind the growth of the ABS and CDO market. Chapter 5 verifies the claim that an overspill of demand for yield flowing from the other US debt markets crucially contributed to this growth. The concluding chapter of the second part (Chapter 6) starts by estimating whether wealth concentration significantly contributed to the demand for traditional debt securities, and then moves on to discuss how far wealth concentration contributed to the direct demand for CDOs.

The final chapter of this dissertation, Chapter 7, concludes and synthesises all of the previous findings and provides some recommendations for policy options that would help in making the current system more stable.

2. Changes in relative income inequality from a global perspective

"[P]ersonal income distribution ... is a focal point at which the functioning of the economic system impinges upon the human beings who are the living members of the society and for whom and through whom the society operates, it is an important datum for understanding the reactions and behaviour patterns of human beings ... Without better knowledge of the trends in secular income structure and of the factors that determine them, my understanding of the whole process of economic growth is limited" (Kuznets, 1955)

Rising income inequality has recently moved into the centre of political and economic debates in line with increasing claims that the rise in income inequality might have been a root cause of the subprime crisis. However, most of the existing research on inequality concentrates on the impact of rising relative (i.e. proportional) income inequality within developed countries (especially within the US), while the changes of inequality between countries and between global citizens are often neglected. Given that trade and financial flows are increasingly interconnected, it is additionally necessary to take the changes in intra-developing-country inequality, inter-country inequality and global inequality into account. This chapter thus seeks to provide an extensive overview of world scale developments in relative income inequality with the aim of verifying if it was relatively high in the pre-crisis period. The results will provide the basis for the discussion of the potential role of these changes in the build-up of the subprime crisis that will take place in Chapter 3.

The structure of this chapter is as follows: Section one briefly explains how income inequality is measured: Section two gives an overview about main trends and levels of inter-country inequality. Section three first discusses important methodological issues and then the different results regarding the trends in global inequality: Section four shows the trends of intra-country inequality between the mid-1980s and mid-2000s.

2.1. Measuring income inequality

Four concepts can be distinguished when measuring income inequality: intra-country inequality, inter-country inequality, weighted inter-country inequality, and global inequality[9]. Intra-country inequality expresses the economic inequality between individuals or households in one country. To measure the level of inequality, individuals/households are asked about their income/expenditure through household surveys (HS) and then are ranked according to their income (from the poorest to the richest). The degree of inequality is established according to the difference between the income of these individuals – the individuals normally are grouped into deciles or quintiles to achieve an easier comparability. Inter-country inequality is measured in the same way as intra-country inequality, with the difference that i) countries are the unit of analysis (i.e. each country is one observation) and ii) the ranking from the poorest to the richest is established by considering the gross domestic product (GDP) per capita at market exchange rates or by taking purchasing power parity (PPP) into account (see Table 1, column 2). Weighted inter-country inequality is based on the latter concept but additionally considers population weights, to take into account that changes in bigger countries have a greater impact on the level and trend of international inequality between individuals (see Table 1, column 3). Thus, if for example China or India close the income gap with developed countries weighted inter-country inequality will decrease much more than if Zambia's or Bolivia's average income grew faster than that of developed countries[10]. However, weighted inter-country inequality only approximates global inequality between individuals, while studies designed to specifically estimate global inequality yield much more reliable estimates (Milanovic, 2005), as they account for both inter- and intra-country inequality by taking individuals as unit of observations (see Table 1, column 4)[11].

[9] Milanovic (2005) names the latter three Concept 1 (inter-country), Concept 2 (weighted inter-country), and Concept 3 (global inequality). I do not use this phrasing as I also include intra-country inequality trends in my discussion, which can be seen as the first concept.

[10] The convergence of China and India with developed countries will only lower weighted inter-country (and global) inequality as long as their income is below the mean world income, if it is above the mean, inequality will increase if these two countries continue to grow faster than other developed countries (Anand and Segal, 2008).

[11] These individuals are, however, grouped into quantiles in existing studies. Furthermore, all but one study estimate the intra-country inequality for many countries due to a lack of data – this will be discussed in more detail in the following sections.

Table 1: The four concepts of income inequality

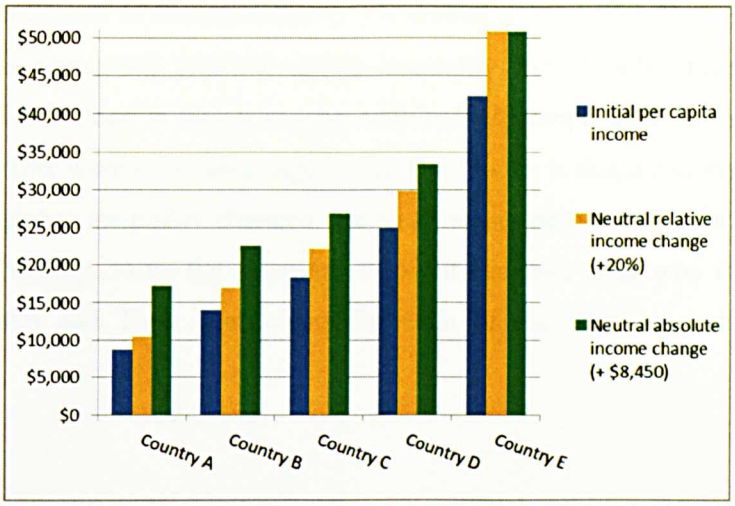
	Intra-country inequality	Inter-country inequality	Weighted inter-country inequality	Global inequality
Unit of observations	Individual	Country		Individual
Population size	Ignored		Included	
Income welfare concept	Income or expenditure	GDP per capita		Mean income or expenditure
Intra-country inequality	-	Ignored (assumed as equal)		Included
Main data source	Household surveys	National accounts		Household surveys (often combined with national accounts)
Currency conversión	None	Market exchange rate or PPP exchange rate		

Source: Milanovic (2005) with adaptations

Inequality can be measured in relative and absolute terms. Relative inequality "can be conceptualized as average disproportionality ... [of income or wealth, i.e. relative] inequality occurs when units possess disproportionate shares ... The units could be individuals or groups of individuals, such as households or countries or nations" (Firebaugh, 2003, pp.70-71). The concept of absolute inequality is, in contrast, based on amount additions or subtractions. This means that absolute inequality can widen even though relative income inequality stays constant or declines, i.e. if rich and poor countries will grow at the same rate, their income ratio (i.e. relative inequality) will stay constant but the absolute "gap between richer and poorer nations naturally will widen" (Firebaugh, 2003, p.73), as is demonstrated in Figure 3. Absolute inequality thus will only decrease if the income of the poorer units grows much faster than that of richer units or if richer units have negative growth rates[12]. However, nearly all studies that measure income inequality refer to relative inequality without explicitly mentioning this fact. The same is true for the income inequality subprime crisis literature. The following review of the literature therefore only discusses findings regarding relative inequality.

[12] See Ravallion (2004) and Atkinson and Brandolini (2010) for an excellent overview about the distinction between relative and absolute inequality. Please note that the findings of Atkinson and Brandolini (2010) strongly suggest that in absolute terms the inequality levels of all four concepts have increased continuously since 1820.

Figure 3: Relative and absolute income changes



The existing unequalness of income can be measured by various disproportionality functions (see Cowell (2000) for an overview and discussion of different inequality indices). However, the following discussion will be restricted to the two most common indicators to ensure the comparability between the different results. The most widely used relative inequality indicator is the Gini Index; because this index can be nicely represented graphically, via the Lorenz curve, and that the lower bound (0 = total equality) and the upper bound (1 = total inequality) can easily be understood by the broader public (Milanovic, 2005). A second commonly used indicator in international inequality studies is the entropy based Theil Index. This index also has zero as lower bound but the logarithm of the sample size as upper bound (Theil, 1967). The Theil and the Gini Index, are the only indices that "satisfy [all of] the five most highly desired properties of an inequality indicator: (1) it is symmetrical; (2) it is income scale-invariant; (3) it is invariant to absolute population levels; (4) it is defined by upper and lower bounds; (5) it satisfies the Pigou-Dalton principle of transfers (any redistribution from richer to poorer reduces the inequality measure, and vice versa)." (Korzeniewicz and Moran 2009, p. 123).

The two main distinctions between the Gini and the Theil Index are their sensitivity to transfers and their decomposability. An income transfer around the middle of the distribution has a greater effect on the Gini coefficient than an income transfer from the top part of the distribution to the bottom (Cowell, 2000), whereas the opposite is true for the Theil coefficient (Korzeniewicz and Moran, 2009). However, both indices are highly

correlated, e.g. a study by Dikhanov (1996) shows that with regard to intra-country inequality the coefficient of determination (r^2) is around 0.998-0.999. Both indices can be decomposed into intra-group and inter-group inequality, but the advantage of the Theil Index over the Gini Index is that it can be additively decomposed if the subgroups are overlapping. In other words, the advantage of the Theil Index is that it can exactly establish to what degree global inequality changed due to increases/decreases in intra-country and inter-country inequality. From the equations below it becomes clear why this is the case and how the Gini and Theil coefficients for each of the four concepts are derived mathematically.

2.1.1. The Gini coefficient

To calculate intra-country inequality with the Gini coefficient, first the income differences of all individuals (N) are established by comparing the income (y) of all persons in the sample. These differences are summed, and divided by the total number of income comparisons (N^2) and the mean income (μ) (Equation 1). The same procedure, but with countries as unit of analysis instead of individuals, takes place to calculate inter-country inequality (Equation 2). To measure weighted inter-country inequality population shares (p) are taken into account additionally so that populous countries receive a bigger weight (Equation 3), while the global Gini coefficient includes intra-country inequality (weighted by income and population size), inter-country inequality (weighted by income and population size) and an overlapping component (Equation 4). The latter is a residual and takes into account that the mean income of subgroups from different countries may overlap (e.g. the mean income of the richest Peruvian decile and the poorest US decile) – this residual gets bigger when the distance between the mean incomes of countries becomes smaller. Hence, the Gini Index is not additively decomposable into intra- and inter-country inequality. The respective formulas to derive the Gini coefficients for the four different inequality concepts are as follows:

$$Intra-country\ Gini\ coefficient = \frac{1}{\mu_1}\frac{1}{N^2}\sum_a^n\sum_{z>i}^n(y_a - y_z) \quad (1)$$

where N are individuals, μ_1 is the mean income of all individuals, y_a is the income of the a-th individual, and y_z is the income of the z-th individual;

$$Inter-country\ Gini\ coefficient = \frac{1}{\mu_2}\frac{1}{n^2}\sum_i^n\sum_{j>i}^n(y_j - y_i) \quad (2)$$

where n are countries, μ_2 is the mean world income, y_i is the mean income of the i-th country, and y_j is the income of the j-th country;

$$Weighted\ inter-country\ Gini\ coefficient = \frac{1}{\mu_3}\sum_i^n\sum_{j>i}^n(y_j - y_i)p_i p_j \quad (3)$$

where μ_3 is the population weighted average world income, p_i is the population share of the i-th country, and p_j is the population share of the j-th country;

$$Global\ Gini\ coefficient = \sum_{i=1}^n G_i p_i \pi_i + \frac{1}{\mu_3}\sum_i^n\sum_{j>i}^n(y_j - y_i)p_i p_j + L \quad (4)$$

where G_i is the intra-country Gini coefficient of the i-th country, π_i is the share in world income of the i-th country, and L is a residual (see Milanovic, 2005).

2.1.2. The Theil coefficient

The Theil coefficient can be income (Theil T) or population (Theil L[13]) weighted. The intra-country Theil T coefficient is derived by multiplying the income shares (y/μ) of all individuals by the log of their income share. The products are then divided by the total population size (N) and summed (Equation 5). The Theil L coefficient simply has reversed population and incomes shares (Equation 6). Inter-country inequality is calculated in the same way but with countries as unit of analysis instead of individuals (Equation 7 and Equation 8). To derive weighted inter-country Theil coefficients, population weights (p) are taken into account instead of a fixed weight ($1/n$) (Equation 9 and Equation 10). Global inequality is derived by summing the income (Theil T) or population share (Theil L) weighted intra-country Theil indices for all countries and adding the sum of the weighted inter-country differences (Equation 11 and Equation 12). Thus, the Theil Index allows to additively decompose global inequality in an intra- (first part of the last two equations) and inter-component (second part of the last two equations). The respective formulas to derive the Theil T and Theil L coefficients for the four different concepts are as follows (see Anand, 1983 for more details):

[13] The Theil L index sometimes is also called the mean logarithmic deviation (MDL).

$$Intra-country\ Theil\ T\ coefficient = \sum_a^n \frac{1}{N}\left(\frac{y_a}{\mu_1}\right) log\left(\frac{y_a}{\mu_1}\right) \quad (5)$$

$$Intra-country\ Theil\ L\ coefficent = \sum_a^n \frac{1}{N} log\left(\frac{\mu_1}{y_a}\right) \quad (6)$$

where N is the number of individuals, y_a is the income of the a-th individual, and μ_1 is the population's average income;

$$Inter-country\ Theil\ T\ coefficient = \sum_i^n \frac{1}{n}\left(\frac{y_i}{\mu_2}\right) log\left(\frac{y_i}{\mu_2}\right) \quad (7)$$

$$Inter-country\ Theil\ L\ coefficient = \sum_i^n \frac{1}{n} log\left(\frac{\mu_2}{y_i}\right) \quad (8)$$

where n is the number of countries, y_i is the mean income of the i-th country, and μ_2 is the mean world income;

$$Weighted\ inter-country\ Theil\ T\ coefficient = \sum_i^n p_i \frac{y_i}{\mu_2} log \frac{y_i}{\mu_2} \quad (9)$$

$$Weighted\ inter-country\ Theil\ L\ coefficient = \sum_i^n p_i\ log\left(\frac{\mu_2}{y_i}\right) \quad (10)$$

where p_i is the population share of the i-th country;

$$Global\ Theil\ T\ coefficient = \sum_{i=1}^n w_i T_i + \sum_i^n \left(p_i \frac{y_i}{\mu}\right) log \frac{y_i}{\mu} \quad (11)$$

$$Global\ Theil\ L\ coefficient = \sum_{i=1}^n p_i L_i + \sum_i^n p_i\ log\left(\frac{\mu}{y_i}\right) \quad (12)$$

where w_i is the income share of the i-th country, T_i is the Theil T coefficient of the i-th country, and L_i is the Theil L coefficient of the i-th country.

2.2. Levels and trends of inter-country income inequality

Existing studies that measure unweighted inter-country inequality show that between 1820 and 2000 income inequality between countries increased substantially, i.e. a 'Great Divergence' took place during this period[14]. Pritchett (1997) reports that from 1870 to 1990 "the ratio of per capita incomes between the richest and the poorest countries

[14] All of the discussed results are based on GDP per capita adjusted for purchasing power parity (PPP) exchange rates, as this measure is commonly used for the estimation of international inequality.

increased by roughly a factor of five" (p.3). In 1870 the GDP per capita ratio between the richest and the poorest country was 9. In 1960 this ratio was 39, and in 1990 the mean GDP per capita in the richest country was 45 times higher than the mean GDP per capita of the poorest country. The reason for this divergence is that during this period the vast majority of developing countries had lower growth rates than high income OECD countries (i.e. Japan and the West European countries and their offshoots: Australia, Canada, New Zealand, and the US). Between 1960 and 1990, for example, 16 out of 108 developing countries had a negative average growth rate, 28 had an average growth rate of less than 0.5, and 40 had an average growth rate of less than one percent. Consequently, in 1990 the average GDP per capita of high income OECD countries was 4.5 times higher than that of developing countries (in 1870 this ratio was 2.4).

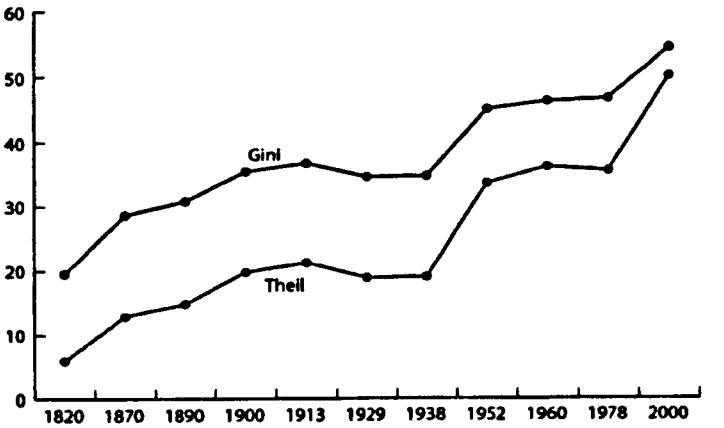
The UNDP (1992) arrived at similar results and shows that the income ratio between the richest 20% and the poorest 20% of countries increased twofold between 1960 and 1989 (in PPP terms that ratio between the two groups was 50:1 in 1989). The reason being that the former countries on average grew 2.7 times faster than the latter during this period. Firebaugh (1999) also reports that inter-country inequality increased monotonously between 1960 and 1989. In a more recent study, Milanovic (2005) shows that unweighted inter-country inequality already started to increase after 1820 (with the exception of the period between World War I and World War II): while the Gini coefficient in 1820 was around 0.20 it increased to around 0.55 by 2000, i.e. it nearly tripled during these 180 years (see Figure 4a)[15]. The reason for this development was that some parts of the world, which initially had been relatively equal, steadily diverged between 1870 and 2000 (while the mean incomes of rich OECD countries were converging). The divergence in the post-1978 period apparently took place due to (i) the sluggish growth performance in Latin America (following the debt crisis and the neoliberal reforms), (ii) the decline in Eastern European/former Soviet Union incomes (following the collapse of the Eastern Bloc and the subsequent free market reforms), and (iii) the disastrous economic developments within many African economies.[16]

[15] The increase between 1938 and 1960 can be partly explained by a greater country coverage (before 1938 less than 50 countries were included in the sample, after 1960 more than 125 countries were covered), however if the sample size is held constant the Gini still increases by 8 points.

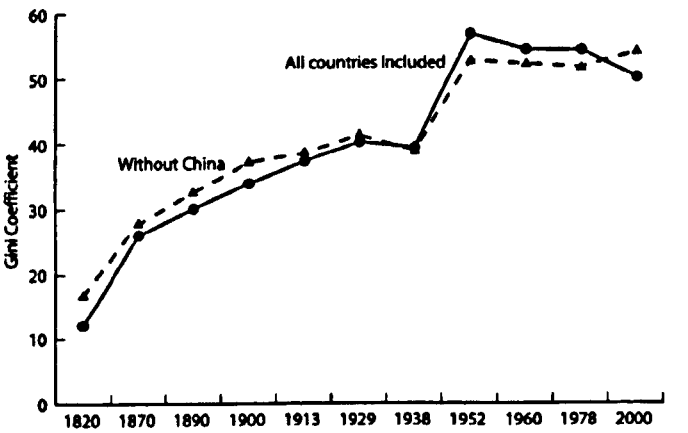
[16] It is also interesting to note that between 1960 and 2000 the movement of countries "among contenders [i.e. upper middle-income countries] and the Third World was largely downwards. ... [O]nly two countries

Figure 4: Inter-country income inequality, 1820 - 2000

a. Unweighted



b. Weighted



Source: Milanovic (2005)

Weighted inter-country inequality, in contrast, shows a decreasing trend since the middle of the 20th century (see Figure 4b). Similar to unweighted inter-country inequality Milanovic (2005) gives the most comprehensive overview about historical changes. According to his research, weighted inter-country inequality increased massively in the periods 1820 – 1929 and 1938 – 1952. The main reason for the distinct increase after 1938 can be attributed to relative high growth figures of populous rich countries while populous poor countries were growing relatively slowly in contrast to richer countries[17]. In turn, the

(Botswana and Egypt) escaped from the trap of the Fourth World", while 19 new countries entered this category in this period (Milanovic, 2005, p.68-70).

[17] Some of the increase between 1938 and 1952 might be explained by the increasing sample size. However, the population coverage was already around 80% before 1952 as the most populous countries were included

main reason for the decline in weighted inter-country income inequality after its peak in 1952 was "the decreasing income gaps between the three most important countries (China, India, and the United States)". In the post-1978 period the main driver of this development was the fast growth of China, i.e. if China were to be excluded from the sample the measured weighted inter-country inequality would even increase slightly between 1978 and 2000.

Other researchers confirm Milanovic's general findings, although they report that the turning point was later. Schultz (1998, p. 328) reports that the "Gini concentration ratio based on [weighted] inter-country PPP incomes increased about 6% from 1960 to 1968 and thereafter decreased about 6% by 1985". In the later years of his sample (i.e. between 1985 and 1989) the ratio increased slightly from 0.54 to 0.55, but the Gini coefficient in 1989 was still significantly lower than it was in 1968 (0.58). According to Schultz's research a change in the world's population composition was no major factor behind this decline in inequality. Instead, the rapid growth rates of China, due to its huge population size, were the main factor leading to the change in the trend of weighted inter-country inequality: in the 1960s China's growth was relatively low, while it was above the world's average growth rate from the 1970s onwards. The findings from Boltho and Toniolo (1999) confirm and extend these results: while the weighted inter-country Gini coefficient increased between 1960 (0.52) and 1970. It decreased thereafter from 0.54 in 1970 to 0.50 in 1998; mainly due to the "rapid growth rates of India and, especially, China" (p. 6). Firebaugh (2003) also reports that weighted inter-country inequality reached its maximum between 1965 and 1970 and thereafter declined[18].

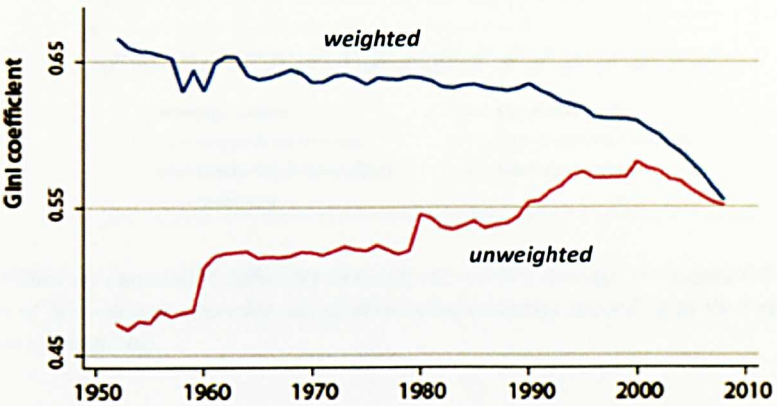
Recent publications by Milanovic (2009, 2010b, 2012) suggest that the levels of inter-country income inequality are even higher than originally expected (see Figure 5). The reason for the higher pre-2000 inequality levels being new PPP data from the 2005 survey of the International Comparison Programme (ICP) because these new estimates led to a downward revision of PPP GDP figures in 10 of the 13 most populous countries. As most of these populous countries are relatively poor (e.g. in China, India and the Philippines

in the sample from 1820. Thus, the change in the sample size contributed only slightly to the increase in inequality (Milanovic, 2005).

[18] Different studies report different inter-country Gini coefficients as they have (i) a different sample, (ii) different data sources, and/or (iii) different PPP estimates. These differences are not discussed in more detail because the focus of the dissertation lies on global and intra-country inequality.

PPP GDP figures are around 40% lower than previously estimated[19]) income inequality is much higher than previously thought, i.e. prior to 2000 inter-country inequality was around 5 and 8 Gini points higher (compare Figure 4 with Figure 5). However, the revision has no trend effect because the pre-2005 PPP GDP is estimated according to national GDP growth rates, and the new PPP estimates have no impact on GDP growth rates (Milanovic, 2009).

Figure 5: Inter-country income inequality, 1952 - 2007

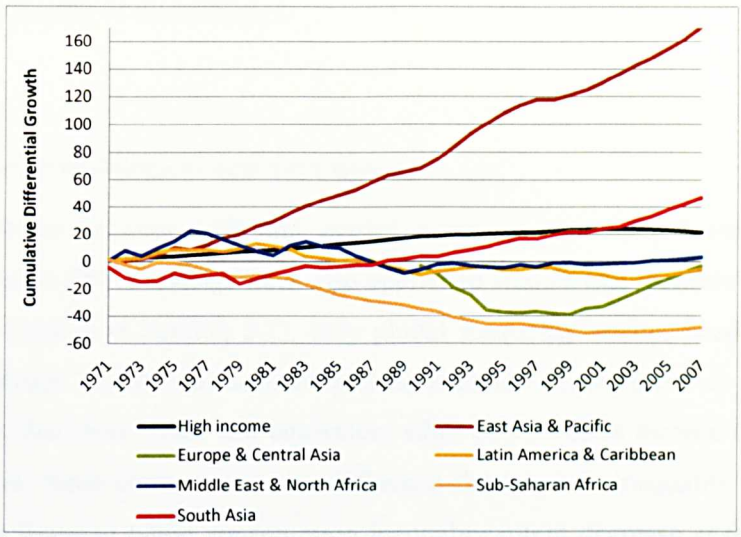


Source: Milanovic (2010b)

These new estimates from Milanovic also show that the 'Great Divergence' between countries stopped and instead a convergence took place from 2000 onwards. The reasons for this U-turn are the favourable economic developments in "African countries that have grown at the rate of more than 4 percent per annum, post- Communist countries (growth at more than 6 percent per annum), and Latin America (3 percent p.a.)." (ibid., 2012, pp.10). However, although unweighted inter-country inequality was declining substantially after 2000, it was still much higher than prior to the 1990s. The reason is that, if taken as a group, only the developing countries from East Asia and Pacific, and South Asia had a cumulative average GDP per capita growth that was higher than the cumulative average GDP per capita growth rate of high-income countries since 1971 (see Figure 6), i.e. only these two country groups could catch up with high income countries in the period 1971 to 2007.

[19] Prior to the ICP 2005 survey the PPP estimates of India relied on 1985 survey estimates, and the ones of China were based on the results of two research papers as China never took part in any PPP survey prior to 2005 (Milanovic, 2009).

Figure 6: Cumulative growth in GDP per capita relative to the world average



Note: The plot shows the cumulative difference between the world's average per capita GDP growth and the growth rates of high-income countries and of developing countries according to their region (Source: WDI (2011); own calculations).

With regard to weighted inter-country inequality the downward trend in inequality accelerated after 2000. The result was that weighted inter-country inequality decreased roughly by 10 Gini points between 1960 and 2007 (see Figure 5). The acceleration mainly took place because of stable high growth rates in China and rising growths rates in India. This meant that not only China but also India put significant downward pressure on weighted inter-country income inequality after 2000. Weighted inter-country inequality would thus have also declined after 2000 if China would have been excluded from the sample. However, despite these favourable developments inter-country inequality in 2007 was still much higher than the inequality levels one normally finds within countries (see Section 4 within this chapter).

2.3. Levels and trends of global income inequality

All studies that measure global income inequality have to choose between different methodological options and different sources for their data. Depending on their choice their estimated inequality will be higher or lower and the estimated trend may be different. In this section therefore first some general methodological and data issues are discussed,

then the methodology and data that are used by recent studies are analysed, before finally summarising the results of these studies.

2.3.1. General methodological and data issues

While the choice between PPP and market exchange rates, and between different methods to calculate PPP exchange rates also applies to studies that measure inter-country inequality (see Table 1 in Section 2.1), only global inequality studies need to decide in favour of HS means or national account means, expenditure or (gross or net) income, grouped or individual-level data, and equivalent adult or per capita income (see Table 2). Next to the level, these choices can also influence the trend in inequality (e.g. income inequality might increase while consumption inequality might decrease at the same time due to increasing social transfers or higher saving rates by the rich). Unfortunately, all of the data needed to calculate global inequality have serious shortcomings and depending on the chosen indicators these problems might be exacerbated, as will be discussed below.

To measure global inequality it is necessary to take into account intra-country inequality coefficients for as many countries as possible (see Equation 4, Equation 11, and Equation 12 in Section 2.1). Typically, not the primary data from HS compilations but datasets which report Gini coefficients and quantile shares are used for this purpose. The best way to avoid inconsistency between the data of the latter is to use "data-sets where the observations are as fully consistent as possible" (Atkinson and Brandolini, 2001, p.796). Unfortunately, even though more and more datasets with intra-country inequality data compilation exist and the comparability and the quality of these data have become better in recent years, none of these datasets provide data which are fully consistent. The biggest problem is that national HS differ in their inequality concepts (consumption, expenditure, net-income, or gross-income[20]), reference units (family, household, individual), and sources (Francois and Rojas-Romagosa, 2007). Milanovic (2005) for example shows that between 1996-2000 59 out of 122 HS reported domestic income inequality while the remaining 63 reported domestic expenditure inequality. A further problem is that most

[20] To make matters worse, the way in which income and expenditure is calculated differs between countries. Some income HS, for example, impute rents for owner occupied housing while others do not. The approaches, furthermore, can change over time within a country which means that also intra-country Gini coefficients are not necessarily one hundred percent comparable over time (Atkinson and Brandolini, 2001).

countries only undertake HS every five years (or less often) and that the studies take place at different points in time in different countries. Therefore, global inequality studies are forced to either impute the missing values or to report only results for so called benchmark years (e.g. in Milanovic's (2005) study the benchmark year 1998 includes inequality coefficients of the period 1996-2000). To my knowledge none of the existing datasets and global income studies considers equivalent adult figures, as these are very hard to measure and also would differ between countries (e.g. according to the costs for children's goods and services).

Table 2: Possible indicators and their impact on the results

Possible Indicators	Indicator that leads to lower inequality estimates	Reason
PPP exchange rates vs. market exchange rates	PPP	Poor countries have lower price levels ($1 buys more in Zimbabwe than in Germany)
GK PPP vs. Afriat or EKS PPP	GK PPP	Poor countries' incomes are overestimated (international prices are more influenced by rich countries – Gerschenkron effect)
GDP per capita vs. HS means or HFCE	HS means or HFCE	Public expenditures are excluded (these are larger in rich countries)
Expenditure vs. (gross or net) income	Expenditure	Expenditure tends to be more equally distributed (rich save substantial parts of their income)
Grouped data vs. individual-level data	Grouped data	Income/expenditure differences between the individuals within quantiles are not considered
Equivalent adult vs. per capita	Equivalent adult	Large households and households with many children do not require as many resources

So far, the two most widely used inequality datasets are the Deininger and Squire (DS) database, which is available from the World Bank website, and the Word Income Inequality Database (WIID) which is an extension of the DS dataset and administered by the United Nations. The main problem with the DS dataset is that the estimates identified to be the most reliable (labelled as 'accept') are related to different inequality concepts and mix different reference units. DS therefore recommend to use dummy variables to deal with this problem and to create a comparable series but as Atkinson and Brandolini (2001) have pointed out, "simple 'dummy variable' adjustments for differences in definitions are not a satisfactory approach" (p.795). WIID, in contrast, lists a wide range of Gini

estimates, and quintile or decile shares, which are based on different inequality concepts, reference units and/or sources. However, this poses the problem that for many countries different inequality series exist and that researchers have to identify which of these series are the most appropriate. Furthermore, the problem persist that only quantile shares (quintiles or deciles) and not the individual data are reported.

Therefore, Milanovic has created two new datasets[21]: (i) the World Income Distribution dataset (WYD), which is based on individual-level data whenever possible and reports ventile shares and inequality coefficients for benchmark years, and (ii) the All The Ginis dataset which takes into account distributional shares and Gini coefficients from the Luxembourg Income Studies (LIS), the Socio-Economic Database for Latin America and the Caribbean (SEDLAC), the WYD, the World Bank East and Central Europe database (ECA), and the WIID dataset. However, even with this improvement in the comparability two problems persist. First, HS surveys are still based on different income concepts, and second, the Ginis of the different sources are calculated from grouped and from individual-level data, depending on the source (Milanovic, 2010a). Hence, at least, an adjustment for the different income concepts is still needed to use the data of these dataset for empirical work.

The second problem with regard to the measurement of global inequality is that typically PPP exchange rates are used when the Gini coefficients of countries are scaled to national account means or household means. Three different methods have been used in recent years to construct the domestic price levels: (i) the Geary-Khamis (GK) Method, (ii) the Eltetö-Köves-Szulc (EKS) method, and (iii) Afriat's method. Most authors argue that PPP exchange rates are superior to market exchange rates because the latter do not reflect that domestic goods and services in poor countries are much cheaper than in richer countries, and therefore inequality would be overstated if market exchange rates would be used instead of the domestic price level (ibid, 2005). However, relatively little discussion has taken place in inequality studies regarding the shortcomings of the different methods and the PPP approach in general.

[21] These are relatively frequently updated and available on the World Bank website.

Most studies that have measured global inequality so far use GK PPP data[22]. Although the GK method is inferior to the EKS method and Afriat's method because it gives higher weight to the prices of richer countries: rich countries have a higher share in world output. This means that the international prices used in the GK method to construct the PPP exchange rate for every country are closer to the price levels of richer countries. This leads to inflated PPP figures for poor countries because this method does not sufficiently consider that expensive products are substituted by cheaper ones in poorer countries – this problem is called substitution or Gerschenkron bias (ibid, 2005; Anand and Segal, 2008). The EKS method and Afriat's method do not suffer from this bias (as they do not construct a vector of international prices) and are therefore preferable when estimating PPP exchange rates. Unfortunately, the Afriat Index cannot be calculated for all countries as it requires that countries have 'common homothetic preferences'. Therefore, the most appropriate indicator for global inequality studies would be PPP exchange rates which are constructed via the EKS method (Anand and Segal, 2008). Fortunately, the newest ICP study from 2005 uses the EKS method to estimate PPP exchange rates. However, even when this method is used three general problems persist: ICP PPP studies are only undertaken every five years, and not all countries are directly included in this study, so that the results are based on a representative basket of goods and services which can differ from country to country (for an extensive analysis of the problems associated with PPP data see Deaton (2010)).

Even if most of the aforementioned measurement problems were to be solved (e.g. via a global HS which take place every year, and yearly PPP measurements which include all countries), the problem of survey sampling error, non-response, underreporting, and misreporting, and top-coding still prevails. With sampling error it is meant that very poor (as they often have no registered address) and very rich households (as they are not easily accessible) often are underrepresented in the sample. Underreporting of income and nonresponse is mainly a problem with regard to rich households (e.g. due to top-coding). The same possibly is true for misreporting, e.g. for investment and property income, although individuals throughout the distributional ladder, like micro-enterprises, often are unsure about their actual income and/or expenditure (for more detailed information on these topics see Atkinson and Brandolini, 2001; Deaton, 2005; Milanovic, 2005; Anand

[22] The GK method was used to construct the Penn World Tables and by Maddison for his datasets.

and Segal, 2008; Pinkovskiy and Sala-i-Martin, 2009). In addition, "many income surveys are 'top coded' – that is incomes above a certain threshold are lumped together [so that they] fail to capture the potentially huge distribution ... within that top code" (Shaxson *et al.*, 2012, pp.13). The outcome of these survey problems means that intra-country income inequality is underestimated, thereby leading to an underestimation of global inequality[23].

Most studies that try to measure global income inequality use GDP per capita and not HS means for the reason that GDP per capita is readily available for most countries on an annual basis for a long-time period, whereas HS only started to become available since the 1980s. Furthermore, it is claimed (see e.g. Bhalla, 2002) that HS means underestimate income and therefore GDP per capita is a better indicator to be used. However, next to the point that it is strange to assume that HS results can be used to establish intra-country inequality but not the average income levels of the country (Milanovic, 2005), two very important points speak against the usage of GDP per capita. Firstly, GDP entails retained earnings, depreciation and non-redistributed government revenue; thus, personal income/expenditure is overestimated when GDP per capita is used (Anand and Segal, 2008). This upscaling of income/earnings not only changes the level but also can have an impact on the trend, if GDP per capita and HS means are not changing proportionally, which often is the case. Secondly, although GDP per capita entails the unreported and misreported income of the rich, it does not solve but rather exacerbates the underestimation problem because the incomes of all quantiles are upscaled by the same proportion (i.e. if GDP per capita is 20% higher than the HS mean, the income of all quantiles is upscaled by 20%).

Another national account figure which also is readily available for most countries is household final consumption expenditure (HFCE). However, although this indicator seems to be a much better proxy of income/expenditure than GDP – according to Deaton (2005) the population weighted mean ratio of HS income means to GDP is 0.54 (272 surveys) while the ratio is 1 with regard to HFCE (266 surveys) – it also has certain drawbacks. Firstly, it includes expenditure from nonprofit organisations and imputed rents. Secondly, HFCE is a residual value (national production minus government and firm's consumption) whose amount is influenced by possible errors in estimating national production and

[23] For this reason Milanovic (2010b) claims that it would be better to measure consumption inequality as "consumption surveys are more reliable because the underestimate of consumption by the rich is less than the underestimate of income by the rich." (p.11)

government and firm's consumption; especially the first and the latter are often only rough estimates (Anand and Segal, 2008). Consequently, HS means seem to be the first best indicator when measuring global inequality, while the 'upscaling' via HFCE or GDP per capita is only the second and least best option respectively.

2.3.2. Methodology and data used by studies

Table 3 gives an overview about the main methods applied by studies published between 2005 and 2011 – Bourguignon and Morrison's (2002) study is included as only two recent studies researched long-term global inequality trends. In general it can be said that the study from Milanovic (2012) is the sole study that has used the 'best available indicators' (i.e. EKS PPP exchange rates, HS means, and individual-level data wherever this is possible) to estimate global income inequality. Furthermore, it becomes visible that some studies are using approximation techniques for missing years and mix households and individuals as unit of analysis (as discussed above the DS dataset mixes the two); both can distort the results significantly.

To be more precise, Bourguignon and Morrison (2002) estimate global income inequality in 15 benchmark years between 1820 and 1992 by gathering data for eighteen groups of countries (e.g. a group of 46 African countries, 37 Latin American countries, Argentina and Chile, Scandinavia) and 15 populous individual countries (e.g. China, Brazil, Germany, India, US). They combine the income shares of the bottom nine deciles and top two ventiles (assuming equal distribution within these quintiles) with historical GPD per capita data from Maddison (which they needed to extend for some countries) for their estimates. In years where distribution data was missing for groups/countries the distribution was assumed to be the same as in similar groups/countries; in the case of missing GDP data the Maddison series was extended by using growth rates of neighbouring countries.

Table 3: Recent global inequality studies and their methods and data

	Coverage	Income mean	PPP exchange rate	HS data source	Expenditure /income	unit of analysis	grouped / individual level data	approximation of missing distributional data
Bourguignon & Morrison (2002)	15 countries and 18 country groups 1820 - 1992	GDP per capita (Maddison 1995)	GK	various	mixed	not clear	nine deciles and two vintiles (of the top)	yes (similar countries)
Chotikapanich et al. (2009)	91 countries 1993 and 2000	GDP per capita (PWT 6.1)	GK	WYD and WIID	mixed	households	beta-2 approx. of distribution from quantile data	no
Dikhanov (2005)	45 countries 1970 - 2000	HFCE (World Bank data)	EKS	not clear	mixed	not clear	quasi-exact polynomial interpolation of distribution	not clear but most likely
Dowrick & Akmal (2005)	67 countries 1980 and 1993	GDP per capita (own estimates)	Afriat	DS	mixed	mix of individuals & households	quintiles (parametric approx. if only Gini coef. available)	no
Holzmann et al. (2010)	114 countries 1970 - 2003	GDP per capita (PWT 6.2)	GK	WIID (adjusted by Grün & Klasen, 2007)	mixed	households	parametric (log-normal) approx. of distribution from quintile data	yes (not exactly clear how)
Milanovic (2005)	122 (86 common sample) 1988, 1993, 1998	HS mean	GK	mainly micro data (some grouped data from World Bank)	mixed	individuals	ventiles (sometimes deciles or quintiles)	no
Milanovic (2012)	124 1988 - 2005	HS mean	EKS	mainly micro data (some grouped data from World Bank)	mixed	individuals	ventiles (sometimes deciles or quintiles)	no
Pinkovskiy & Sala-i-Martin (2009)	191 countries 1970 - 2006	GDP per capita (PWT 6.2 and own extension)	GK	WIID and POVCAL for China and India	mixed	mix of individuals & households	parametric (log-normal) approx. of distribution from quintile data	yes (linear trend or same distribution in all years)
Sala-i-Martin (2006)	138 countries 1970 - 2000	GDP per capita (PWT 6.1)	GK	DS and WIID	mixed	mix of individuals & households	Kernel estimation of distribution from quintile data	yes (linear trend or same distribution in all years)
Van Zanden et al. (2011)	39 - 99 countries (core group 30 countries) 1820 - 2000	GDP per capita (Worldbank 2008, growth rates from Maddison 2003)	EKS	various	mixed	not clear	parametric (log-normal) approx. of distribution from Gini coefficients	yes (top income shares, unskilled wages, population heights, and interpolation)

This approach was extended in a recent publication from van Zanden *et al.* (2011). The main changes are the extension of the distribution dataset and the incorporation of the new ICP 2005 PPP estimates (using the growth rates from Maddison). First, van Zanden *et al.* generated a new Gini coefficient dataset by (i) using WIID data, (ii) incorporating inequality estimates of historical studies 'overlooked' by Bourguignon and Morrison, (iii) estimating the distribution according to income shares of the top 1% and 5% (assuming log-normality), (iv) using proxies to calculate Gini coefficient, namely the ratio between GDP per capita and real wages of unskilled workers and the distribution of heights within the population of a country, and (v) using some interpolation to be able to get estimates in all years for a core-group of 30 countries. From the resulting data the income distributions of all countries is calculated by assuming that their intra-country distribution is log-normal. This distributional data is then scaled to the calculated GDP per capita estimates. Interestingly, the resulting level and trend of global inequality is very similar to Bourguignon and Morrison's results (see Figure 8 in the next section).

Milanovic (2005) argues that the usage of approximations, country groups, and GDP per capita data is suitable if historical trends are studied but that this approach is not justifiable anymore if actual HS data is available. Therefore, he constructs the WYD dataset with a common sample of 86 countries (in total the dataset has data from 122 countries) for the benchmark years 1988, 1993 and 1998[24], relying mainly on micro data from HS and to some extent on grouped data from World Bank sources. From the micro data he forms ventiles and uses decile or quintile data, according to availability, for the countries for which only grouped data is accessible. Milanovic, like Bourguignon and Morrisson, assumes that the income within these quantiles is equally distributed. In contrast to the other studies, he uses HS means (adjusted by GK PPP) to scale these income distributions to be able to estimate global income inequality. Milanovic (2012) updates the estimates for the years 2002 and 2005 using the same approach but the new ICP 2005 PPP estimates are based on the EKS method. According to Anand and Segal (2008), Milanovic's approach has two major weaknesses. Firstly, his assumption that the distribution within quintiles is constant leads to an underestimation of inequality,

[24] The data for a benchmark year is constructed as follows: if data are available for the benchmark year this data are taken, if these data are not available, the distributional data of the previous or following year are taken as proxy, if these data are also not available the data from the subsequent year are taken as proxy (i.e. for the benchmark year 1988 distributional data of the years 1986, 1987, 1989, and 1990 are considered).

especially due to populous countries like China and India[25]. Secondly, the amount of quantiles per country is not constant over time (e.g. for the 1993 benchmark more micro data is available than for the 1988 benchmark) which leads to changes in the underestimation of inequality. As a response to the first criticism, Milanovic (2012) shows that the underestimation accruing from the usage of ventile data is minimal: by comparing Gini coefficients calculated from micro data and from ventile data he shows that the underestimation is around 1%.

Dowrick and Akmal (2005) also use benchmark years (1980 and 1993) and assume equal distribution within quantiles, but in contrast to Milanovic (2005, 2012) they use Afriat PPP exchange rates to measure global income distribution. The main problems with their approach, next to the assumption of equal distribution, is that they are using data from the DS dataset which mixes individuals and households and that they scale the distribution with GDP per capita. To circumvent the underestimation of inequality Chotikapanich *et al.* (2009) calculate continuous beta-2 household income distributions for 91 countries from the quantile data of the WYD and WIID dataset. However, the weakness of their study is that these beta-2 income distributions are combined with GDP per capita data and not with HS means[26]. Only one recent study that uses benchmark years scales distributional data with HFCE to estimates global income inequality. Unfortunately, it does not become clear from Dikhanov's (2005) paper which data (source) he uses to estimate his quasi-exact polynomial distribution data which he scales by HFCE but it is likely that the data for some countries is approximated, given that the distributional data that are used are not readily available for all of the 45 countries[27] for all benchmark years (i.e. 1970, 1980, 1990, and 2000).

Sala-i-Martin (2006) was the first person to estimate the global income distribution for all years of the period 1970 to 2000. To be able to achieve this, and to be able to take into account 137 countries, Sala-i-Martin did not distinguish between households and individuals and, more importantly, he needed to approximate most of his distributional data – only for one country, the US, annual distributional data is available for the whole

[25] Milanovic lessens this problem in splitting China and India into rural and urban population. However, the quantile data of these two countries stays very large (e.g. in China 180 million per quantile in 1993).

[26] Interestingly, their results are nevertheless very similar to those of Milanovic (2005) – see Figure 8 in the next section.

[27] To receive a global picture the income distributions of the largest of these countries are taken to fill regional gaps.

period. To be more precise, for the 80 countries for which several observations are available from the DS and WIID dataset, he uses a linear trend to fill the gaps (his so called group A countries), for the 29 countries for which only one HS survey result exists he imputes the missing years by using the average trend of the region to which the country belongs (group B countries), and for the 28 countries for which no HS data exists he approximates the distribution for all years according to the average quintile share and trend of neighbouring countries (group C countries). After having approximated the majority of the distributional data, he estimates a continuous distribution by using a nonparametric kernel density function. This income distribution is scaled with PPP GPD per capita estimates from the Penn World Tables.

Sala-i-Martin's approach has been heavily criticized by Milanovic (2002)[28] and Anand and Segal (2008). The first critique was that the distribution had been estimated from very few data points (i.e. quintiles) which are derived "from grouped data and estimated by fitting the Lorenz curves. Thus, quintiles which are themselves estimates are used to estimate the entire distributions." (Milanovic, 2002, p.10). This criticism is also valid for the studies of Chotikapanich and Dikhanov. However, Sala-i-Martin uses a kernel density estimation which should only be used when many independently and identically distributed data points are available and – beside the point that only few data points are available – these "quintile means used by Sala i-Martin are 'trimmed means' ... based on ordered income data and are, therefore, neither independently nor identically distributed" (Anand and Segal, 2008, p.78). To make matters worse, Sala-i-Martin uses a constant bandwidth for all countries and years which is erroneous. In a nutshell, his nonparametric estimates seem not very reliable. The second critique is "the sparseness of the data which is an even more serious problem." (Milanovic, 2002, p.14). The income distribution of countries can vary significantly from HS to HS without having a linear trend and the inequality levels and trends of countries within a region often differ significantly. Therefore, Sala-i-Martin's approach is a "dramatic oversimplification with an unknown bias." (ibid, p.16).

To overcome the critique regarding the non-parametric estimation, Pinkovskiy and Sala-i-Martin (2009) have measured the income distribution by using a lognormal

[28] In this memo Milanovic is criticising a former version of the 2006 publication which uses the same methodology.

functional form[29]. As Sala-i-Martin (2006) they use quintiles[30] and scale the distribution to GDP per capita means (to be able to estimate the whole period with PWT 6.2 GDP per capita estimates they are extending the PWT data for the years 2005 and 2006, assuming that the GDP per capita growth rate in these years corresponds to a 4-year moving average). Nevertheless, Pinkovskiy and Sala-i-Martin approximate even more distributional data than Sala-i-Martin as they are including 191 countries (plus rural China and India) in their estimates. This means that for about half of all countries only one or no HS result exists[31], on average only 5.5 surveys per country are available for this 36 year period, and on average only 25% of the world population is covered directly every year. Pinkovskiy and Sala-i-Martin try to improve Sala-i-Martin's approximations by testing different interpolation (missing years between known distributions) and extrapolation (missing years before the first and last known distribution) methods. However, some "extrapolations violate the range of the Gini in the survey data (from 0.17 to 0.81)" (p.14). This problem confirms Milanovic's (2002) critique about the unreliability of estimated distributional data. Therefore, Pinkovskiy and Sala-i-Martin choose to extrapolate distributional data by horizontal projection (i.e. the Gini coefficient is assumed to remain constant), while interpolation between known distribution takes place by using piecewise cubic splines.

Holzmann *et al.* (2007) also use a lognormal functional form and are scaling distributional data with GDP per capita to try to improve Sala-i-Martin's (2006) estimates and they have less heroic approximations than Pinkovskiy and Sala-i-Martin (2009) with regard to country and year coverage. However, they too have needed to use massive approximations to be able to cover the distribution of 114 countries in 5 year intervals

[29] Next to the lognormal distribution, also a gamma distribution and a Weibull distribution are considered. However, Pinkovskiy and Sala-i-Martin conclude that their "results demonstrate that the lognormal distribution offers far superior fit to the data than do either of these common two parameter alternatives." (p.5).

[30] Pinkosvskiy and Sala-i-Martin try to take into account the bias from underreporting at the top and at the bottom by only considering the three middle quintiles in a non-baseline specification, assuming that "1) individuals are placed correctly into quintiles, and 2) measurement error is present only for individuals in the first or last quintile, the ratios of the middle three quintiles to the sum of the middle three quintiles are measured correctly" (p.15). The results are very similar regarding the trend but the inequality level is about 1 Gini point higher than in the baseline specification. However, this approach is not solving the problem with regard to top incomes, as it is well documented that the income at the top is following a Pareto and not a lognormal distribution (see e.g. Reed, 2001; Clementi and Gallegati, 2005; Sinha, 2005; Yakovenko and Rosser, 2009).

[31] From the paper it becomes not clear how many countries of the sample respectively belong to Group A, Group B, and Group C, however most of the new countries must belong to Group B (one HS) and Group C (no HS) countries.

between 1970 and 2000 and for 2003. They firstly assumed that the level of inequality in 1970 was the same as at first reported level of inequality (i.e. horizontal projection), and secondly they used a "moving average to catch changes in trends of inequality." (p.5). Hence, both, Pinkovskiy's and Sala-i-Martin's, and Holzmann *et al.*'s study have an unknown bias.

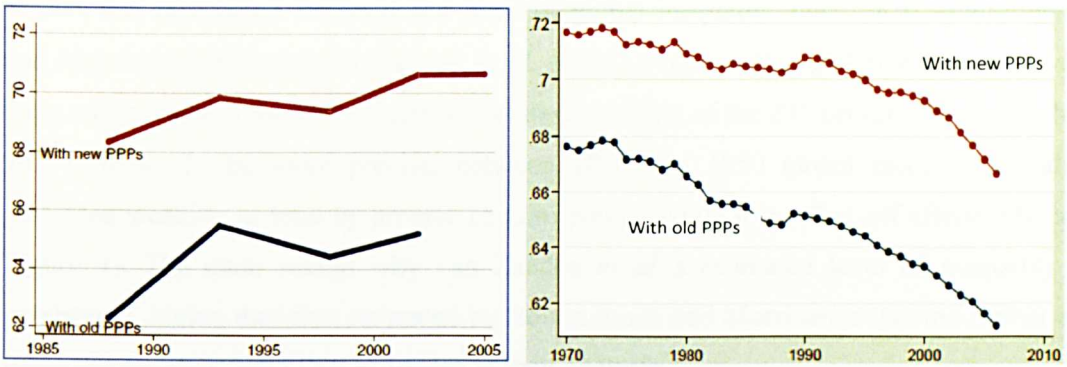
2.3.3. Results of the studies

The two most prominent researchers with regard to global income inequality are arguably Milanovic and Sala-i-Martin. When one has a look at their two latest estimates (stand November 2011) in Figure 7, it becomes immediately visible that global income inequality estimates (i.e. the trend and the level) differ significantly depending on the methods and data used. While Milanovic (2012) reports that the global Gini coefficient increased by around 2 points between 1988 and 2005 when the new ICP 2005 PPP estimates are taken into account[32], Pinkovskiy and Sala-i-Martin (2009) claim that the Gini coefficient decreased by more than 3 Gini points during the same period. Most studies are backing Milanovic's findings that there was no decrease in global inequality prior to the crisis when measured via the Gini coefficient (see e.g. Bourguignon and Morrison, 2002; Dikhanov, 2005; Dowrick and Akmal, 2005; van Zanden, 2011), while Holzmann *et al.* (2007) are backing Sala-i-Martin's (2006) and Pinkovskiy's and Sala-Martin's (2009)[33] findings that global inequality decreased significantly after 1980 (see Figure 8a). With regard to the Theil Index the picture is similar. Some studies report a slight upward trend – Milanovic (2005, 2010b), Dowrick and Akmal (2005), and Bourguignon and Morrision (2002) –, while others, like Sala-i-Martin (2006), Dikhanov (2005), Holzmann *et al.* (2007), and Pinkovskiy and Sala-i-Martin (2009) report a downward trend in global inequality after 1980 (see Figure 8b).

[32] The increase might be due to an increase of available micro data over time. In 1988 for 45 out of 103 countries micro data is available while in 2002 and 2005 for 117 out of 122 countries micro data is available). This change in the availability of micro data means that over time more ventile and less decile or quantile data is used. This leads to a lower underestimation of inequality due to the assumption that income within the quintiles is distributed evenly.

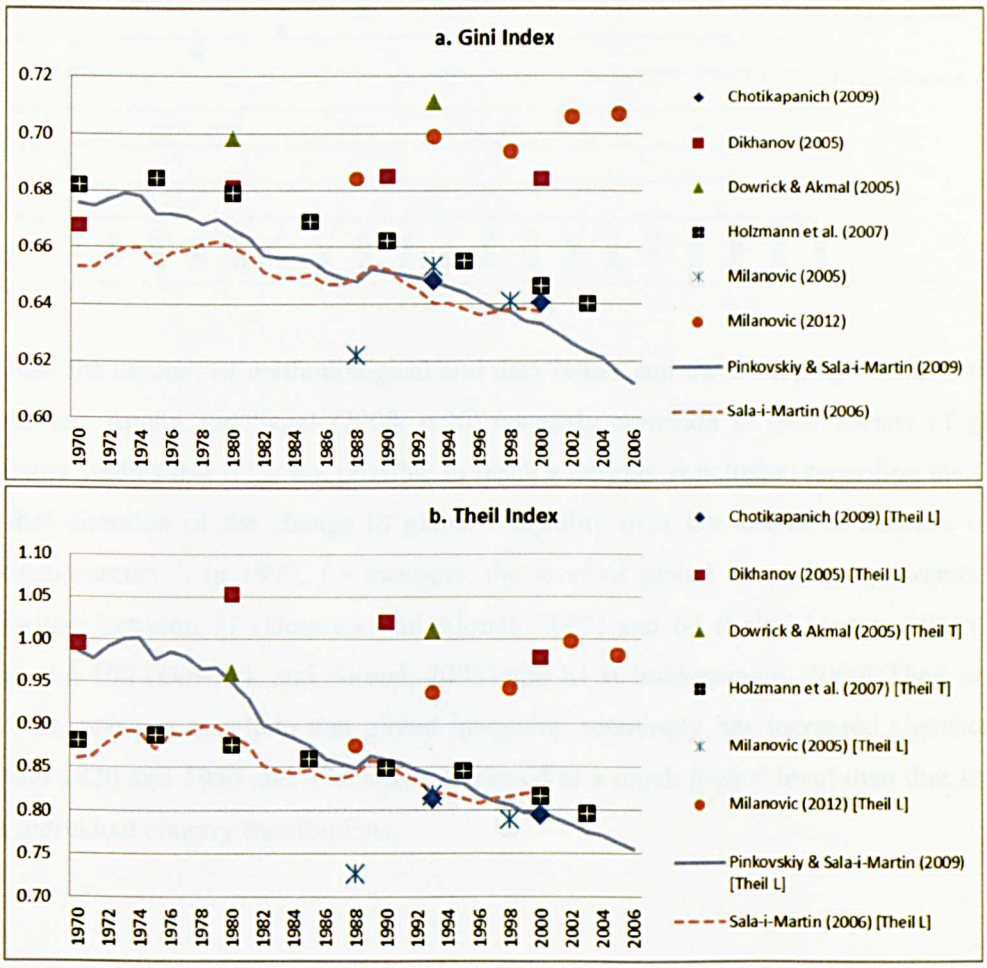
[33] Pinkovskiy's and Sala-i-Martin's baseline results presented in Figure 5a and 5b are not taking into account the new ICP 2005 PPP estimates. It is not clear why they only present inequality figures based on the old PPP estimates in their paper.

Figure 7: Global income inequality, two diverging results (Gini Index)



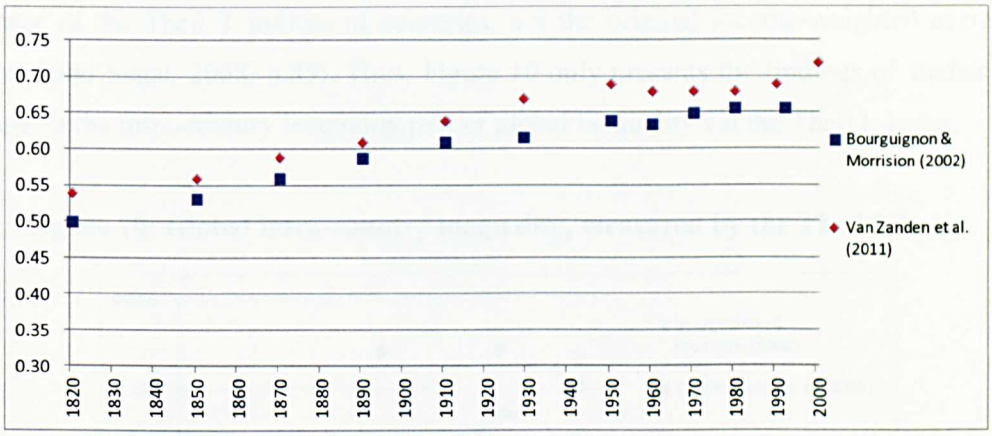
Note: The left plot shows the global inequality Gini Index estimated by Milanovic (2012). The right plot shows the global inequality Gini Index estimated by Pinkovskiy and Sala-i-Martin (2009). For an overview of the differences in their methods and data sources see Table 3: Recent global inequality studies and their methods and data

Figure 8: Various pathways of global income inequality since the 1970s



With regard to historical changes the picture seems to be much clearer. The two existing studies that researched the level and trend of global inequality since 1820, Bourguignon and Morrison (2002) and van Zanden *et al.* (2011), reported that global inequality levels were much lower in the 19th century and at the beginning of the 20th century than in the late 20th century. To be more precise, between 1820 and 1950 global income inequality increased steadily, in total by around 15 Gini points, while it levelled off afterwards (see Figure 9). The main reason why van Zanden *et al.*'s estimated level of inequality is persistently higher than that estimated by Bourguignon and Morrison is that the former are using the new ICP 2005 PPP estimates in their analysis.

Figure 9: Long period changes in global income inequality (Gini coefficient)

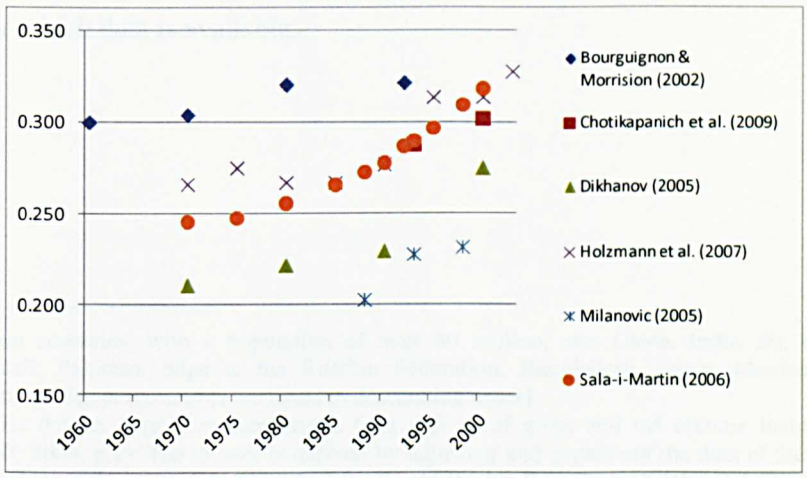


Given the amount of methodological and data issues and the diverging results between the studies, Anand and Segal (2008, p.90) correctly conclude in their review of global inequality studies that it "is not possible to reach a definite conclusion regarding the [level and the] direction of the change in global inequality over the last three decades of the twentieth century.". In 1993, for example, the level of global inequality apparently was somewhere between 71 (Dowrick and Akmal, 2005) and 64 (Sala-i-Martin, 2006) Gini points and 100 (Dowrick and Akmal, 2005) and 81 (Chotikapanich, 2009) Theil points. However, one can conclude that global inequality seemingly has increased significantly between 1820 and 1950 and afterwards remained at a much higher level than that known from individual country distributions.

2.4. Intra-country income inequality

All global inequality studies anonymously report that intra-country inequality has increased on a global level after 1980. Some studies decompose the intra-country and the inter-country component by taking into account the Gini Index, while others are using the Theil T or Theil L Index. However, as discussed above, only the Theil Index is additively decomposable into an intra- and inter-component. Furthermore, only the Theil L Index (i.e. the mean logarithmic deviation) has a consistent interpretation of the inter- and intra-country components with regard to global income inequality because the Theil T Index uses income and not population shares of the countries. "Eliminating between-country inequality by equalizing the mean incomes of countries will therefore also change the measured intra-country component: the elimination will leave a population-weighted average of the Theil T indices of countries, not the original income-weighted average." (Anand and Segal, 2008, p.85). Thus, Figure 10 only presents the findings of studies that measured the intra-country inequality part of global inequality via the Theil L Index.

Figure 10: Global intra-country inequality, measured by the Theil L Index



All but one study suggest an increase in intra-country inequality since the mid-1980s. The main driver for this rising trend in global intra-country inequality is the increasing inequality levels in populous countries. These have the biggest weight in the calculation.

The net income Gini coefficient of 12 out of the 15 most populous countries[34] increased between the mid-1980s and the mid-2000s (among them the three most populous countries China, India, and the US), meaning that the non-population adjusted average net income Gini coefficient of these fifteen countries increased by around five points during this time, according to the data from Solt's (2010) SWIID 3.0 income inequality dataset[35].

If one looks at the individual Gini coefficients of countries, it becomes immediately apparent that since the mid-1980s intra-country income inequality has increased in most high income countries and in most developing European and Asian countries prior to the crisis[36] (see Figure 11a-c), while it was on average relatively stable in Latin American and the Caribbean, and Middle Eastern and North African developing countries, and declining in Sub-Saharan Africa (see Figure 11d-e). However, intra-country income inequality levels were still much lower than the level of global income inequality[37], i.e. the population unadjusted average inequality was around 30 Gini points in high-income countries, 35 Gini points in European and Central Asian developing countries, 40 Gini points in East and South Asian and in Middle Eastern and North African developing countries, 45 Gini points in Sub-Saharan countries, and 50 Gini points in Latin American and Caribbean developing countries for which data is available.

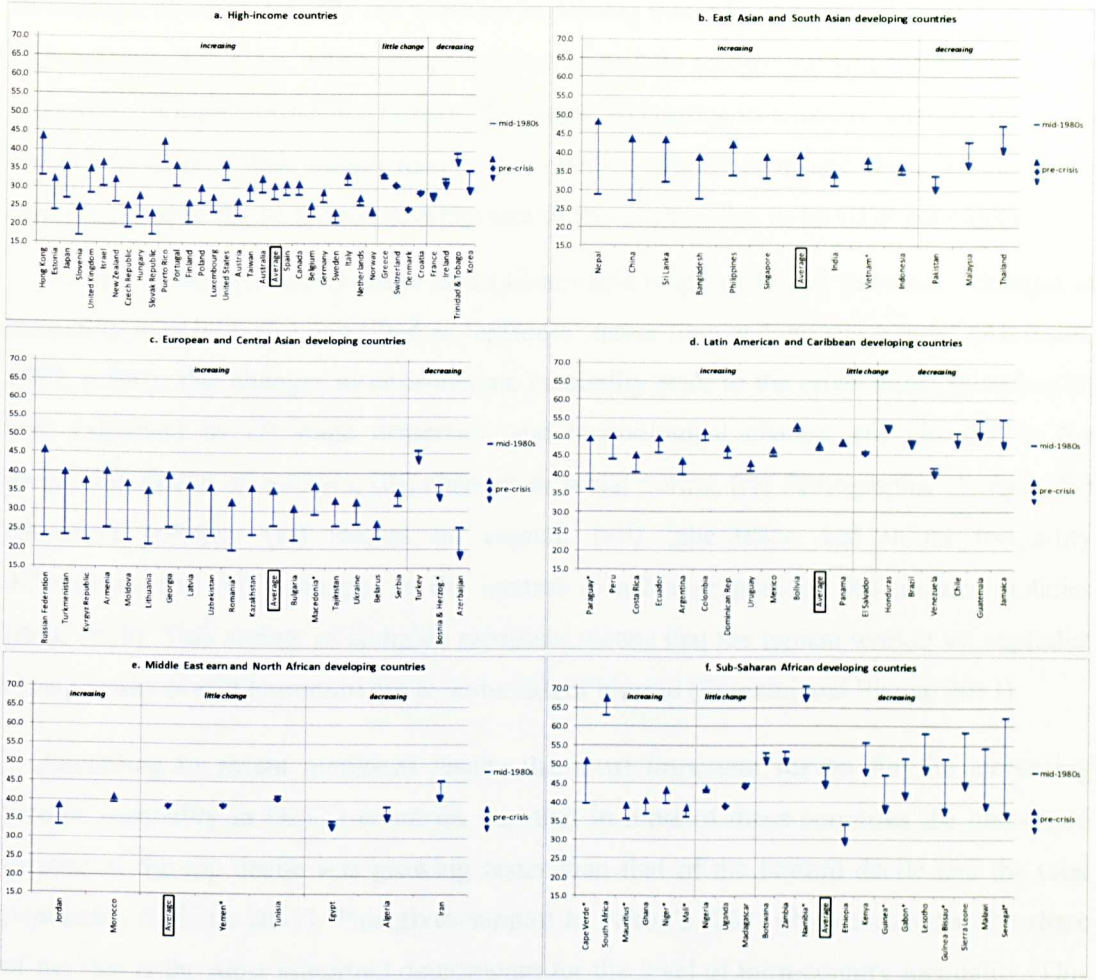
[34] These fifteen countries, with a population of over 80 million, are: China, India, the United States, Indonesia, Brazil, Pakistan, Nigeria, the Russian Federation, Bangladesh, Japan, Mexico, Philippines, Vietnam, Germany, Egypt (countries are listed in descending order).

[35] Solt's SWIID dataset "provides comparable Gini indices of gross and net income inequality for 153 countries" (Solt, 2009, p.1). The dataset is derived by adjusting and expanding the data of the WIID dataset via a customised algorithm with data from the LIS, World Bank's Povcalnet, SEDLAC, Milanovic's All The Ginis dataset, the ILO's Household Income and Expenditure Statistics, and the University of Texas Inequality Project's UTIP-UNIDO dataset. Although Solt uses a more sophisticated approach than e.g. Sala-i-Martin (2006) and Pinkovskiy and Sala-i-Martin (2009), the dataset still can be criticised on the ground that it is impossible to know the exact adjustment coefficient for each year/country. However, if one uses Milanovic's All The Ginis dataset (which for some countries reflect (net or gross) income inequality and for other countries consumption inequality) one comes to similar results: according to his data inequality also has increased in 12 out of these 15 countries (the only differences being that according to Milanovic's data inequality in Pakistan has increased while it has decreased in Nigeria), leading to an (non-population adjusted) average increase in the Gini coefficient by around four points.

[36] In most countries the increase in inequality was most pronounced between the mid-1980s and the mid-1990s and in some countries inequality even declined slightly after the mid-1990s.

[37] The only two countries which had pre-crisis inequality levels which were similar to the magnitude of global income inequality were South Africa and Namibia.

Figure 11: Change in intra-country income inequality (Gini coefficient)



Note: These plots show changes in net income inequality. For marked countries the initial value shows 1990 (or close to that year) Gini coefficients. The pre-crisis values are Gini coefficients of the year 2007 or the latest available figure after 2003 (data source: Solt (2010)).

The presented changes in and levels of inequality suggest that Li *et al.*'s (1998) and Korzeniewicz and Moran's (2009) conclusion that intra-income inequality is relatively stable over time and that countries can be clustered into two groups, a high-inequality and a low-inequality group, is questionable[38]. Moreover, these data do not support Kuznets' (1955, 1965) hypothesis that during the path of development inequality should first rise, as

[38] According to Li *et al.* inequality depends on civil liberties, the level of secondary schooling, financial depth and the initial distribution of land, while Korzeniewicz and Moran claim that one group consists of Western countries and their offshoots that had and have 'good' institutions and a low inequality equilibrium (below 33 Gini points), while the high inequality equilibrium group (above 50 Gini points) consists of 'ex-plantation colonies' where elites were and are dominant while huge parts of the population were and are subordinated.

more people are getting employed in the non-agricultural sector which pays higher wages on average, and then steadily fall when an increasing majority of people is employed in the high-income sector, i.e. when the proportion of middle-income earners increases and the proportion of poor subsistence farmers decreases. According to Kuznets' analysis the intra-country inequality thus should have an inverted-U shaped form and its level should be clearly related to the economic development of the country (i.e. to its GDP per capita).

However, this inverted-U shape is not observable empirically and therefore "changes in inequality may be better described as 'episodic' rather than as long-run trends" (Atkinson, 1997, p.300). The changes in intra-income inequality prior to the crisis might therefore be best explained by (i) wage dispersion and technological change, (ii) changes in the bargaining power of workers, (iii) changes in social norms, (iv) demographic changes, (v) education policies, (vi) returns on capital, (vii) inheritance and initial inequality differences, and (viii) changes in the income distribution policies and taxation policies (ibid, 1979). This variety of complex processes means that the typical worker vs. capitalist class identity is still important but to some extent blurred (Franzini and Pianta, 2011).

According to recent empirical results the most important reason for the increasing income inequality in OECD countries was that in most of these countries the household income of the top decile was growing faster than that of the bottom decile and the total population (OECD, 2011). This gives support to Palma's (2011) hypothesis that the share of the rich is the most important determinant for the level of intra-country inequality. This increase in top incomes can be mainly explained by (i) an under-proportional increase of real wages compared to productivity which means that the (adjusted) profit share since 1980 rose by "some ten percentage points in continental European countries, and even more in Japan [and by] around five percentage points" in the UK and US (Stockhammer, 2012a, p.8)[39]; (ii) the over-proportional increase of top management and superstar wages (especially in Anglo-Saxon countries) – while at the same time workers at the bottom often witnessed declining real wages (see e.g. Ellis and Smith (2010), ILO (2008), Atkinson *et*

[39] The decline of the wage share in the US and UK would be much higher if management salaries in the US would be counted as profits. The causes of the increase (decrease) in the profit share (wage share) in OECD countries are disputed. For example, the IMF (2007b) argues that the main reason for the change is rapid technological change, Jayadev (2007) shows that globalisation has important effects and Stockhammer (2012b) demonstrates that financialisation, globalisation and the retreat of the welfare state are the most important determinants to explain this phenomena.

al. (2011) and Hein (2011); and (iii) the more unevenly distributed capital income (see e.g. OECD (2011)).

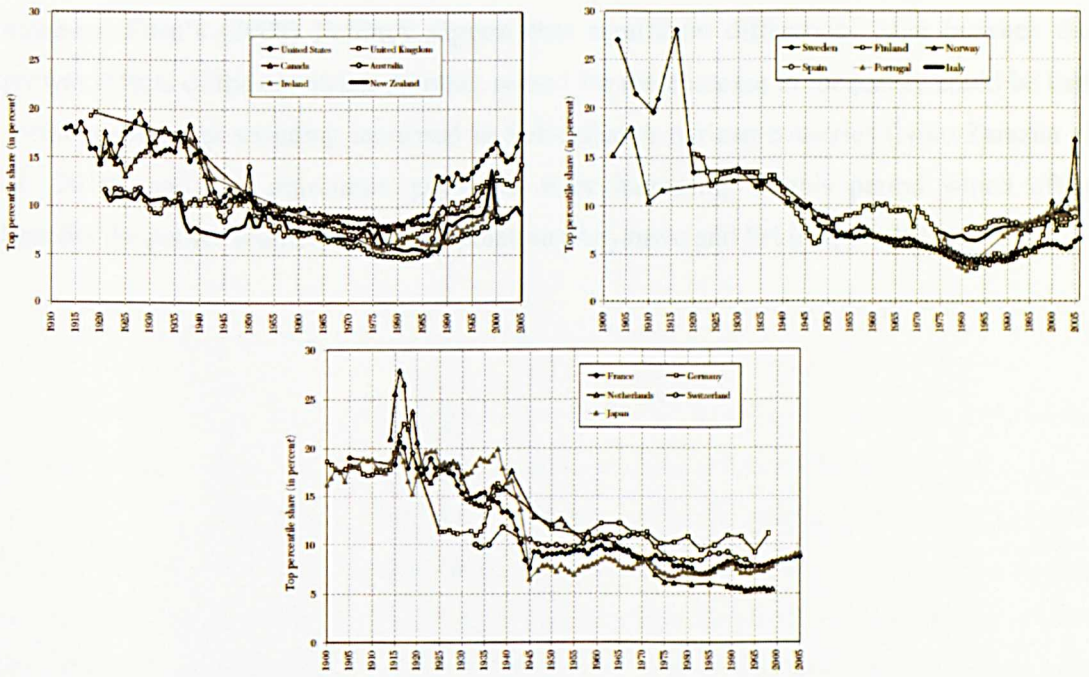
The resulting increase in market income inequality was not offset by redistributive policies because market income inequality was growing twice as fast as redistributive transfers, partly for the reason that redistributive policies in rich countries became weaker in the decade prior to the crisis (Immervoll and Richardson, 2011). This meant that inequality "first began to rise in the late 1970s and early 1980s in some Anglophone countries, notably in the United Kingdom and the United States, followed by a more widespread increase from the late 1980s on" (OECD 2011, p.6), so that between the mid-1980s and mid-2000s the "inter-decile (P90/P10) ratio recorded an average increase of ... 7%, while the inter-quintile share ratio (S80/S20) ... increased by 10%" (OECD, 2008, p.28).

These findings from household surveys are supported by Atkinson *et al.*'s (2011) data which is based on income tax statistics; according to their results total income shares of the top 1% income earners were increasing in all countries for which data is available after 1985, with the exception of the Netherlands and Switzerland (see Figure 12). The considerable drop in the top percentage share in the 1914–1945 period was mainly a result of a sharp decline of (reported) top capital incomes due to the Great Depression and the two World Wars. After 1945 the shares in many countries did not rise again to their old values which can be partly explained by the introduction of progressive tax systems and a higher bargaining power of workers. The significant decline in top marginal wage and capital income tax rates within OECD countries due to the neoliberal reforms in the 1980s[40] was therefore an important driver for the increase in net income inequality. According to Hein (2011) another reason for the rise of the top income shares was the increase in business profits (i.e. by the relatively high dividends for shareholders) and top management salaries (including bonuses and stock options), which suggests that changes in the income at the very top, i.e. top 1%, top 0.1% and top 0.01% explain most of the increase in income inequality in OECD countries (Rosnick and Baker, 2012).

[40] The average OECD central government top marginal wage income tax rate decreased by 22% points between 1981 and 2007 (from 58% to 36%) and the average OECD net top statutory rate on dividend income decreased by 26% points (from 57% to 21%) according to the data from the OECD (2012).

It is more difficult to generalise the reason for the changes in income inequality in non-OECD countries, and it is beyond the scope of this dissertation to undertake an in-depth research of the reasons by region and/or country. One of the reasons why intra-country inequality increased in many countries arguably is that the wage share declined in most developing countries after 1980 (ILO, 2008; Rodriguez and Jayadev, 2010). In European and Central Asian developing countries the increase in inequality also seemed to have gone hand in hand with the break-up of the Eastern Block and the subsequent neoliberal market reforms (i.e. most of the increase in inequality took place in the 1990s and inequality started to level off afterwards), whereas in many Asian countries inequality rather increased in the second half of the period due to market reforms that led to an increase in the top income share (especially in the case of China, see Atkinson *et al.*, 2011.

Figure 12: Top percentile share in total gross income (in %)



Source: Atkinson et al. (2011)

Middle Eastern and North African, and Latin American and Caribbean countries, in contrast, on average had only minor changes in inequality if the mid-1980s and pre-crisis inequality levels are compared. In the case of the latter the reason is that while inequality levels were first increasing due to the 'lost decade' and the subsequent neoliberal reforms

in the 1980s and 1990s (reaching their peak in the late 1990s) they were declining back to the levels of the early 1990s or below afterwards. This was mainly due to higher growth rates which led to more employment in the formal sector, the commodity price boom which lead to higher income in rural areas, a decline in skill premium, and an increase in social government spending in many countries (see e.g. Cornia, 2010; Gasparini *et al.*, 2011; Lustig and Gasparini, 2011).

The only region which experienced a significant overall decrease in income inequality since the mid-1980s is Sub-Saharan Africa. The average decline was around 4 Gini points since the mid-1980s (SWIID 3.0) and around 3 Gini points since the beginning of the 1990s (All The Ginis dataset). According to Sala-i-Martin and Pinkovskiy (2010) the main reason for this decline in inequality was that the enhanced growth performance in most

African countries did not only benefit the elites but also poorer segments of the population; however, Fosu's (2008) findings suggest that significant differences exist between the growth effects of the countries. Another reason for the decrease in inequality could be that social government spending increased in Sub-Saharan African countries (Niño-Zarazúa *et al.*, 2010), and that remittance payments were increasing in this period which often benefits the poorer segments of the population (Anyanwu and Erhijakpor, 2010).

3. Income inequality and the subprime crisis

"The ultimate reason for all real crises always remains the poverty and restricted consumption of the masses as opposed to the drive of capitalist production to develop the productive forces as though only the absolute consuming-power of society constituted their limit." (Karl Marx, 1894)

Research on the impact of changes in distribution on economic processes and social matters has a long standing history in economics and was prominent in the works of Smith, Ricardo, Marx, and Keynes. Especially Marx and Keynes stressed that high levels of inequality can have not only destabilising effects for social relations but also for the economic system. Although the topic became somewhat out of fashion in the last quarter of the 20th century (Atkinson, 1997), Marxian and post-Keynesian economists in particular, continued to theoretise the possible negative impacts of income inequality. One of the reasons for this unwaning interest is the finding that a rise in income inequality was a major weakness of the economic system prior to and during the Great Depression (see Eccles; 1951; Galbraith, 1975). The results of Chapter 2 clearly show that in the pre-crisis period intra-country income inequality was increasing in most countries and that global income inequality was very high in a historical context (even though inter-country inequality declined after 2000). The former was mainly due to an increase of top incomes and a decrease of the wage share. It is therefore possible that the high levels of income inequality played an important role in the build-up of the subprime crisis.

To verify this possibility a thorough review of the existing literature will be undertaken in this chapter. Given that different economic strands have diverging explanations as to why economic crises take place, it is however necessary to begin first with a broad explanation of different theoretical concepts and viewpoints before the role of income inequality in the subprime crisis can be understood fully. Due to space limitations and time constraints this will be done for the two economic schools that most extensively discuss the relation between income inequality and crises, Marxism and post-Keynesianism, and for the two dominant economic schools of today's time, neo-classical economics and new-Keynesianism. For simplicity reasons the latter two are discussed under the heading mainstream economics [41]. The aim of this review is not to give a detailed in-depth analysis

[41] The justification for this approach is that, in contrast to Marxian and post-Keynesian crisis theories, neo-classical and new-Keynesian economics are published in today's top-ranked economic journals.

of each crisis theory but rather to outline and contrast the theoretical underpinning of different strands and to compare their general explanations for economic crises and their viewpoints regarding inequality with respect to the matter.

The structure of this chapter is as follows: Section one reviews the role of inequality in Marxian crisis theories. Section two reviews the role of inequality in post-Keynesian crisis theories. Section three reviews the role of inequality in mainstream crisis theories, and section four concludes the findings to establish if income inequality indeed contributed to the growth and collapse of the US subprime mortgage market.

3.1. Inequality and its role in Marxian crisis theories

3.1.1. Marxian theories of crisis: an overview

The common denominator on which Marxists agree is that the capitalist system is inherently unstable because its internal contradictions will periodically result in a fall of the rate of profit to a point at which capital accumulation is negatively affected and a crisis breaks out[42]. The reason that lower profits lead to a crisis and not only to a slowdown of economic growth is the existence of the 'contract-credit system'. This implies that payment obligations exist which cannot be served anymore if the rate of profit falls too strongly (Crotty, 1985). However, Marx's followers disagree about the main reason for the fall in profit rates. This is understandable as "Marx appears to associate crises with the tendency for the rate of profit to fall, with tendencies to overproduction, underconsumption, disproportionality and over-accumulation with respect to labour" (Clarke, 1994, p.7). Furthermore, Marx is not consistent in giving primacy to one of these causes. He states for example in Grundrisse and in the three volumes of Capital, that the law of the tendency for the rate of profits to fall is fundamental to understand the limits of capitalism and that capital is the main barrier for capitalist production; but, at the same time he writes that prior to a crisis wages are always rising – implying that this is the main reason for the fall in profit. Marx repeatedly stresses the point that ultimately crises are caused by poverty and restricted consumption. This ambiguity is not surprising given that Marx never formulised a full-fledged crisis theory and that most of his remarks on the vulnerability of

[42] According to Marx there are several countertendencies which prevent crises, e.g. increasing productivity, credit, increasing labour resistance if wages fall etc, however, these tendencies work only temporarily and cannot prevent that a crisis finally occurs.

the capitalist system to crises were not laid down in finished works but stem from notebook entries which only got published after his death (e.g. Grundrisse and Capital Volume II and III)[43].

Nevertheless, Marxians have developed three main approaches to explain capitalist crises on the basis of the different fragments of crisis theories in Marx's texts. Some argue that crises arise due to problems at the first stage of the accumulation process, where money is converted into constant capital (machines, raw material etc.) and variable capital (labour), because either real wages increase and/or raw material becomes more expensive due to scarcity; both leading to a profit squeeze due to higher costs. A second group explains crisis with the inherent contradiction in the production process which leads to the law of the tendency for the rate of profit to fall – due to an increasing constant to variable capital ratio. A third group argues that problems to sell the produced commodities at a price above production costs, i.e. the realisation of surplus value due to overproduction and/or underconsumption, is the main cause for the falling profit rates (Sweezy, 1942; Shaikh, 1978; Kenway, 1980; Clarke, 1994; Bell and Cleaver, 2002; Evans, 2004; Harvey, 2010a). The conclusion that one could draw from this ambiguity is that it is not possible to give primacy to one of these three theories but that the capitalist system faces many potential threats that can lead to crisis (e.g. very low wages can be as devastating for the functioning of the capitalist system as can be very high wages on the ground that both can undermine capitalist profits to such a degree that accumulation stops).

However, since Marx's death intensive debates about the 'real' Marxian crisis theory have taken place and the vogue between different approaches has changed in the last 120 years, depending on the strength of the argumentation, but also depending on the political and economic environment. Initially the followers of Marx were broadly divided into overproduction and/or underconsumption (e.g. Engels, 1975; Kautsky, 1901-1902; Luxemburg, 1913) and disproportionality (e.g. Hilferding, 1910) crisis theorists[44]. Although the two theories are not incompatible, tensions between these camps grew over time with each of them claiming that their approach was the authentic way to understand

[43] Therefore it is surprising that many Marxists argue that 'their' theoretical approach is the only authentic Marxian one and that other approaches are either not valid or only of minor importance. Nowadays these claims come mainly from Marxists that state that the tendency for the profit rate to fall is the real root cause for all crises (see e.g. Yaffe, 1972, Shaikh, 1978, Brenner, 2009; Freeman, 2010, Kliman, 2012).

[44] See Sweezy (1942) and Clarke (1994) for an excellent overview about the historical debates among Marxists.

and explain the underlying cause of economic crises. The debate between these two camps came to an end in 1942 when Paul Sweezy solved fundamental flaws in the existing overproduction/underconsumption theories. Since then disproportional theories became of secondary importance in explaining capitalist crises[45]. In the 1960s increasing numbers of Marxist scholars began to argue that the inherent tendency of the rate of profit to fall is the real root cause of all capitalist crises, although Sweezy and Baran developed the overproduction/underconsumptionist argument further in 1966. The importance of this 'law' had been stressed earlier (e.g. Dobb, 1939) but it only became the mainstream argument among Marxist circles during the crisis years in the 1970's (e.g. Mattick, 1971; Shaikh, 1978). At the same time also the profit squeeze theory became highly popular among some Marxists (e.g. Glynn and Sutcliffe, 1972; Rowthorn, 1980). The main reason for this shift in thought was that the 1970s crises could not be solved by Keynesian demand management and thus could not be explained in terms of underconsumption but instead seemed to be based on an erosion of company profits either due to an increase in the accumulation of constant capital or due to an increase in wage shares (Clarke, 1994).

3.1.2. Inequality and its role in Marxian explanations for crises

The issue of distribution is inherent in all Marxian crisis theory as all theories are based on the notion of class struggle between capitalists and workers which in one way or another ultimately leads to falling profits for the former which is followed by a crisis[46]. According to Marx, the source of capitalists' profit is surplus value which is created by the exploitation of variable capital: labour output can be divided into output paid for with wages and output which is appropriated by capitalists; the bigger the latter the higher the surplus value created by labour. The degree of exploitation thus depends on real wages, labour time, and the productivity of workers. If, ceteris paribus, working time or output increase or real wages decrease surplus value automatically increases. For capitalists, however, it is not the surplus value but the profitability of their investment in constant and variable capital that is the main measure of success. To decrease unit costs capitalist thus

[45] Although most Marxists still see disproportionality as very important to explain and understand capitalist crises, it is nowadays rather seen as a trigger of a crisis which is caused by more fundamental contradictions within the capitalist system.

[46] The outcome of a crisis is that profits rise again because production capacity will be reduced (which leads to the destruction of some constant capital and a reduction in production) and rising unemployment leads to a reduction in real wages.

increase their constant capital stock to increase the productivity of labour (i.e. to use less labour per unit produced).

Accordingly, supporters of the 'tendency for the profit rate to fall' theory argue that the main reason for all crises is that the rate of profit falls if the amount of constant capital increases more than the level of exploitation (i.e the capital to surplus value ratio increases). To be more precise, "neither growing worker resistance nor rising real wages are the intrinsic causes of mechanization, though they may well speed up this tendency" (Shaikh, 1978, p. 233), instead the pressure to expand production and increase productivity (as a cause of intensified competition) is the real underlying reason for the increasing investment in constant capital (Shaikh, 1978; Bell and Cleaver, 2002; Evans, 2004). In other words, the followers of this theory see inequality as an outcome of the capitalist process but not as the root cause of crises. According to the second Marxist theory, the profit squeeze theory, a decrease in income inequality can be the root cause of a crisis. The argument is that an expanding scale of operation leads to more employment (i.e. to a reduction of the so called reserve army), which strengthens the bargaining position of the workers. If the subsequent rise in real wages is higher than the simultaneous increase in the exploitation of workers, capitalists' profits will fall, leading to less accumulation and hence a crisis[47].

The only Marxian theory which focuses directly on rising income inequality as a possible root cause for capitalist crises is the overproduction/underconsumption theory. This theory has different strands, however, the main logic behind it is that the produced surplus value needs to be realised (i.e. the output needs to be sold) to make profits and capitalists have the tendency to produce more than can be sold. Capitalists are producing to become richer (and not to fulfil people's needs and wants) and they are forced to increase their output due to competition (self-preservation). The increased accumulation leads to a

[47] Since its increasing popularity in the 1970s the profit squeeze theory has been widely criticised to be non-Marxian (see Shaikh, 1978, Clarke, 1994 and Evans, 2004 for an overview of the criticism). However, this criticism is somehow hard to explain as already at earlier points in time Marxians acknowledged that Marx stressed the important role that rising wages can play. Sweezy (1942, pp.149-154), for example, stresses that the profit squeeze theory is well documented in Marx's writings throughout all three volumes of Capital, e.g. "if one were to attempt ... saying that the working class receive too small a portion of their own product, and the evil would be remedied by giving them a larger share of it, or raising their wages, we should reply that *crises are precisely always preceded by a period in which wages rise generally* ... it seems, then, that capitalist production comprises certain conditions [that] permit the working class to enjoy that relative prosperity only momentarily, and at that always as a harbinger of a coming crisis (Capital II, p. 475-6, italics added)".

higher overall output. At the same time each capitalist tries to reduce wage costs (employment and salaries) to a minimum. While this strategy makes sense for every individual capitalist, ultimately capitalists' success is bounded by consumption demand: "Production mediates consumption; it creates the latter's material; without it, consumption would lack an object. But consumption also mediates production, in that it alone creates for the products the subject for whom they are products. The product only obtains its 'last finish' in consumption. ... Without production, no consumption; but also, without consumption, no production" (Marx, 1993, p.91).

Consequently, a reduction in employment and real wages can lead to a crisis if it substantially reduces the spending capacity of the working class (capitalists also consume but their demand for luxury goods has natural limits)[48]. Without adequate consumption demand, capitalists have no motive to increase their investment spending. Their extra output cannot be sold for a profit since they need to lower their prices to be able to sell all of their output. An increase in inequality can thus lead to stagnation or to a crisis if the result is massive overproduction (Sweezy, 1942; Baran and Sweezy, 1966; Bellamy Foster and Magdoff, 2009; Harvey, 2010a)[49].

3.1.3. 'Marxian' explanations for the subprime crisis and the role of inequality

Heterodox political economists that bring forward 'Marxian' explanations[50] for the subprime crisis can be broadly divided into two groups. One group claims that low profit rates in the producing sector were the root cause for the crisis (e.g. Harman, 2009; Potts, 2011; Freeman, 2010; Choonara, 2009; Kliman, 2012; or, from a different perspective Brenner, 2009). A second group argues that rising inequality and the prevention of

[48] Another reason why the surplus value might not be realised could be that the additional output has no use-value for consumers because markets become saturated. Consequently, capitalists are always forced to invent new product lines, to open up new sectors, and to undertake huge advertising campaigns (Bell and Cleaver, 2002; Harvey, 2010a).

[49] Prior to Marx, Malthus (1820) and Sismondi (1827) developed an underconsumption theory which however differs from Marx's theory in that in Malthus' and Simondi's eyes the purpose of production is consumption and not the creation of surplus value.

[50] Many heterodox economists claim that the subprime crisis was more a Minskian than a 'traditional' Marxian one (e.g. Moseley, 2008; O'Hara, 2009, Bellofiore, 2011) – the Minskian explanation for the crisis will be discussed in Section 3.2.3.

underconsumption is crucial to understand why the subprime crisis occurred (e.g. Bellamy Foster and Magdoff, 2009; Kotz, 2009; Harvey, 2010a; Onaran, 2010a, 2010b, 2011)[51].

The argument of the 'falling rate of profit group' can be summarised as follows: At the end of the 1960s and during the 1970s the profit rates fell sharply in the US, Europe and Japan as the 'golden age' of high profits after World War II came to an end. Although profit rates recovered from the 1980s onwards somewhat, they stayed well below the rates of the 'golden age'. The reason being that the organic composition of capital changed (i.e. the constant to variable capital ratio increased) so that less surplus value per invested capital was achieved[52]. These low profit rates led to less investment in the real sector which meant that "a growing [global] pool of growth of money capital [was] searching for outlets that seemed to promise higher levels of profitability ... All sorts of speculative, unproductive activities flourished [and the] financial system expanded as a consequence, since it played a key part in collecting together the funds for speculation" (Harman, 2009, p. 283). These developments thus fostered first the dot.com bubble and, after its collapse, the investment boom in the housing market followed because the securitisation of mortgages promised high returns for capitalists and thus was a convenient solution to escape the falling profit rate problematic. Many supporters of this theory also acknowledge that an increase in income inequality (i.e. the general decrease in real wages and social benefits) fostered the credit and the subprime mortgage demand from poor households to keep up their living standards. They claim however that the expansion of the financial sector, securitisation, speculation, and the increase in inequality were only reactions to the decline in profit rates in the productive sector, and that therefore the general law of the tendency of profit ultimately is the root cause of the subprime crisis.

The proposition that low profit rates were the main underlying cause of the crisis is challenged by many heterodox economists though – also by some of those that explain the 1970s crisis with the fall in the profit rate due to the 'overaccumulation' of constant capital. Their critique rests upon three main points. Firstly, from 1982 onwards profit rates were recovering and although they were not reaching the peak level of the mid 1960s they

[51] Obviously, the 'original' profit squeeze theory is not prominent to explain the low profit rates as real wages were constant or even falling in most countries prior to the crisis (as discussed in Section 2.4).

[52] Brenners' (2009) argument is different but also stresses that the low rate of profits is the culprit for the crisis. According to his analysis the low profit rates can be explained by the "intensification of international competition [which lead to] over-capacity in the global manufacturing sector ... tending to squeeze global prices and profits" (p.9).

were not particularly low – the rise in corporate profits was based mainly on rationalisation, rising levels of exploitation due to stagnant/decreasing real wages and increasing productivity, and decreasing corporate taxes (see e.g. Li *et al.*, 2007; Moseley, 2007; Shaikh, 2011; Onaran, 2010a; Evans, 2010; Duménil and Lévy, 2012). Secondly, "the reference point for the capitalists in the post 1980s was not the profit rates of the early 1960s in manufacturing, which might be higher than currently, but was the short-term and high return of financial assets" (Onaran, 2010a, p.4). Finally, the argument that an increase in constant capital accumulation led to the lower profit rates prior to the crisis is unconvincing on the ground that gross fixed investment was relatively low since the mid-1980s, while at the same time the labour force was expanded significantly on a global scale (Heartfield, 2008).[53]

Therefore, some heterodox authors (such as Bellamy Foster and Magdoff, 2009; Kotz, 2009; Panitch and Konings, 2009; Harvey, 2010a; Onaran, 2010a, 2010b; Mah-Hui and Hoe Ee, 2011; Russo, 2012) have put forward the argument that a 'Marxian' overproduction/underconsumptionist explanation for the crisis is more plausible and that the increase in income inequality needs to be given much more weight in the discussion[54]. The reason being, that the process of financialisation and the increasing demand for subprime mortgages can directly be attributed to the declining wage share and the increase in top management salaries since the 1980s (as discussed in Section 2.4)[55]: the increasing profits needed to be reinvested which led to a potential 'capital surplus absorption problem', because the consumption demand from ordinary households was restricted due to their stagnant real wages. This potential realisation problem was overcome by an increase in debt levels (mainly by US and UK households) and exports (from countries like Germany, Japan, and China) on the one hand and by increasing investment of surplus values in the financial sector, which was freed more and more from constraining

[53] Another challenge, which is discussed in detail in Chapter 4 (Section 4), comes from Lysandrou (2009, 2011a, 2011b) who argues the increase in the concentration of wealth in the hands of a tiny minority of the global population played a decisive role in the crisis according to this analysis.

[54] Please note that inequality is not seen as the sole cause by these authors but as a very fundamental one. Other crucial reason for the emergence of the crisis that are mentioned by these authors are: financial deregulation, financial innovation, an expansion of credit, speculative investment, the low federal fund interest rate between 2001-2004, the maturation of economies, the absence of groundbreaking innovations that stimulate the economy sufficiently (like the invention of the car), the absence of sufficiently large sinks for the surplus value (like huge urbanisation programmes, huge wars etc.), and increasing market concentration.

[55] Domhoff (2012), for example, reports that in the US CEO's pay and corporate profits went up by 300% and 100% respectively, while production workers pay only increased by 4% and the Federal minimum wage even decreased by 9% between 1990 and 2005.

regulations[56], on the other hand. The expansion of the financial sector meant that "[s]peculative finance became a kind of secondary engine for growth given the weakness in the primary engine, productive investment." (Bellamy Foster and Magdoff, 2009, p. 18). Consumption was thus stimulated by asset bubbles which lead to wealth effects, and at the same time more funds were channelled to poor households in the US – which, given their stagnant/declining wages, needed those funds to sustain their status and high consumption levels. This growth model relied on increasing issuance of credits (e.g. credit card debt, auto loans, and student loans) and subprime mortgages to (poor) households which was unsustainable in the long-run. Consequently, the "collapse of this [inequality driven] debt-led growth model was inevitable" (Onaran, 2010b).

3.2. Inequality and its role in post-Keynesian crisis theories

3.2.1. Post-Keynesian theories of crisis: an overview

Post-Keynesian economics is mainly inspired by the theories of John M. Keynes but "post-Keynesians [also] derive inspiration from a variety of [other] sources ... such as Marx, ... Kalecki, Kaldor, Leontief, Sraffa, Veblen, Galbraith, Andrews, Georgescu-Roegen, Hicks or Tobin, or from other disciplines (sociology, history, political science, psychology and anthropology)" (Lavoie, 2006, p.18). Although their influences are so diverse, post-Keynesian economists are often grouped into two main strands: the fundamentalist-Keynesians (which work in the lines of Davidson, Harrod, Minsky, Kregel, Robinson, and Weintraub) and the non-fundamentalist Keynesians (which work in the lines of Eichner, Kaldor, Kalecki, Pasinetti, and Robinson). This demarcation is not clear cut though – as can be seen for example by the inclusion of Robinson in both camps – and the exact definition of post-Keynesianism has led to extensive debates among post-Keynesians (see e.g. Crotty, 1980; Hamouda and Harcourt, 1988; Arestis, 1996; Davidson, 2003-2004; Kerr, 2005; King, 2005; Lavoie, 2005).

The main difference between fundamentalist and non-fundamentalist Keynesians nowadays is that the former especially stress the importance of the non-neutrality of

[56] The deregulation of the financial market is thus seen to be driven not only by ideology (neoliberalism) but also due to pragmatic reasons, i.e. to prevent stagnation.

money[57], fundamental (non-ergodic) uncertainty[58], and non-gross substitution[59], while the latter mainly concentrate their research on the effects of changes in the income distribution between workers, capitalists and rentiers[60]. Common denominators in post-Keynesian analyses are their emphasis on realism, uncertainty and social and institutional factors, their rejection of Say's law, their insistence on the fallacy of composition (i.e. the belief that micro foundations are often not suitable to theorise the macroeconomy), and their doubt about the beneficial self-equilibration of markets. Probably most importantly, all post-Keynesians see effective aggregate demand as the driving force of the economic system and they believe that investment determines savings, and not the other way around as neoclassical economists claim (Arestis, 1996; Lavoie, 2006). Consequently, post-Keynesian literature discusses three main factors that can destabilise the economic system: (i) an increase in uncertainty, (ii) the endogeneity of money and financial fragility, and (iii) changes in the distribution of income between workers, capitalists, and/or rentiers.

According to post-Keynesians, economic output depends on aggregate private consumption demand, aggregate investment, government expenditures and net exports (Stockhammer, 2008). Investment is seen to be driven by expected profitability which is driven by (expectations about) consumption demand, labour and capital costs, prices of financial assets, and interest rates. Hence, "it is the interaction between the sum of the individual firms' sales expectations (aggregate demand) and their production costs (aggregate supply) that together determine the development in output and employment" (Jespersen, 2009, p.199). Rising uncertainty with regard to sales expectations and production costs can thus lead to a crisis as it can distort the accumulation process, i.e. it

[57] According to Davidson (1984) "[m]oney matters in the long and short run; i.e., money is not neutral – it affects real decision making" (p.562) and thus "has an impact on the real sector" (p.569).

[58] Past information does not always permit stochastic predictions of the future according to Keynes (1937): "By 'uncertain' knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty... Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealthowners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatsoever. We simply do not know." (pp.213-214).

[59] I.e., "[n]onproducible assets that can be used to store savings are not gross substitutes for producible assets in savers' portfolios" (Davidson, 1984, p.567).

[60] In theory, workers receive their income only out of wages, while capitalists receive their income out of profits and rentiers receive their income through dividends, interest payments, rents, and capital gains. However, in reality many households occupy various contradicting class positions, e.g. capitalists and workers receive also rentier income, and managers are occupying the class position of capitalists (as they are executing power in firms), workers (as they are employed and receive wage income), and rentiers (through their stock options) at the same time (Stockhammer, 2004).

can reduce the 'animal spirits' of entrepreneurs and increase their liquidity preferences, so that they stop investing as they are fearing the risk involved (see e.g. Ferrari-Filho and Camargo Conceicao, 2005; Harvey, 2010b). Next to its influence on investment and consumption, uncertainty also 'necessarily gives rise to the possibility of speculation' (Dymski, 2011, p. 331) as it can trigger a misallocation of credit, financial crises via asset bubbles and bursts, over-indebtedness, and/or drastic exchange rate fluctuations (due to huge capital inflows or capital flight). The operation of the (international) financial system is hence seen as inherently instable and crisis prone by post-Keynesian economists (Grabel, 1995; Arestis and Glickman, 2002; Onaran, 2006; Nesvetailova, 2007).

In contrast to neoclassical theory, post-Keynesians believe that money is endogenously created by the system: an increase in credit demand by seemingly creditworthy agents leads to an increase in money supply by the financial system (partly through financial innovation). If financial actors, however, feel that the general default risk grows, their liquidity preference increases automatically and hence the supply of credit will be restricted (Minsky 1986, 1992; Wray, 1990; Lavoie, 2006). Accordingly, an economic crisis occurs if many economic units move from secure hedge financing to speculative financing, and from speculative financing to 'super-speculative' Ponzi financing[61]. This will happen endogenously because economic agents have the tendency to increase their level of indebtedness to (unsustainable) high levels "over periods of prolonged prosperity" (Minsky, 1992, p.8), on the grounds that profit expectations become euphoric over time. Lending and borrowing thus shift endogenously from a stable to a more unstable regime, i.e. banks allow more and more firms to become hedge and Ponzi financing units that consequently need to 'roll-over' their debt constantly. When the euphoria ends and debt levels become too high, asset prices fall and uncertainty and liquidity preferences of financial institutions increase, so that economic units cannot easily 'roll-over' their accumulated debt any longer (especially Ponzi financing units). Consequently, many economic units suddenly become bankrupt which in turn triggers a financial crisis and a recession (ibid, 1986, 1992).

[61] Hedge financing implies that economic units can repay their debt and the associated interest obligations with their cash-flow. Speculative financing units are those who can pay back their interest obligations with their cash-flow but who need to 'roll-over' (part of) their debt obligations, while the cash-flow of Ponzi financing units is neither sufficient to repay their debt nor the interests resulting from this debt. Ponzi units thus either need to increase their debt levels or to sell assets to be able to pay their interest and debt obligations (Minsky, 1986, 1992).

In addition, changes in the wage share, profit share, and rentier income share are crucial for many post-Keynesians in explaining the functioning of the economic system. In their view, an increase in real wages tends to have a positive impact on the economy as it normally leads to higher aggregate consumption demand (as workers have a higher propensity to consume than capitalists and rentiers). This leads to more employment and triggers investment by firms, which in turn raises productivity which makes further wage increases feasible (Palley, 2010a). A decrease of the wage share, on the contrary, is expected to have negative consequences on aggregate consumption demand and hence might lead to a crisis. However, an increase in the wage share can also have a negative impact on the economy: if higher wages negatively affect (expected) profits of capitalists and the (expected) volume of exports[62] firms will have fewer incentives to invest, this can possibly lead to less employment and lower accumulation rates. Economies thus can be wage-led or profit-led, depending on which of these two forces dominate[63] (Bhaduri and Marglin, 1990; Lavoie, 2006; Onaran *et al.*, 2011; Hein, 2011).

An increase in the income share of rentiers (i.e. the financialisation of the economy[64]) can 'indirectly' influence the stability of the economy negatively, if it leads to a lower wage share, higher inequality of household income, and increasing debt levels of households (see Section 3.2.3). Furthermore, financialisation can have 'direct' negative impacts on aggregate investment demand because an important feature of the financialisation process is an increase in shareholder value orientation, i.e. the management of firms (which is aligned by earnings performance related management compensations) pays high dividends to shareholders and buys back shares to ensure high share prices and capital gains for shareholders[65], instead of retaining profits. Consequently, non-financial companies (i) have fewer funds available to finance physical investment, and (ii) become increasingly leveraged, which makes it increasingly difficult for these firms to obtain

[62] Increasing wage costs make domestic firms less competitive on the world market.

[63] Empirically, "in the medium to long run domestic demand in most of the developed capitalist economies tends to be wage-led" (Hein, 2011, p.31). This finding is supported by a recent ILO study, which additionally finds that the "global economy in aggregate is wage-led [which means that there are] limits of strategies of international competitiveness based on wage competition" (Onaran and Galanis, 2012, p.3). In other words, an increase of the wage share in all countries would have a positive impact on global growth.

[64] "Financialization means the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies." (Epstein, 2005, p.3).

[65] Keynes (1936) himself was very critical about the role of rentiers in the capitalist system in general. For him rentiers are 'functionless investors' as "there are no intrinsic reasons for the scarcity of capital" (p.376) and he thus advocated a 'euthanasia of the rentier', i.e. the fixing of the interest rate at a very low level to induce investment, consumption, and secure full employment.

external finance. Thus, capital accumulation has the tendency to decline in finance dominated economies (Stockhammer, 2004, 2005-6, 2008; van Treeck, 2009a) and a crisis might occur if this decrease in investment spending is not offset by a sufficient increase in household consumption – aggregate consumption spending possibly rises because of increasing rentier income and wealth effects (i.e. debt-financed consumption)[66]. Moreover, a crisis might emerge because a finance dominated growth regime increases financial fragility due to the rising leverage ratios within the economy[67] (Palley, 2007; Hein and van Treeck, 2008; van Treeck, 2009b; Onaran *et al.* 2011; Bhaduri, 2011; Hein, 2012).

While post-Keynesians believe that instability and disequilibrium are inherent in free market economies they also believe that state intervention can stabilise the economic system to some degree. To be more precise, in contrast to Marxists they think that crises can be avoided if the macro-economy is well managed, financial markets are sufficiently regulated, and the 'golden rule' is followed that real wage growth is in line with labour productivity growth, i.e. that the wage share should be roughly constant[68] (Shaikh, 1978; Clarke, 1994; Davidson, 2003-4; Setterfield, 2010, 2011; Palley, 2010a; Hein and Stockhammer, 2011).

3.2.2. Inequality and its role in post-Keynesian explanations for crises

"Issues of class, power and distribution of income and wealth are at the heart of [post-Keynesian] analysis." (Arestis, 1996, p.114), as we have seen above. In terms of income

[66] Financialisation is expected to foster rising asset prices (stock market and housing). However, the increasing wealth of households exists only 'virtually', i.e. it cannot be realised by all households at the same time without affecting the asset prices negatively. That is the reason why the wealth effect primarily works via increasing consumer credits – which become available as households have higher collaterals (Bhaduri *et al.*, 2006).

[67] Please note that financialisation theoretically also can lead to a stable finance-led growth regime, which is most likely if the initial decline in investment is not too high and more than offset by increasing rentiers' household consumption and/or wealth effects, the increase in Tobin's q stimulates investment, interest rates are relatively low, and debt levels are kept below a certain threshold (see e.g. Boyer, 2000; Hein and van Treeck, 2008; Hein, 2012).

[68] This 'golden rule' should avoid inflationary pressure (Hein and Stockhammer, 2011) but it is disputed among post-Keynesians if such pressure exists and thus some post-Keynesians advocate a rising wage share (see e.g. Lavoie, 2006; Onaran and Galanis, 2012). Post-Keynesians do not define what the proportion of the wage share should be, i.e. according to the 'golden rule' the economy should be as stable with a constant wage share of let's say 50% than with a constant wage share of let's say 80%. This is interesting in terms of policy recommendations because if real wages grow in line with labour productivity than the current levels of inequality would be cemented (if everything else stays constant). To decrease the current levels of inequality some post-Keynesians thus advocate an increase of the top marginal income tax, inheritance taxes and wealth taxes in order to redistribute profits from the top to the bottom (see e.g. Onaran, 2011; Hein and Truger, 2012).

inequality, post-Keynesians distinguish between the functional and personal income distribution. The functional income distribution is a matter of class: it measures how much of the national income goes to workers (wage-share) and how much of the national income goes to capitalists and rentiers (profit-share); whereas the personal income distribution measures in how far the national income is equally distributed among individuals/households (please note, that an increase in the profit share does not necessarily lead to an increased income inequality, however, it is expected to do so normally[69]).

As outlined in the previous section, post-Keynesians argue that an increase in the functional income distribution tends to have negative impacts on the economy if the economy is wage-led. Similarly, an increase in the inequality of the personal income distribution can have negative consequences for the stability of the economy because poorer segments of the population have a higher marginal propensity to consume than richer segments of the population, i.e. an increase in income inequality is expected to lead to a decrease in aggregate consumption demand (Palley, 2002; Dutt, 2011; Stockhammer, 2012a). Hence, this post-Keynesian argumentation is very similar to the Marxian overproduction/underconsumption theory. This is because an increase in income inequality can lead to a crisis as a result of a systemic consumption demand shortage which subsequently leads to lower capital accumulation and unemployment.

The negative consequences of an increase in income inequality might not be immediately visible in a finance dominated economy though, if the poorer segments of the population are able to accumulate debt due to a greater availability of finance and because of rising asset prices (wealth-effect). However, the rising debt which initially ensures stable or growing aggregate consumption demand eventually becomes a burden to low income households as the interest obligations increase and thus higher saving rates are required by poor households. This means that in the long-run income is redistributed from poorer households to richer households and the consumption of poor households consequently will be constrained. Eventually, this will most likely lead to a debt burdened

[69] A small shop owner is a capitalist by definition, but his/her income might be lower and grow slower than the income of a manager (who by definition is a worker); or, the rentier income of a pensioner might be lower but grow faster than the wage of a blue-collar worker. However, most profits/rents are distributed to the richest segments of the society, e.g. in the US "[t]he top 10 percent of families as a group accounted for about 85 to 90 percent of stock shares, bonds, trusts, business equity, and non-home real estate" in 2007 (Wolff, 2010, p.20).

recession (Palley, 1994; Bhaduri *et al.*, 2006; Dutt, 2006, 2011) or, instead, translate into a financial crisis if rising asset prices and financial innovation enable poor households to engage in Ponzi finance to keep their living standards constant[70] (Hein and van Treeck, 2008; Bhaduri, 2011).

Increasing income inequality might also be counteracted by declining private sector savings (increasing propensities to consume), increased investment expenditure, and/or a trade surplus (i.e. external demand). However, ultimately "a mass-production economy needs mass-consumption markets to support it [and] robust mass-consumption markets rest on a healthy distribution of income." (Palley, 2002, p.11). This argumentation is very much in line with Keynes's original thoughts. In his 'General Theory of Employment, Interest, and Money' Keynes (1936, p.372) states that one of "the outstanding faults of the economic society [is] its arbitrary and inequitable distribution of wealth and incomes", as they lead to a low propensity to consume, and "every weakening in the propensity to consume regarded as a permanent habit must weaken the demand for capital as well as the demand for consumption." (p.106).

3.2.3. Post-Keynesian explanations for the subprime crisis and the role of inequality

Post-Keynesians have brought forward many different explanations regarding the root causes of the subprime crisis, as can be seen from a special edition that was published in the most prestigious heterodox journal, the *Cambridge Journal of Economics*. Among these explanations have been technological and financial innovation (Perez, 2009), imbalances in exchange rate regimes and trade and capital flows (Wade, 2009), central bank policy failures (Morgan, 2009), increased banking concentration and banking leverage (Tregenna, 2009), and the set-up of the institutions of the knowledge economy with regard to intellectual property rights (Pagano and Rossi, 2009). However, arguably the two most widely stated reasons for the crisis, which also have been discussed in the special issue, are (i) failures in financial regulation (Crotty, 2009) in combination with Minskyan instability (Wray, 2009), and (ii) the financialisation of the economy which led to an increase in income inequality (Palma, 2009).

[70] Please note that high propensities to consume by rich households, very low interest rates, and infinitely rising asset prices theoretically could lead to a stable growth regime.

That the Minskian instability hypothesis is so prominent in the post-Keynesian debate is a bit surprising at first sight because "Minsky viewed downturns as caused by investment cycles, not by housing-price collapses [and] he focused attention on non-financial and financial firms, not on households" (Dymski, 2010, p.240). However, proponents of the Minskian view claim that although the subprime crisis differs in important aspects, it can still be regarded as 'Minskian' because Minsky always stressed the important role of institutional changes, money managers, and securitisation in the modern financial system. Moreover, the housing bubble and the growth of the subprime market was a systemic problem that was the result of de-regulation, (over-)optimistic expectations and ratings, financial innovation (i.e. credit creation), the search for high returns, rising asset prices, high leverage, and Ponzi finance schemes. All of which took place in a prolonged period of relative stability, i.e. during the Great Moderation. Thus, the subprime crisis is seen as a good example of the inherent instability of financial markets by many post-Keynesians as it supports Minsky's view that 'stability is destabilising' (see e.g. Kregel, 2007; Whalen, 2007; Wray, 2008a, 2008b, 2009; Wray and Tymoigne, 2008; Vercelli, 2009).

Most proponents that discuss the subprime crisis in the light of Minskyian instability only mention inequality in passing, if at all. Two notable exceptions are Dymski (2010) and Kaboub *et al.* (2010). The latter state that "a major contributing factor to the conditions leading to aggressive subprime lending behaviour is the build-up and persistence of economic inequality that has intensified since 1980" (p.9), and Dymski stresses that an important institutional feature of the subprime crisis was that banks, from the beginning of the 1990s, increasingly targeted low income minorities who had previously been excluded from financial markets. Both thus find that inequality was an important feature in the Minskian instability process. Nevertheless, the advocates of the financialisation theory claim that the Minskian "theory only provides a partial and incomplete account of the [subprime] crisis" (Palley, 2010) and that aggregate demand, and thus also inequality, need to be at the heart of the analysis.

According to the financialisation theory, "[s]lower growth, higher inflation and unemployment, and falling profits and stock prices created growing discontent with the economic status quo" at the end of the 1970s (Crotty, 2012, p.83). This led to 'right-wing' economic coalitions which radically deregulated financial markets, while at the same time institutional investors gained importance and the market for corporate control developed.

The outcome of these developments was the enormous growth of the financial sector in OECD countries and the rise of shareholderism, which meant that firms had increasing pressure to achieve high profits to satisfy rentiers. Along with its unfavourable effects on physical investment (as discussed in Section 3.2.1) the functional and personal income distribution in OECD countries was also negatively affected by this financialisation of the economy: (i) via the rising importance of the financial sector, which had high profits and paid high management salaries, (ii) via the increase in top management salaries and rentiers' income, (iii) via its pressure on companies to reduce non-managerial wage costs, and (iv) via its negative impact on trade union bargaining power and employment (Stockhammer, 2008; Palmer, 2009; Evans, 2010; Crotty, 2012).

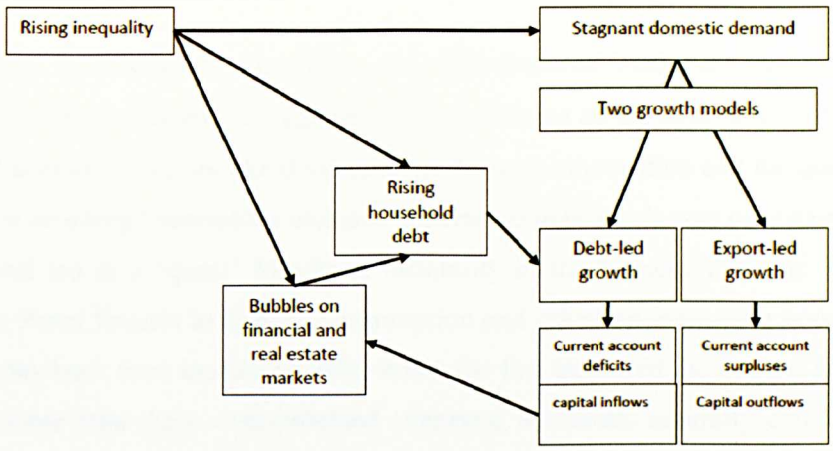
The overall outcome of financialisation and the accompanying increase in intra-country inequality (as discussed in Section 2.4) thus should have been a lack of aggregate demand. This was, however, circumvented by a decrease in personal saving rates and an increase of wealth and debt financed consumption in some countries, i.e. Greece, Ireland, Portugal, Spain, UK, and the US, and by an increasing reliance on exports in the 'mercantilist' countries, i.e. Austria, Belgium, China, Germany, Japan, Netherlands (see Figure 13). This post-1980 global growth regime was only possible because of the increase in consumption expenditure and private housing investment in the US[71]. One reason why the US private expenditure could increase, despite stagnant wages of non-supervisory US workers and increasing income inequality[72], was that the number of working hours per family was going up (mainly due to increased female participation). Another reason was cheap imports (mainly from China). The most important reason was, however, that the bottom 90% of US households stopped saving[73] and at the same time massively increased their debt-to-income ratios (Palley, 2007, 2010ba, 2010b; Stockhammer, 2008, 2012a; Palmer, 2009; Horn *et al.*, 2009; van Treeck, 2009b, 2012; Setterfield, 2010; Hein, 2011; van Treeck and Sturn, 2012; Hein and Truger, 2012).

[71] Between 1980 and 2007 "private consumption as a share of GDP increased massively by almost 10 percentage points" (van Treeck, 2012, p.5).

[72] "Real pre-tax income growth (excluding capital gains) has been considerably lower in 1977-2007 as compared to 1947-1977 for all families except for those at the very top" ... While the pre-1977 period thus can be termed the 'Great Divergence', the "first period is also referred to as the 'Great Convergence' ... as lower and middle incomes have grown faster than top incomes." (van Treeck, 2012, p.6).

[73] The personal savings rate in the US decreased from 10% in 1980 to 0.6% in 2007 (Palley, 2010a).

Figure 13: Rising inequality as a cause of the crisis from a post-Keynesian perspective



Source: Stockhammer (2012a); for simplicity reasons the impact of regulation is not shown in this version

The increased demand for credit was thus not the result of higher income mobility (which prior to the crisis was often argued by mainstream economists) but was instead the consequence of a rise in permanent income inequality in general and the rapid increase in the income of the top 1% in specific[74]. According to this post-Keynesian point of view, the dramatic increase of income of top earners in the US is very important for the story because, apparently, many US households lived for so long beyond their means in an effort to keep their social status relative to those wealthier members of the society. Top income driven inequality thus gave rise to an 'expenditure cascade' in which middle-income and poor households were only able to keep up with the rapidly increasing consumption of the top income earners by curtailing their savings and increasing their borrowing[75] (Barba and Pivetti, 2009; Frank *et al.*, 2010; Hein, 2011, 2012; van Treeck, 2012; van Treeck and Sturn, 2012). "[A]fter 1987 the amount of income considered necessary to get along again increased strongly, by more than 40 per cent until 2007", whereas the increase in median income was much lower (15%) during the same period (van Treeck and Sturn, 2012, p.17). As a consequence, the debt to income ratios of the bottom 95% of the US population in terms of income distribution increased from around 70% in the mid-1980s to around 140%

[74] "[D]uring the seven-year period of economic expansion of the Clinton administration the top 1% of income earners captured 45% of the total growth in (pre-tax) income, while during Bush's four-year period of expansion no less than 73% of total income growth accrued to the top 1%." (Palmer, 2009, p.842).

[75] This relative income hypothesis, which states that to 'keep up with the Joneses' a fall in the personal saving rate and/or increase in borrowing is necessary, was originally developed by Duesenberry (1949).

in 2007, while the debt to income ratios of the richest 5% of the US population stayed relatively constant at around 70%.

According to this view, inequality and debt-financed consumption are central to explaining the pre-crisis growth regimes and the collapse of the subprime market, next to important facilitating factors like de-regulation, financial innovation and the quest for high returns. The resulting tremendous increase in personal debt-levels was unsustainable in the long-run and led to a 'quasi' Minskyan instability in the household sector. Households engaged in Ponzi finance to finance consumption and relied on increasing house prices to be able to pay back their increasing debt. When the Fed increased the interest rates and the housing bubble bust these over-indebted subprime borrowers naturally could no longer repay their debt. This led to mass foreclosures, the breakdown of the market for CDOs, and a decrease in aggregate demand which also had negative consequences on the 'mercantilist' countries (Palley, 2010b; Setterfield, 2010).

3.3. Inequality and its role in mainstream crisis theories

3.3.1. Mainstream theories of crisis: an overview

In contrast to post-Keynesians and Marxists, orthodox mainstream economists "deny that crisis is inherent ... in capitalist production" (Clarke, 1994, p.5). In their view free market operations (i.e. the forces of supply and demand[76]) will ensure that the system is self-regulating via an 'invisible hand' and that economies have equilibrium tendencies, i.e. crises are only exceptional deviations from the normal growth path. This general equilibrium theory is in line with the economic thoughts from classical economists like Smith, Mill, and Ricardo[77] and assumes that full-employment is the norm, that rational economic agents are maximizing utility, and are fully-informed and homogenous in their behaviour, that no fundamental uncertainty exists, that money is neutral, and that (financial) markets work perfectly efficiently. The resulting efficient market theory implies that assets cannot be persistently over- or undervalued as investors would take advantage of price differences, and hence prices will return nearly immediately to their 'fundamental

[76] Neo-Classical economists also believe that self-regulation takes place via adjustments in interest rates and exchange rates. They therefore claim that market interest rates and exchange rates need to be fully flexible.
[77] Although Smith "himself took a broader perspective on *self-interest* than his modern-day disciples [and] used the term 'invisible hand' with some irony" (Stiglitz, 2011, p.591).

values' via arbitrage (Friedman, 1952; Fama, 1970, 1991; Clarke, 1994; Nesvetailova, 2007).

According to this neo-classical view rationality will ensure that banks only give money to creditworthy borrowers, and that borrowers will only demand credits up to a level to which they are able to repay the loan with their (rightly expected) future income streams. Additionally, it is assumed that a prudent monetary policy (i.e. a tight money supply) will ensure low and stable inflation rates. Consequently, crises are not seen as systemic failures of the real or financial sector but they are seen to result "from some policy miscalculation or governmental ineptness, plain corruption or a severe external shock to the economic system" (Nesvetailova, 2007, pp.26-27) [78]. In other words, crises are regarded as market self-corrections which are necessary to overcome sporadic exogenous disturbance and/or misguided government policies (like too high government debt levels which lead to 'debt intolerance' by investors, as prominently argued by Reinhart and Rogoff, 2010) and ensure the long-term healthiness of the system.

Research on financial crises in emerging economies by mainstream economists has put some doubt on this orthodox notion that markets work perfectly fine when they are left on their own. The new-Keynesian Krugman (1979), in his so called first generation model on financial crises, was one of the first mainstream economists who claimed that fundamental macroeconomic variables can be negatively influenced by imbalances in the balance of payments of countries. This strand of research was developed further in so called second, third, and fourth generation models of financial crises after they became a widespread problem in developing economies in the 1990s (Muñoz, 2011). The third and fourth

[78] External shocks are also commonly referred to as 'sunspots'. While those 'sunspots' might influence endogenous variables of the system, ultimately the system is always seen to been thrown out of equilibrium due to random exogenous factors: "Intrinsic uncertainty is caused by stochastic fluctuations in the primitives or fundamentals of the economy. An example would be exogenous shocks that affect liquidity preferences. Extrinsic uncertainty by definition has no effect on the fundamentals of the economy. .... An equilibrium with extrinsic uncertainty is called a sunspot equilibrium, because endogenous variables may be influenced by extraneous variables (sunspots) that have no direct impact on fundamentals. A crisis cannot occur in a fundamental equilibrium in the absence of exogenous shocks to fundamentals, such as asset returns or liquidity demands. In a sunspot equilibrium, by contrast, asset prices fluctuate in the absence of aggregate exogenous shocks, and crises appear to occur spontaneously." (Allen and Gale, 2007, p.129). For example, in Diamond and Dybvig (1983) model bank runs are an idiosyncratic phenomenon. The reason for the bank run is the knowledge of lenders that, due to the maturity mismatch between deposits and credits, banks are not able to repay all deposits at the same time if a bank run occurs on a particular bank. Another reason why a crisis occurs might be that "bank's initial portfolio choices ... in combination with small shocks to the demand for liquidity ... cause a collapse in asset prices [and] substantial asset-price volatility and/or default" (Allen and Gale, 2007, p.148). However, in both models the trigger of the crisis is seen to be an exogenous shock.

generation of these models claim that in financially open economies negative effects of massive capital outflows together with the creditworthiness of the balance sheets of the economy are the two key components to explain financial crises. In other words, (i) countries receive external capital and are getting indebted in foreign currency; (ii) at some point investor's perception of the riskiness of the domestic balance sheets changes, which leads to massive capital outflows (e.g. due to expected depreciation or contagion); (iii) this capital flight weakens the currency and exhausts the reserves of a country; (iv) the already weakened local currency collapses; (v) highly leveraged entities within the country are unable to repay their external (short-term) debts; (vi) the financial and real sector turns into crisis (see e.g. Krugman, 1999; Dornbusch, 2001; Tornell *et al.*, 2004). The key trigger for a financial crisis thus is seen to be the change in the expectations of foreign investors.

The assumption about the endogenous stability and efficiency of markets, however, most prominently got challenged by the imperfect and asymmetric information theory from the new-Keynesian Nobel Prize winners Akerlof (1970) and Stiglitz (with Rothschild, 1976). According to their theory not all market participants have the same information and, therefore, markets work not as perfectly as orthodox economists claim. Firstly, there are difficulties to appropriate the returns for the investment necessary to receive 'first-hand' information because this information spreads quickly in the market. Secondly, one party might have better information than other parties (e.g. a borrower is better informed about the riskiness of an investment than the lender). In other words, market incentives exist (i) to minimise the costs in acquiring information, (ii) to conceal information to other market participants (e.g. agency problems), and (iii) to insure against risk (e.g. credit rationing). This means that market disequilibria can arise endogenously (see Stiglitz (2002) and Rosser (2003) for an excellent overview)[79].

Accordingly, an economic crisis can result from an economic downturn, which "may be initiated by an oil price shock, a monetary shock, or a dramatic change in expectations" (Stiglitz, 1992, p.284), because information imperfections in the equity market lead to the situation that "relatively small fractions of new capital is raised by new equity issues" (p.278). In addition, banks are starting to restrict their lending, whereas during the pre-

[79] Other market imperfections might be caused "when there are 'externalities' (where one party's actions can have large negative or positive effects on others for which he does not pay or reap the benefits ... or where risk markets or other markets are absent (one can't, for instance, buy insurance against many of the most important risks that one faces)." (Stiglitz, 2012, p.34).

downturn period most investment is financed with credits. The consequence is that firms will not only invest less and hire fewer workers – which has negative impacts on aggregate demand – but also many firms will go bankrupt due to their high debt levels. This in turn will lead to further lending restrictions and less equity issues, and a further exacerbation of the crisis. This theory is also directly linked to third and fourth generation models of financial crises because imperfect and asymmetric information is seen to be crucial to understand why "a sudden change in lenders' perceptions concerning 'emerging market risk' [can emerge, which in turn] can lead to huge capital outflows, undermining the viability of the entire financial system" of a country (Stiglitz, 2000, p.1080). So, in a nutshell, financial fragility is not seen to develop endogenously (i.e. to be inherent to the system) but necessarily "...is a situation in which small shocks have a significant impact on the financial system" (Allen and Gale, 2007, p.126). These shocks may be trivial (bankruptcy, refusal of credit, a suicide, etc.) but they are significant enough to change the perceptions of market participants or to bring an important actor of the system into trouble.

Another strand that challenges the position of the endogenous stability of markets, which has gained more and more attention in recent years and can be seen as an outcome of the asymmetric information theory (see Akerlof, 2002), is the so called behavioural finance theory – based on Kahneman and Tversky's (1979) work and most prominently put forward by Shiller (2000), Shleifer (2000) and Akerlof and Shiller (2009). According to this theory psychology factors like greed, loss of self-control, investor's preferences, overconfidence and -optimism, and under- and over-reactions due to herding behaviour explain financial instability. In other words, the theory assumes that 'non-rational' behaviour leads to speculation and to the deviation of market prices from their 'fundamental' value and explains why bubbles and financial crashes exist[80].

However, the most widely used mainstream models of today, the so called Dynamic Stochastic General Equilibrium (DSGE) models, normally do not consider the findings of behavioural finance (i.e. the models normally rely on the assumption that all individuals are identical, utility-maximising, and rational), and they also treat incomplete and asymmetric information and agency problems as special cases (i.e. they assume that all markets are in equilibrium). In addition, most DSGE models do not incorporate money, the

[80] This theory is closely related to the mania and panic theory from Kindleberger (see Kindleberger and Aliber, 2005).

financial sector (e.g. no borrowing and lending takes place) and the government sector in a meaningful realistic sense, and they do not take into account that macroeconomic outcomes can be very different from the existing micro-foundations (for a detailed discussion of the limitations of DSGE models see Dullien (2009) and Stiglitz (2011)). Due to these shortcomings, and more importantly because these 'New Consensus' models "have failed [to] predict that the [recent] financial crisis would happen; and ... understated its effects" (ibid, 2011, p.591), the usefulness of DSGE models is questioned by some prominent mainstream economists.

3.3.2. Inequality and its role in mainstream explanations for crises

From the previous discussion it becomes clear that income inequality does not play a prominent role in mainstream discussions of crises. Strangely this is also true for behavioural economics which, to my knowledge, does not discuss changes in the behaviour of households based on changes in inequality levels. For orthodox economists equilibrium is determined by the laws of supply and demand, and institutions and power relations are normally not taken into account. This means that inequality is seen as a 'just' outcome of differences in productivity (e.g. through Cobb-Douglas production functions, see Fischer (2011)), which is not expected to have a destabilising effect on the economic system because changes in earnings, debt and savings are seen as optimal in an economic sense, Say's law is assumed to hold (i.e. supply creates its own demand), and full-employment is assumed as norm.

The fact that inequality is not prominent in mainstream research can also be seen from the fact that the vast majority of DSGE models are based on one representative agent. This means that "there are no distributive issues [and] no scope for exploitation [because] what the worker loses through lower wages, he/she gets back in his/her role as 'owner' through higher profits" (Stiglitz, 2011, p.598). Furthermore, DSGE models normally disregard the possibility of excess indebtedness, as no financial market is included in most models. In other words, according to the vast majority of mainstream theories and models, inequality will have neither a negative impact on aggregate demand nor will it lead to over-

indebtedness[81]. Even if capital markets are taken into account mainstream theories of consumption "...see no link between the inequality of (permanent) income and aggregate personal consumption, and hence no need for government action..." (van Treeck and Sturn, 2012, p.1). The reason for this view is that households are expected to be able to smooth fluctuations in income with the help of financial markets and that inequality is seen to be rather influenced by transitory changes (e.g. depending on the age of the individual) and not by permanent changes in lifetime income (Krueger and Perri, 2006). However, since the onset of the subprime crisis a minority of mainstream economists have questioned these assumptions. These are discussed in detail in the next section.

3.3.3. Mainstream explanations for the subprime crisis and the role of inequality

The majority of mainstream economists think that either "there is no convincing link that would enable us to associate high levels of income inequality with the financial crisis" (Roháč, 2011, p.1) or that inequality might have played a facilitating role but that other factors were much more important. The most often discussed root causes of the crisis are therefore the lack of regulation (see e.g. Davies, 2010), greed on the part of the banks (see e.g. Brummer, 2009), the widespread undervaluation of risk (see e.g. IMF, 2008; Trichet, 2008), and global imbalances together with a misguided monetary policy based on too low interest rates (see e.g. Obstfeld and Rogoff, 2009), as discussed already in the introduction.

Nevertheless, more and more prominent economists acknowledge that income inequality also was a root cause for the crisis. Rajan (2010) was one of the first that prominently theorised the link between inequality and the subprime crisis. According to his view skill-biased technological change increased permanent inequality in the US, and the "political response to [this] rising inequality ... was to expand lending to households, especially low-income ones [with] the broader aims of expanding credit and consumption" (9). This expansion of credit led to a consumption boom (which helped to circumvent under-consumption problems in other countries and was financed by increasing capital inflows) and the over-indebtedness of US households which was not sustainable in the long-run. In accordance with heterodox economists Rajan thus also acknowledges the important role of credit to circumvent a possible demand shortage.

[81] A notable exception is the model from Kumhof and Ranciere (2010) and the model from Kumhof *et al.* (2012) that are both discussed in the next section.

In contrast to post-Keynesian and Marxist economists, he is however not claiming that the economic system as such is prone to crisis. His main emphasis lies on government failure (in his view government incentives for financial markets and poor households ultimately enabled the increased borrowing of low income households) and educational failures (which lead to increasing inequality). This main conclusion with regard to policy recommendations is that education needs to be strengthened to decrease inequality, banking regulation should be strengthened to prevent speculation, and multilateral organisations should act to reduce the existing global imbalances, while domestic governments should not intervene otherwise.

In line with Rajan, other mainstream economists like Roubini (in a 2011 opinion piece), Krugman (2010), Reich (2010), Stiglitz (2009, 2012), Milanovic (2012), Kumhof and Ranciere (2010), and Kumhof *et al.* (2012) also reject the orthodox notion that there is no link between inequality and demand problems. In line with Rajan, Milanovic (2012, p.195) emphasises that "[p]oliticians were eager to 'solve' the irritable problem of middle-income stagnation" and thereby facilitated the access to housing for the middle class and poor with the aim of maintaining consumption. For Roubini (2011), on the contrary, the main problem is that "free markets don't generate enough final demand" so that increases in private debt are a consequence of a general failure of market forces.

Stiglitz (2009, 2012) agrees that the crisis has shown that the economic system is not always endogenously stable. He also argues that aggregate demand in the US and in the world in general would have been insufficient without the lax monetary policy after 2001 and the stock market bubble and then the housing bubble that "fuelled a consumption boom that allowed Americans to live beyond their means" (ibid, 2012, p.54) to keep up with the living standards of the richer parts of the population. For him the main reason for this problem is asymmetric information which led to market distortions, and coordination and macroeconomic failures. The resulting increasing power and rent seeking behaviour of the top 1%, which successfully lobbied for less state intervention and less redistribution, and the decreasing power of the working class (due to de-regulation, globalisation and weaker labour unions) coupled with the sectoral shift away from manufacturing and the existing skill-biased technological change meant that polarization of incomes increased sharply prior to the crisis. However, this behaviour was unsustainable in the long run as households became overleveraged and because the housing bubble could not last forever.

Krugman (2010) agrees that the influence of rich people on domestic policies has been a major problem, but in contrast to Stiglitz he is claiming that not underconsumption but overconsumption by poor and middle-income US households was a major problem prior to the crisis.

Like the heterodox economists, all of these mainstream authors acknowledge that next to the high inequality levels in the US the high levels of global inequality were also important. Vandemoortele (2009) especially stresses this link. According to his view "within- and between-country inequality are mutually reinforcing" (iv), while intra-country inequality led to an aggregate demand problem global inequality contributed to BoP imbalances, unequal capital flows and the accumulation of reserves, which all have played an important part in the run-up to the crisis. This point is conceptualized by Kumhof *et al.* (2012) who are using an open economy DSGE model which is based on a closed economy DSGE model developed by Kumhof and Ranciere (2010). Both models have two groups of households: investors (the top 5% of the population) and workers (the bottom 95% of households). In the closed economy model crisis results from an external 'bargaining power shock' that results in increasing inequality. The increase in inequality leads to higher credit demand from workers who seek to smooth consumption, while the top 5% recycle their gains to poorer households in the forms of loans. Over time workers get over-indebted and "large-scale household debt defaults [leading to] an abrupt output contraction" (p.1).

The 2012 extension of this model argues the result of increasing inequality on a global scale is that workers in countries that have highly developed financial markets (US, UK) borrow not only domestically but also from (emerging) economies which have a less developed financial system (China). The latter group of countries use an export oriented strategy to grow despite weak domestic consumption demand, while the rich part of their population recycles its increasing gains to developed economies with sophisticated financial markets. Countries with developed financial markets and current account deficits on the other hand overcome the under-consumption problem because of the ability and willingness of workers to increase their lending[82]. The authors conclude that the resulting increasing BoP imbalances and over-indebtedness of workers in rich countries contributed

[82] This theory does however not explain why in countries like Germany and Japan (which both have sophisticated financial markets) household debt levels were not increasing significantly – instead both countries relied on export-led growth.

to the subprime crisis which affected both groups of countries negatively in the post-crisis period.

3.4. Conclusions

The previous discussion clearly shows that the issue of distribution is inherent in all Marxian crisis theories as they are all based on the notion of class struggle between capitalists and workers. The only Marxian theory which sees rising inequality as the root cause for crises is however the overproduction/underconsumption theory. For many post-Keynesians possible aggregate demand problems due to changes in the functional income distribution between workers, capitalists and rentiers are also at the heart of the analysis; but, fundamental uncertainty and Minskian instability (which are both normally not related to inequality by post-Keynesians) are at least as prominent in post-Keynesian crisis discussions. In contrast to Marxist and post-Keynesian economists, the vast majority of mainstream economists believe that the capitalist system is endogenously stable and that only exogenous shocks destabilise the system. Furthermore, mainstream theories and models do not regard inequality as destabilizing prior to the crisis.

In spite of these differences, economists from all three strands provide a similar explanation (most comprehensively articulated by post-Keynesians, see Figure 13) why income inequality was a root cause of the subprime crisis: a possible global aggregate consumption demand problem was circumvented by a massive increase in household borrowing in some countries, mainly in the US and the UK, and a mercantilist export-led growth strategy in other countries, for example in China and Germany. The increase in borrowing by private households in debt-led countries was made possible by a stock market bubble and more importantly by a housing bubble and financial liberalisation. The driving force for this increasing demand for loans was that in an era of stagnant real wages low- and middle-income households wanted to keep their status in relation to richer peers which had increasing incomes ('keeping up with the Joneses' effect). Over time global BoP imbalances increased and many of the bottom 90% households became over-indebted. The collapse of this system occurred in summer 2007 when the delinquency rates of US households – due to rising interest rates and falling house prices – on subprime and jumbo mortgages became too high. The subsequent breakdown of the CDO market made the

bailouts of banks across the world necessary and culminated in a global credit crunch and recession. The impact of the crisis on the real economy was felt strongest in debt-led countries, as consumption via borrowing was no longer possible, but was felt also in mercantilist countries due to the decrease in their exports.

The rising intra-country income inequality and the high level of global income inequality (see Chapter 2) thus are seen as important contributing factors for the crisis by heterodox and some mainstream economists. This does not mean that an increase in income inequality will always necessarily lead to a crisis. Indeed also a decrease in inequality can lead to a crisis if profits are squeezed too much, and recent empirical research by Bordo and Meissner (2012) and Atkinson and Morelli (2011) suggest that institutional and country-specific circumstances need to be taken into account to establish if income concentration leads to credit booms and (financial) crises. However, similar explanations of the link between income inequality and the subprime crisis by economists are using different theoretical concepts strongly suggest that the first research question has to be answered with yes, i.e. the increase in income inequality indeed contributed to the growth and collapse of the US subprime mortgage market.

The majority of economists nonetheless still give primacy to other factors than inequality to explain the root causes of the subprime crisis, namely the deregulation of the financial sector, the lax monetary policy after 2001, wrong government incentives, and the greedy behaviour of the financial sector. One important reason why inequality is not at the forefront of debate is that changes in income inequality explain why the household demand for (subprime) mortgages and other loans was rising, but they cannot explain why these credits have been re-securitised into CDOs that were sold to investors. To close this gap in explanatory power the remaining parts of this dissertation will argue and show that the flipside of income inequality, wealth concentration, also needs to be taken into account to make economic inequality truly prominent in the subprime crisis debate.

4. Wealth Concentration and its possible link to the subprime crisis

Ill fares the land, to hastening ills a prey,
Where wealth accumulates, and men decay
(Oliver Goldsmith, 1770)

The inequality arguments that were discussed in the last chapter concentrate on the flow side of inequality, i.e. the effect of increasing income inequality on aggregate consumption and credit demand. In other words, the focus of the analysis lies on the poorer end of the population and their reaction to larger income inequality. The flipside of increasing income inequality, the concentration of wealth[83] in the hands of few individuals, is neglected in these conventional crisis theories. That does not mean that wealth concentration has not been discussed at all. Some of the aforementioned authors mention for example that in the pre-crisis period an increase in top incomes and more concentrated wealth led to speculation and an increasing demand for risky financial products with high yields (see e.g. Bellamy Foster and Magdoff, 2009; Crotty, 2009; Harman, 2009; Onaran, 2010b; Milanovic, 2011). However, these statements are merely made as a passing note without demonstrating empirical evidence and/or developing a deeper theoretical framework about a possible crisis mechanism stemming from increasing wealth holdings at the top.

The only exception is the research from Lysandrou (2009; 2011a; 2011b), who argues that not only the 'dispersion' aspect of income inequality (i.e. the distribution of income across different groups) but also the 'concentration' aspect of inequality was important in the build-up of the subprime crisis. His argument, in a nutshell, is that changes in absolute wealth concentration (i.e. the absolute amount of money that rich people need to (re-)invest) were important because an increase in the concentration of wealth led to an increase in the demand for investible securities, while at the same time the supply of these securities was limited. If Lysandrou's analysis is correct, economic inequality had an absolutely centrally causal role for the subprime crisis and was at least as important as de-regulation: just as stagnant incomes of the bottom 90% and rising income of the top 10% were among the 'supply-push' factors in the ABS and CDO growth inasmuch as mortgage loans constituted the raw material for many of these securities (and inasmuch as they helped to fuel the housing bubble), so was wealth concentration one of the 'demand-pull'

[83] The term wealth refers most of the times to the amount of material assets that a person or household possesses minus the liabilities of that person or household (i.e. the net worth of a person or household). However, "[t]here is a lack of agreement on concepts, indicators and definitions" (Schürz, 2011, p.1).

factors to create more and more of them. The aim of this chapter is to establish if absolute wealth concentration indeed has increased prior to the crisis and to outline the possible link between wealth concentration and the growth of the ABS and CDO market.

The structure of this chapter is as follows: section one reviews the pre-crisis trends in wealth inequality and wealth concentration on a global level. Section two gives an overview about the extent of absolute wealth concentration in the hands of HNWIs. Section three outlines the 'bond yield conundrum' phenomenon and the 'search for yield' theory and section four synthesizes the findings and discusses the methodological aspects as to how a robust link between absolute wealth concentration and the subprime crisis can be established.

4.1. Historical and current levels of relative wealth inequality

Trends in wealth inequality have long been hotly debated. On the one hand, Marx and Engels, and their followers, argued that the inevitable tendency of the rise in wealth concentration was a reason for the unsustainability of the capitalist system, while on the other hand defenders of capitalism (e.g. Porter, Giffen, and Marshall) have argued that wealth concentration was constant or narrowing but not growing. However, neither capitalist critics nor capitalist defenders have provided substantial evidence for their claims (Lindert, 1986). This situation has changed somewhat thanks to the efforts of some economists that specialised in the history of inequality. However, although more historical and recent wealth data have become available in recent years, Williamson and Lindert's (1980, p.72) statement that "the extant wealth data do not improve in quantity and quality over time [because the] twentieth-century wealth distributions are based on numbers only a little more plentiful and probably more flawed than wealth data for earlier centuries" is unfortunately still to a large extent true. Hence, it is not possible to give such an in depth overview about current levels and historical trends of global wealth inequality as it is for income inequality (see Chapter 2).

Wealth inequality is normally measured in the same way as income inequality. The two most widely used concepts to describe wealth inequality levels are the Gini Index (see Equations 1 – 4 in Section 2.1.1, but with wealth instead of income) and the relative concentration of wealth at the top (i.e. the wealth holdings of the Top 1%, Top 5% and/or

Top 10% of the population as a percentage of total holdings). Intra-country wealth inequality studies only exist for a few countries for which data could be found relatively easily (most studies deal with the US and UK). To my knowledge no existing study has sought to measure inter-country wealth inequality levels, and only recently have two studies tried to measure global wealth inequality. The reason for this is that while income data already is relatively sparse and imprecise, and a comparison of income inequality between countries is not one hundred per cent reliable, the situation is even worse in the case of wealth data.

Data on wealth holdings are retrieved mainly from six sources: household surveys, household balance sheets, tax records, investment income data, and direct wealth estimates for named persons. However, none of these data sources is free from severe shortcomings. Therefore, "the available data has to be interpreted with caution" (Schürz, 2011, p.1). Household survey data on wealth, for example, are less reliable than income survey data because wealth is more heavily skewed and thus sampling errors are more likely. Furthermore, non-response and misreporting – deliberately or because of ignorance – are much more prevalent in wealth surveys than in income surveys and many of the data are also top coded. As a result, surveys most likely underestimate the degree of wealth inequality and have a middle-class bias (Davies and Shorrocks, 2000, Schürz, 2011, Shaxson *et al.*, 2012). Consequently, some researchers (e.g. Davies *et al.*, 2007, 2010) prefer to use household balance sheet data to measure wealth inequality levels, because household balance sheets combine survey data and data from residual estimations[84]. However, the estimation of the latter often includes errors and is therefore also not fully reliable (Davies and Shorrocks, 2000). The problems of household balance data are similar to the problems of household final consumption expenditure data (see Section 2.3).

Alternatively, wealth or estate tax data can be used to measure wealth inequality. These data source have the advantage that the declaration is not voluntary and that most of the population is covered (in the case of the estate tax only the dead population though). However, both sources have the disadvantage that the coverage, definition and valuation of wealth depend on the nation's tax law, and that especially the very rich part of the population often (successfully) tries to evade taxes – especially if tax rates are increasing

[84] The residual values are retrieved by subtracting the balance sheet holdings of institutional households from total national balance sheet holdings.

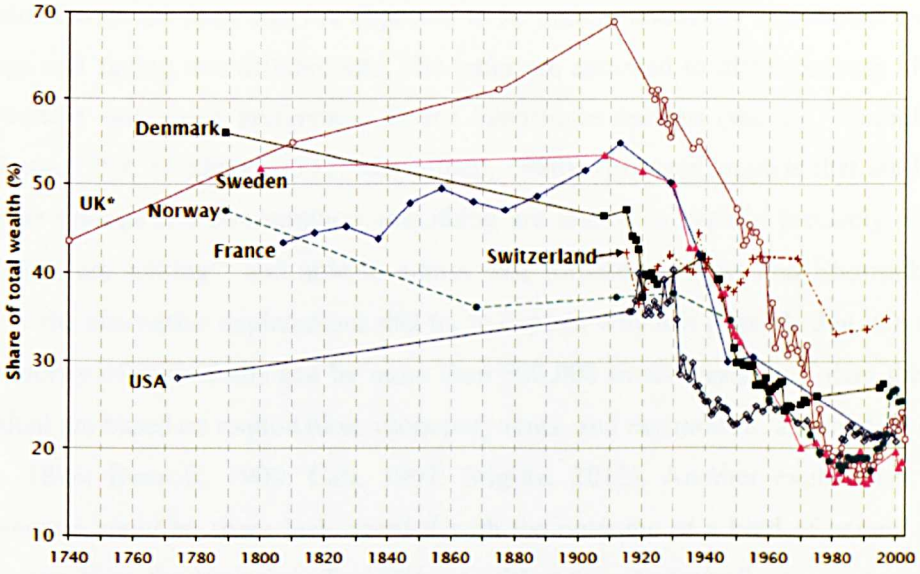
as it was the case in many countries after the Second World War. Estate tax data have the further shortcoming that less wealthy individuals tend to die earlier and that the age distribution therefore differs from the general population. Another alternative to derive wealth data, which is seldom used though, is Giffin's investment income method which applies a yield multiplier to investment income estimates. This method has the drawbacks that it is very sensitive to the initial assumptions, that it does not account for yield differences that are resulting from portfolio variations, and that the used methodology tends to underestimate the concentration of wealth holdings. The last existing data source, which is used to measure the wealth concentration at the top-end of the population, is publicly available information about rich individuals (i.e. so called rich-lists). Rich lists are however also problematic as not necessarily all rich people are covered in these lists and because the wealth estimates are only based on informed guesses, e.g. the amount of liabilities often is not known (see Davies and Shorrocks (2000) for an excellent overview of the different available data sources and their strengths and shortcomings).

The most likely result of all of these shortcomings is that the reported wealth inequality levels tend to be understated. Despite this underestimation problem, existing figures suggest that "[w]ealth is distributed less equally than labour income, total money income or consumption expenditure. While Gini coefficients in developed countries typically range between about 0.3 and 0.4 for income, they vary from about 0.5 to 0.9 for wealth. Other indicators reveal a similar picture. The estimated share of wealth held by the top 1 percent of individuals or families varies from about 15-35 percent, for example, whereas their income share is usually less than 10 percent." (Davies and Shorrocks, 2000, p.607). These high levels of wealth inequality are not a new phenomenon. The Gini coefficient for the holdings of assets in the US was, for example, 64 in 1774 and rose to 83 in 1870. An important reason[85] for this rise in wealth inequality was that the richest individuals could more than double their wealth share during this period. In 1774 the top 1% held around 13% of all assets while this figure increased to around 27% in 1870 (Williamson and Lindert, 1980). The wealth holdings of the top 10% also increased from around 50% in the revolutionary period to around 70% in 1860 (Martin, 1971), and the existing data suggests that in 1890 the top 9% of the population held around 71% of all wealth, while the top 0.03% held an astonishing 20% (Bouroff, 1900). These figures indicate that the richest part

[85] The possible causes for an increase of the top 1% and top 10% wealth share are discussed below.

of the US population gained most from the 9-fold increase in total wealth between 1850 (US$ 7.2 billion) and 1890 (US$ 65 billion). The same must be true for the period between 1890 and 1930 in which the share of the top 1% on total US wealth holdings increased to around 40% (see Figure 14).

Figure 14: Top 1% wealth shares in seven Western countries, 1740 - 2003



Source: Ohlsson et al. (2008)

The historical trend of the wealth holdings of the top percentile in the UK and in France is similar to the US but the level of wealth concentration at the top was much higher in these countries. In 1740 the top 1% of UK households held around 44% of all wealth; this figure increased to 61% in 1875 and to a staggering 69% before the start of World War One. The estimates for France suggest that at the beginning of the 19th century the top 1% held around 43% of all wealth, a figure which increased to around 58% until 1911 (see Figure 14). In contrast to the US, the shares of the top 5% and top 10% remained relatively stable during the same period in both countries (Lindert, 1986; Ohlsson *et al.*, 2008). Sweden also experienced a slight increase of wealth concentration between the industrial revolution and World War One; however, the decreasing top percentile shares in Denmark and Norway during the same period suggest that wealth inequality does not automatically grow during the early stages of industrialisation. For the middle- and end-period of the 20th century the picture is much more uniform across countries, with decreasing wealth shares

of the top 1% in all of these countries after 1930 and an increase in wealth concentration at the top from 1980 onwards.

What are the reasons that wealth holdings can become so concentrated among the wealthiest 1%? In general, it is assumed that "a family's wealth is determined by (i) its age, and its history of: (ii) earnings, (iii) saving rates, (iv) rates of return, and (v) inheritances" (Davies and Shorrocks, 2000, p.613). To be more precise, wealth holdings among individuals with the same age are expected to be mainly unequally distributed because of earnings and saving rate differentials. The latter are assumed to differ because of varying consumption smoothing preferences or for inheritance reasons (see e.g. Modigliani and Brumberg, 1954; Friedman, 1957; Modigliani, 1988). However, models that are based on life cycle savings and consumption smoothing are unable to explain precisely why some individuals are willing[86] and able to amass vast fortunes (Davies and Shorrock, 2000). Many of the alternative explanations that try to explain why it is possible that in a society a tiny minority of individuals can be more than 500,000 times wealthier[87] than the median individual are based on exploitation, monopoly rents, and asymmetric information (see e.g. Irving, 1896; Bouroff, 1900; Call, 1907; Stiglitz, 2012). Another explanation for this phenomenon could be sheer luck coupled with the outcome of a kind of natural physical law[88]: over time the majority of existing wealth gets automatically concentrated in the hands of few individuals because after having gained some wealth those individuals are able to exchange and invest more money and thus they are able to amass even more wealth over time (see e.g. Bouchaud and Mézard, 2000; Buchanan, 2002; Levy and Levy, 2003; Scafetta *et al.*, 2004; Sinha, 2005; Chatterjee and Chakrabarti, 2007; Yakovenko and Rosser, 2009).

[86] Standard theory assumes that people are saving to have a constant consumption over their lifetime. Arguably, a billionaire is neither saving to be able to keep his current consumption level after retirement nor to ensure that his children have a decent life style.

[87] The median wealth in Germany in 2007 was around 20,000 Euro (DIW, 2009), for example. According to the Forbes Rich List, in 2007 the richest German individual, Karl Albrecht, had around 15 billion Euro (US$ 20 billion) AuM, which was 750,000 times the median wealth; the third richest German individual, Michael Otto, owned around 10 billion Euro (US$ 13.3) assets, which was around 500,000 times the median wealth.

[88] The idea that the distribution of wealth follows a universal natural law was first proposed by Vilfredo Pareto at the beginning of the 20th century. Pareto found not only that there exist "many individuals at the lowest end of the scale and fewer and fewer as you progress along the graph toward higher levels of wealth [but also] that they dwindled in a very special way toward the wealthy end of the curve: Each time you double the amount of wealth, the number of people falls by a constant factor. The factor varies from country to country, but the pattern remains essentially the same." (Buchanan, 2002, p.4).

While certainly more research is needed on this topic, all of these non-standard arguments might explain why wealth concentration decreased so sharply during the middle of the 20th century. According to Bouchaud and Mézard's (2000) model, high progressive taxes that are coupled with redistribution have a dampening effect on the level of wealth concentration in capitalist societies. This finding is in line with Ohlsson *et al.*'s (2008) and Davies and Shorrocks' (2000) observation that, next to the Great Depression and the two World Wars, rising taxation at the top and redistribution are important determinants to explain the sharp decline of wealth concentration in industrialised countries during large parts of the 20th century (see Figure 14). Other possible reasons for the decrease of wealth concentration during that time were stronger competition laws, better labour protection and near full-employment (which lessened the exploitation of workers). Moreover, these heterodox approaches might also partly explain the rise in wealth concentration from 1980 onwards. After 1980 taxation in many developed countries became less progressive and also redistributive policies declined, while at the same time privatisation[89] and the emergence of global monopolies (e.g. in the IT sector) led to an increase in monopoly rents, whereas the weakening of labour standards and an increase in unemployment augmented the scope for labour exploitation.

Other important factors for the increase in wealth concentration from 1980 onwards were the tremendous increase of global stock market indices[90] and real estate prices, and the significant increase in top incomes (see Section 2.4). The latter point is important because high income households have a higher propensity to save due to the fact that individuals have natural limits to consumption – it is nearly impossible to spend millions of dollars on personal consumption goods. Therefore, one might even wonder why the reported wealth concentration levels have not grown even more in recent years. One reason could be that prior to the crisis the wealth of the bottom 90% also increased vastly due to the stock market and housing bubble. Another, probably much more important, reason might be that much of the increase in surplus wealth is not recorded in household survey and tax statistics due to top-coding, sampling errors, nonresponse, misreporting, tax avoidance, and tax evasion (Shaxson *et al.*, 2012). Reportedly, many rich households shift

[89] Davies and Shorrocks (2000), for example, state that in the UK a number of large fortunes resulted from the privatisation wave of the 1980s and 1990s.

[90] The Dow Jones Index increased from around 1,200 in 1985 to around 14,000 in mid-2007, the DAX Index increased from around 1,000 in 1985 to around 8,000 in mid-2007, and the Nikkei Index increased from around 12,000 in 185 to around 16,500 in mid-2007 (its peak was 39,000 in December 1989 though).

their funds to tax havens to avoid high tax payments: a recent study by Henry (2012) estimates that rich individuals are hiding US$ 21 trillion in financial assets offshore[91].

Two of the existing studies try to estimate the current levels of global wealth inequality between individuals. Both studies are based on the same methodology but they estimate the level of global wealth inequality for two different benchmark years: 2000 and 2010. The study for the year 2000 is undertaken by Davies *et al.* (2010) and retrieves existing data about wealth levels for 39 countries (financial and non-financial balance sheet data from 19 countries, financial balance sheet data from 16 countries, and household survey data from 4 countries[92]) that cover around 61% of the world population. To be able to include the missing 39% of the world population (190 countries) the wealth per adult is estimated via regressions[93] (34% of the world population) and region and income class imputations[94] (5% of the world population). The results of this exercise suggest that in 2000 the inter-country wealth inequality level was very similar to the inter-country income inequality levels reported in Section 2.2 (i.e. around 58 Gini points).

In a second step, the authors estimate and impute the intra-country wealth distribution to be able to measure global wealth inequality. For 20 countries the wealth distribution can be retrieved from household survey data (15 countries) and tax records (5 countries). However, next to their different sources these data also have different units of analysis (household, family, adult) and for some countries only decile shares are available. Thus, Davies *et al.* use a programme to construct "a synthetic sample of 1,000 observations that conforms exactly with any valid set of quantile shares derived from a distribution of positive values" for these countries (2010, p.241). The same programme is applied on an adjusted WIID income distribution dataset[95] to estimate the wealth distribution for

[91] According to less recent estimates HNWIs 'only' held around US$ 12 trillion in at least 46 tax havens in 2007, which led to an estimated global annual tax loss of around US$ 250 to US$ 310 billion (Palan *et al.*, 2010).

[92] Davies *et al.* (2010) are arguing that household balance sheet data are preferable over household survey or tax data to assemble reported wealth averages. Thus, they use balance sheet data whenever possible. However, it seems strange that they take the distributional estimates from surveys and tax records to retrieve intra-country wealth inequality but that they do not 'trust' the wealth averages from the same source.

[93] They apply OLS and seemingly unrelated regressions that take into account consumption per capita, life expectancy, GDP per capita growth, population growth and density, market capitalisation rates, available private credits, urban population percentages, phone subscriptions, and two dummy variables (one for countries in transition and one for countries that have only survey data).

[94] "For the 81 countries that lack any data, the mean per capita wealth of the appropriate continental region (6 categories) and income class (4 categories) were assigned" (Davies *et al.*, 2010, p.237).

[95] The authors take into account that wealth is less evenly distributed than income by multiplying the income figures with a constant ratio.

additional 124 countries. Finally, for 85 countries, for which insufficient information is available, the wealth distribution is imputed according to regions and income classes. The resulting estimates suggest that the global wealth Gini coefficient in the year 2000 was around 89 if official exchange rates are used and around 80 if the data is adjusted for purchasing power parity. The latter estimate is around 10 Gini points higher than that for the global PPP income Gini coefficient, which was around 70 in the year 2000 according to the estimates from Pinkovskiy and Sala-i-Martin (2009) and Milanovic (2012).

The second study, from Credit Suisse (CS, 2010), assembles existing data about wealth levels for 48 countries (17 with financial and non-financial balance sheet data, 27 with financial balance sheet data, and 4 with household survey data) that cover around 63% of the world population. To retrieve global wealth estimates for the benchmark year 2010, these data are supplemented by similar regression techniques and region and income class imputations that Davies *et al.* (2010) are applying. Also in line with Davies *et al.* (2010), the study constructs wealth distributions for all countries by taking into account survey and tax information of 21 countries, adjusted income distribution data of 142 countries, and regional and income class information for the rest of the countries for which insufficient data is available – the most important difference between the two studies is that the CS study extrapolates the upper wealth tail according to a Pareto distribution. The resulting estimates (see Table 4) suggest that the global Gini coefficient for wealth was slightly lower in 2010 (88.1) than in 2000 (89.2). This decrease in global wealth inequality was mainly the result of a lowering gap of the wealth per capita between richer and poorer countries, e.g. the three wealthiest countries US, Japan and UK increased their mean wealth per adult by a lower ratio than poor populous countries like China, India, Indonesia, Russia and Brazil (see Table 4, last column). Intra-country wealth inequality, on the contrary, had the same upward trend as intra-country income inequality (see Table 4, fifth column).

Table 4: Global wealth distribution in 2000 and in 2010

	2000		2010		Change 2000 - 2010	
	Gini coefficient	Wealth per adult (US$)	Gini coefficient	Wealth per adult (US$)	Change Gini coefficient	Wealth per adult (ratio 2010 to 2000)
Argentina	74.0	24,753	74.7	17,316	0.7	0.70
Brazil	78.4	8,300	79.6	25,270	1.2	3.04
Canada	68.8	108,464	68.3	225,896	-0.5	2.08
China	55.0	5,672	69.0	17,126	14.0	3.02
France	73.0	103,619	75.8	255,156	2.8	2.46
Germany	66.7	89,770	68.4	164,561	1.7	1.83
India	66.9	2,036	77.8	4,910	10.9	2.41
Indonesia	76.4	2,502	77.3	12,112	0.9	4.84
Italy	60.9	119,773	62.6	226,423	1.7	1.89
Japan	54.7	191,877	60.7	201,387	6.0	1.05
Korea	57.9	32,969	60.7	70,751	2.8	2.15
Mexico	74.9	17,484	78.0	25,399	3.1	1.45
Pakistan	69.8	2,347	65.6	4,646	-4.2	1.98
Russia	69.9	1,708	70.6	10,408	0.7	6.09
Thailand	71.0	2,527	70.1	5,143	-0.9	2.04
UK	69.7	162,999	71.7	229,940	2.0	1.41
US	80.1	192,399	80.9	236,213	0.8	1.23
Vietnam	68.2	1,701	68.2	4,606	0.0	2.71
World	**89.2**	**30,669**	**88.1**	**43,784**	**-1.1**	**1.43**
Global top 1% share	**40.1**		**43.6**		**+3.5%-points**	

Sources: Davies et al. (2010); CS (2010)

It can therefore be concluded that, while both studies find "very large inter-country differences in the level of household wealth ..., the principal reason for the high global inequality of wealth [is the] high inequality of wealth within countries" (Davies *et al.*, 2010, p.224), and the high concentration of wealth at the top. Nevertheless, the pre-crisis concentration of wealth at the top was not exceptionally high in relative terms compared to historical levels (at least in Western countries, see Figure 14). The increase in wealth concentration after 1980 might be an important phenomenon nonetheless, because inequality can also be measured in absolute terms (as discussed in Section 2.1) and it is possible that the degree of absolute wealth concentration was higher in the pre-crisis period than at the peak of relative wealth concentration at the beginning of the 20th century. The next section therefore discusses how far the wealth holdings at the top have changed prior to the crisis.

4.2. High net worth individuals and absolute wealth concentration

The post-1980 increase in relative wealth concentration and inequality implies that absolute global wealth concentration also increased prior to the crisis. However, from the relative figures that were discussed so far neither the pre-crisis levels of absolute wealth concentration become obvious nor does it become clear if the absolute wealth holdings at the top were exceptionally high in a historical context. Unfortunately, "[o]fficial publications do not report estimates of absolute inequality, and even academic studies are rare" in the case of income (Atkinson and Brandolini, 2010, p.3) and non-existent in the case of wealth[96]. Furthermore, it is beyond the scope of this dissertation to estimate the exact existing and historical levels of absolute wealth inequality. The subsequent discussion therefore has the aim to give an overview about the amount of the global pre-crisis wealth holdings of rich individuals by summarising the findings of three different publicly available wealth reports (from Capgemini and Merrill Lynch (CML), the Boston Consulting Group (BCG), and Credit Suisse (CS)) about the combined wealth holdings of global high net worth individuals (HNWIs) and ultra-high net worth individuals (UHNWIs).

There is a general consensus that HNWIs are rich individuals that have a net worth of at least US$ 1 million. However, there is a disagreement between the three reports which asset classes should be included and excluded to establish the net worth of a person: The World Wealth Reports from CML include in their definition all equities, fixed income securities, cash and deposit holdings, real estate holdings (excluding primary residences), and alternative forms of investment, while consumables and consumer durables and collectibles are excluded. BCG's Global Wealth Report is less inclusive and estimates the assets under management (AuM) from households on the basis of "cash deposits, money market funds, listed securities ... and onshore and offshore assets [while] wealth attributed to investor's own businesses, residences, or luxury goods" are excluded (2008, p.7). The estimates from CS's 2010 Global Wealth Data Book, on the contrary, are based on the most inclusive definition that essentially comprises all individual wealth holdings that are considered in household balance sheets and household survey data (e.g. also primary residences). In the case of UHNWIs the definition of the wealth threshold differs as well among the studies: CML define UHNWIs as those individuals which "hold at least US$ 30

[96] Google scholar only has one entry with the keywords 'absolute wealth inequality', which relates to one of my presentations, and no entry with the keywords 'absolute wealth concentration'.

million in financial assets" (2008, p.3), for CS the threshold is higher and starts at US$ 50 million, and according to the BCG definition UHNWIs are only those individuals who have at least US$ 100 million AuM[97].

Unfortunately, there exists no precise information about the actual wealth holdings of HNWIs because existing global governance arrangements allow them to be highly mobile and secretive and "survey data from which ... wealth distribution estimates are derived tend to under-represent the wealthiest groups and to entirely omit ultra high net worth individuals" (CS, 2010, p.9), e.g. "the US Survey of Consumer Finances ... explicitly omits the 400 wealthiest families from its sampling frame" (ibid, p.78). All three wealth reports are therefore relying on rough estimation techniques to be able to report the global wealth holdings of very rich individuals. The estimates from CS are based on the methodology as described in Section 4.1 and the finding that the existing "data indicate a good fit with a Pareto distribution for wealth levels above USD 250,000" (2010, p.9); this Pareto distribution is used to extrapolate the wealth holdings for the top wealth tail of 216 countries. The estimates from CML are covering 71 countries (98% of global GDP) and are based on a two-step approach which is similar to the CS' method: "wealth levels by country are estimated using national account statistics [and] the final figures are adjusted based on world stock indexes", and the wealth distribution within countries is "based on formulized relationships between wealth and income" (2008, p.34). The BCG wealth report is less clear about the methodology used and somewhat vaguely describes the wealth estimates as based on "a comprehensive market study of wealth, which covered 62 countries representing more than 96 of global GDP, and an equally comprehensive benchmarking survey of 111 wealth managers, who oversaw a total of $ 9.9 trillion in client assets and liabilities" (2007, p.6).

The rough estimates of the three wealth reports suggest that, depending on the estimation method and definition of HNWIs, in 2010 the global population size of HNWIs was between 11 and 24 million individuals (see Table 5, last three rows) whose global AuM had a net worth of between US$ 42.7 and US$ 69.2 trillion, (see Table 5, first three rows). The CS estimates for 2010 are naturally the highest among the three studies as primary residences are included. BCG, on the contrary, excludes all real estate holdings,

[97] The BCG also uses a third concept, 'established wealthy', for individuals that have more than US$ 5 million AuM.

which probably explains why its wealth estimates between 2001 and 2007 are lower than the CML estimates. If one adds the estimates of HNWIs real estate holdings from the CML wealth reports (see Figure 22 in Section 4.4) to the BCG estimates the picture changes however, i.e. the real estate adjusted BCG wealth figures are constantly higher than the CML figures from 2003 onwards. In other words, the CML estimates most likely represent a lower bound of HNWIs wealth holdings if similar definitions are used.

Table 5: HNWIs' AuM and population size

HNWIs Assets under Management (US$ trillion)														
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BCG estimates					20.5	20.0	25.1	28.6	29.3	34.5	38.7	32.4	41.9	47.4
CML estimates	19.1	21.6	25.5	25.5	26.2	26.7	28.5	30.7	33.3	37.2	40.7	32.8	39.0	42.7
CS estimates														69.2
HNWI Assets under Management as percentage of global wealth														
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BCG estimates					31.6	30.3	31.9	32.9	33.3	34.6	35.3	31.7	37.1	38.9
HNWI population size (in millions)														
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BCG estimates (households)					6.1	5.8				9.6	10.7	9.0	11.2	12.5
CML estimates (individuals)	5.2	5.9	7.0	6.9	7.1	7.3	7.7	8.2	8.7	9.5	10.1	8.6	10.0	10.9
CS estimates (individuals)														24.0

Sources: BCG (2007 – 2011); CML (2000, 2002, 2005, 2006, 2008, 2011); CS (2011)

Both the CML and the BCG estimates suggest that the wealth holdings of HNWIs have increased substantially prior to the crisis (CS only reports estimates for the year 2010). To be more precise, the CML figures suggest that the wealth holdings of HNWIs increased 2.1-fold between 1997 and 2007, while the BCG estimates suggest a 1.9-fold increase between 2001 and 2007. To put these figures in perspective: between 1997 and 2007 global GDP 'only' increased 1.8-fold (from US$ 30.3 trillion to US$ 55.8 trillion)[98] and according to the BCG estimates total household wealth 'only' increased 1.7-fold between

[98] In the two decades prior to the subprime crisis there was even a six fold increase in HNWI wealth – from US$ 7 trillion in 1986 (Haseler, 2000) to US$ 41 trillion in 2007 – while there was only a fourfold increase in world GDP over the same period (WDI, 2011).

2001 and 2007 (from US$ 64.9 trillion to US$ 109.6 trillion) – meaning that the estimated share of HNWIs' wealth holdings on total global wealth increased from 31.6% in 2001 to 35.3% in 2007 (see Table 5, middle row). Interestingly, the estimates of CML and BCG also suggest that HNWIs were only affected negatively in 2008 by the crisis. Their wealth and population size not only quickly returned to the 2007 levels but even exceeded them in 2010.

A comparison of the number and holdings of UHNWIs is even more difficult as less data is available and because different studies are using different wealth thresholds. According to the estimates from CML (2008) it seems however that the share of UHNWIs' assets on total HNWIs' assets increased from around 34% to 37% between 2005 and 2007[99]. This increase in wealth concentration among HNWIs meant that in 2007 around 100,000 UHNWIs held assets that had a net worth of about US$ 15 trillion. CML (2011) also estimates that in 2010 around 103,000 UHNWIs had a combined net worth of around US$ 15.5 trillion (36.1% of total HNWI wealth), which implies that the crisis affected UHNWIs slightly more than ordinary HNWIs as their number and AuM grew less after 2007. Again, CML's estimates seem to be rather conservative. A recent UHNWI study by Wealth-X (2011), that uses the same wealth threshold of US$ 30 million in their definition, estimates that in 2010 the global population of UNHWIs was around 186,000, and that those individuals held around US$ 25 trillion in net asset. CS (2010), using a higher threshold (US$ 50 million), estimates that in 2010 around 81,000 individuals were UHNWIs[100].

Unfortunately, neither the CS nor the BCG publish wealth estimates for UHNWIs and only two wealth reports, CS's Wealth Databook and Wealth-X's World Ultra Wealth Report, publish estimates about even richer individuals, i.e. billionaires. CS again only publishes population figures though (around 1,000 billionaires in 2010), while Wealth-X (2010, p.10) estimates that "there are 1,235 billionaires globally, with a combined net worth of $ 4.18 trillion". These estimates are surprisingly similar to the ones from the Forbes magazine – all of these three sources use different concepts and data sources – that

[99] According to Klass *et al.* (2006) and Atkinson (2008) research apparently not only the wealth of UHNWIs was growing faster than that of HNWIs prior to the crisis but also the wealth of the top UHNWIs was growing faster than that of 'ordinary' UHNWIs.

[100] The BCG only publishes selected household size figures for UHNWIs in their 2011 report. According to this publication, the fifteen countries with the highest number of UHNWI together had more than 9,000 households that had a net worth exceeding US$ 100 million – CS (2010) estimates that the total number of individuals with assets above US$ 100 million is around 30,000.

states that at the beginning of 2010 around 1,000 billionaires households had collectively about US$ 3 trillion AuM (CS, 2010). Finally, it is interesting to notice that the Forbes pre-crisis estimates are lower: in 2007 the group of billionaires probably consisted of around 777 households with US$ 2.6 trillion AuM (IFSLc, 2008). This suggests that the subprime crisis, financial crisis, and debt crisis only had a minor effect on the wealth holdings of the majority of the top 1% of the HNWIs population.

Given this vast amount of wealth in the hands of few individuals (according to the CML estimates HNWIs represented just 0.15% of the world's population of 6.6 billion in 2007) the question arises if ever in human history the amount of absolute wealth concentration was higher than nowadays. Unfortunately, there exist no historical global estimates of rich individual holdings and also no "exchange rate that would convert Roman sesterces or Castellan seventeenth-century pesos into dollars of equal purchasing power today. Even more, what 'equal purchasing power' might mean in that case is far from clear" (Milanovic, 2011, p.27). Nevertheless, Milanovic (2011) compares the wealth of the richest people in their time (the Romans Crassus, Augustus and Pallas, Carnegie and Rockefeller, and the richest men of today Gates, Buffet, and Slim) with the respective average income of the population at that time, and concludes that most likely John D. Rockefeller was the richest man ever. In 1937, when his wealth peaked at US$ 1.4 trillion, Rockefeller could have paid 116,000 US workers with the yearly returns of this wealth (assuming an interest rate of 6%), while Crassus in the year 50 BCE 'only' could have commanded about 32,000 Romans and Bill Gates, the second richest man ever in these relative terms, 'only' could have paid 75,000 US workers with the return of his wealth in 2005.

However, if one compares absolute wealth holdings the picture changes: Rockefeller's US$ 1.4 trillion in 1937 are equivalent to around US$ 20 trillion in 2007 (adjusted with the historic yearly CPI inflation rates that are readily available from the US Bureau of Labour)[101]. This net worth would have placed Rockefeller not even within the top 10 in the

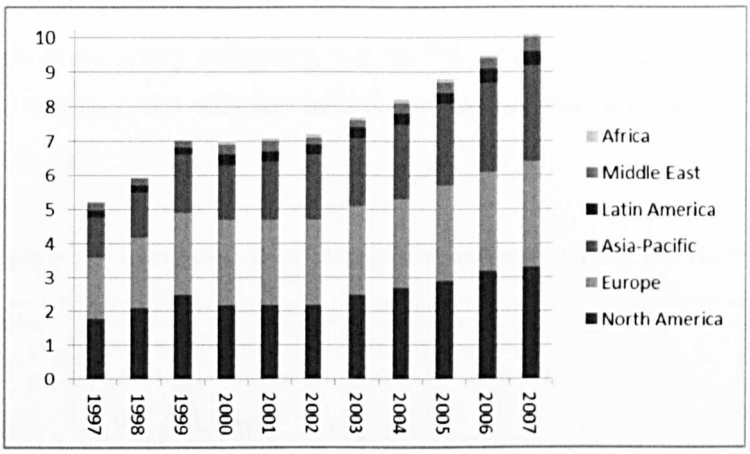
[101] Call (1907) claims that Rockefeller's wealth was much higher, i.e. US$ 2.5 to US$ 3 trillion at the beginning of the 20th century, on the basis that a New Yorker evening newspaper stated that Rockefeller's yearly income in 1905 was between US$ 72 and US$ 100 million. However, according to this income estimate his wealth was rather around US$ 1.2 to US$ 1.7 trillion at that time and not US$ 2.5 trillion (taking into account a typical interest rate of 6%). If US$ 1.7 trillion are adjusted with the yearly US CPI inflation rates from 1914 onwards (before they are not available) the result suggest that Rockefeller's wealth in 2007 figures was around US$ 37 trillion, which is still much below the wealth figures of the three richest persons in 2007.

Forbes global billionaires list of 2007 (David Thomson and family were ranked 10th and had US$ 22 billion AuM) and he would have had less than half of the wealth of each of the three richest individuals in that year (in 2007 Bill Gates' estimated wealth was US$ 56 trillion, Warren Buffet's US$ 52 trillion, and Carlos Slim's US$ 49 trillion). This finding is especially remarkable if one keeps in mind that at the time when the relative wealth concentration was highest only few countries had citizens that were very rich in a global comparison because many countries that nowadays host many UHNWIs were still in the early stages of industrialisation (e.g. China, Brazil, India, Hong Kong, Japan, Mexico, Russia, Saudi Arabia). In other words, it can be assumed that prior to the Second World War nearly all of the richest people were located in a few Western countries like the US, UK, Germany and France, while prior to the crisis more than one third of the HNWIs population and around 45% of HNWIs assets came from Asian-Pacific, Latin American, Middle Eastern, and African countries according to CML's estimates (see Figure 15).

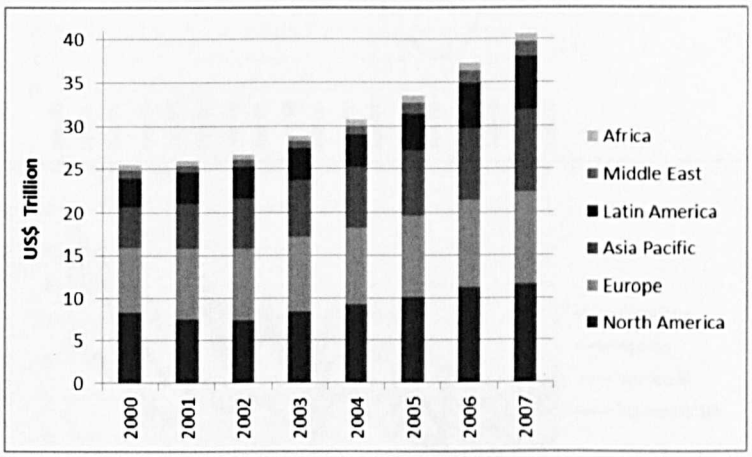
To conclude, the figures that were presented in this and the last section suggest that relative global wealth inequality probably did not increase prior to the crisis. The level of absolute wealth concentration, in contrast, most likely was higher than ever before in history because although the richest individuals in 2007 were less rich than their counterparts at the beginning of the 20th century in relative terms (i.e. their share on total wealth was smaller), they were richer in absolute terms (i.e. their inflation adjusted net worth was much higher). The figures from Table 4 (last row) and Table 5 (first two rows) furthermore suggest that both the absolute and the relative concentrations of wealth in the hands of the top 1% and top 0.1% of the global population were increasing in the years prior to the crisis. The main reasons for this phenomenon were probably that (i) as an outcome of financialisation the incomes of the top 1% were increasing faster than the incomes at the bottom (e.g. via higher profit shares) and global asset prices were rising, (ii) the globalization of capitalism led to a massive increase of HNWIs on a global scale (e.g. through the market opening of Eastern Europe and Asia), (iii) taxation became less progressive and less redistribution took place. To see how far these developments are related to the subprime crisis the widely noticed 'search for yield' problem will be discussed in the next section.

Figure 15: HNWIs population and AuM, by region

a. Population in million



b. AuM in US$ trillion



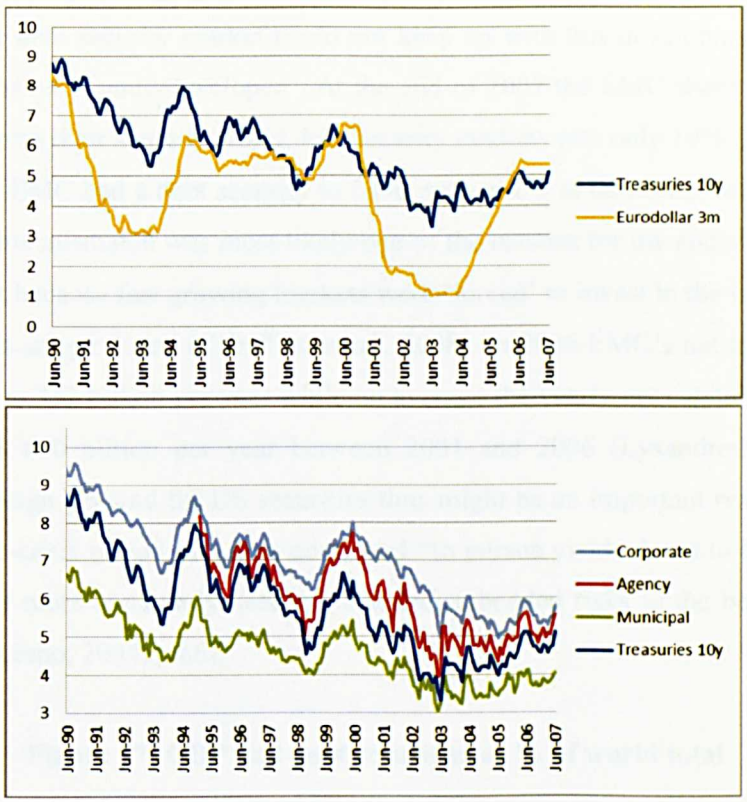
Source: CML (2000, 2002, 2005, 2006, 2008)

4.3. The 'bond yield conundrum' and the 'search for yield'

The estimated amount of CDOs in 2002 was about US$ 0.25 trillion and yet by the time these products triggered the financial crisis in mid-2007 that figure had increased to about US$ 3 trillion (Blundell-Wignall, 2007b). This rapid growth is closely correlated with some other unusual developments in the US financial system over this period. One was the persistently low nominal long-term yields in all of the major US bond markets, a development that eventually gave rise to a much discussed 'bond yield conundrum' after June 2004 – this term was first mentioned by Alan Greenspan (2005). Before mid-2004 the low long-term interest rates could be explained by the greater stability of 'fundamentals'

and low short term interest rates (i.e. by the 'Great Moderation'), but the persistence of these low yields after that point in time was puzzling. Financial markets expected long term rates to rise in tandem with the rise in the federal funds rate as was the case in previous periods of monetary tightening, e.g. in 1983, 1987, 1994 and 1999. This did not happen. On the contrary, not only did long term rates not rise, they actually continued to fall[102] (see Figure 16).

Figure 16: Long and short term interest rates in the US (in %)



Note: The top plot compares the 3-month Eurodollar rate with the 10-year Treasury yield. The bottom plot demonstrates the downward movement of traditional long-term bond yields in the US (Sources: Bloomberg, 2010, FR Statistical Release H.15, 2010).

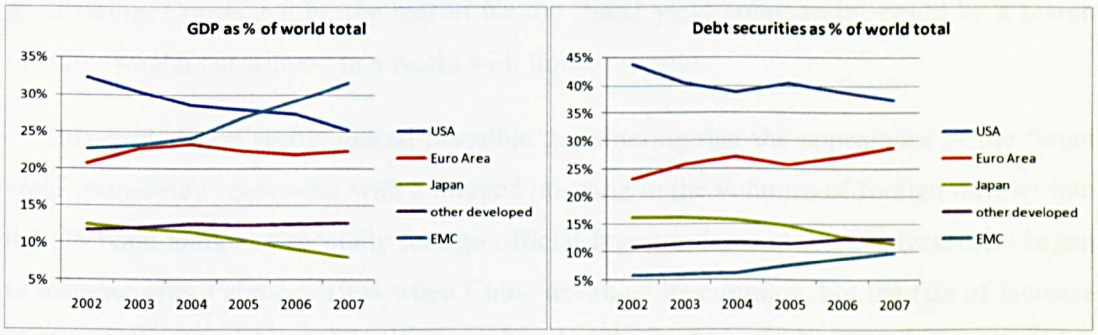
The development of macroeconomic expectations reveals why the decrease of long-term yields was so puzzling. According to the Blue Chip Financial Forecasts from May 2005 the federal fund rate was expected to remain relatively stable above 4% until 2015

[102] In June 2005 the long term rate was 73 bp lower than it was one year before. In December 2006 the rate was still slightly lower, although the federal fund rate was 425 bp higher than it was 2 ½ years earlier (Kozicki and Sellon, 2005).

(Kozicki and Sellon, 2005)[103]. Furthermore, long-term inflation expectations were very stable at around 2.5% from 1999 onwards, long-term growth expectations were constantly around 3% after 2002 (Backus and Wright, 2007) and positive expectations about the future federal budget deficit reversed in 2001 (CBO, 2003). None of these parameters, therefore, seems to explain the 'bond yield conundrum'. So, what caused this conundrum? One possible explanation which has been put forward is that there could have been a global shortage of highly rated fixed income securities.

After 2000 many emerging market countries (EMC) were experiencing high growth rates, but their debt security market could not keep up with this development, i.e. EMC's bond markets stayed 'underdeveloped'. At the end of 2007 the EMC share in global GDP was 32% whereas their share in world debt security markets was only 10% (see Figure 17). Consequently, EMC had a debt security to GDP ratio of 0.5 at that time, while the US had a ratio of 2. This mismatch was most likely one of the reasons for the enduring US current account deficit because fast growing markets were 'forced' to invest in the US, where most financial assets are produced (Caballero *et al.*, 2008). In 2006 EMC's net capital outflows had increased to 332 billion per year while on average the yearly net capital inflows to the US were US$ 600 billion per year between 2001 and 2006 (Lysandrou, 2011a). The increase in foreign demand for US securities thus might be an important reason to explain why in the pre-crisis period investors continued "to pursue yields down to levels not seen for 40 years or more apparently heedless that the embedded risks in the bond market are mounting" (Picerno, 2004, p.86).

Figure 17: GDP and debt securities as % of world total



Source: IMF Global Financial Stability Report (2003-2008)

[103] Projections of the CBO confirm this expectation. In 2003 the forecast for the average 3-month Treasury Bill Rate was 4.9% between 2005 and 2013 (CBO, 2003).

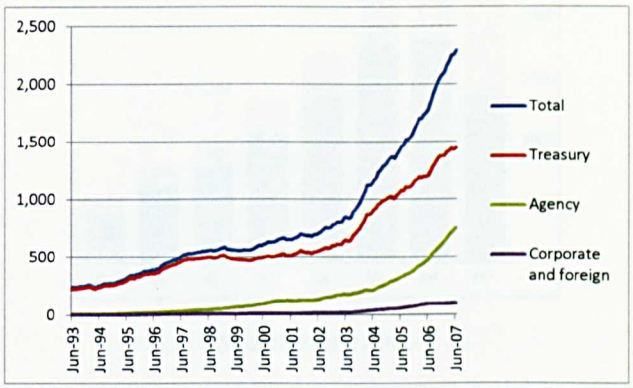
Different asset classes are not perfect substitutes. Debt securities and equities, for example, differ significantly in their characteristics: in contrast to equities, bonds promise a fixed put value and coupon rate, are more standardised and have a clear default rating, and are more liquid. According to Krishnamurthy and Vissing-Jorgensen (2007) investors also have three divergent motives, besides return, when they invest in fixed income securities: liquidity, surety of cash-flows, and regulatory concerns. Specific classes of fixed income securities satisfy these motives to different degrees. These differences of specific financial assets explain why market participants have different portfolio management strategies that change over time, e.g. investors tend to increase their holdings of riskless fixed income securities when the equity market turns downward.

The supply of debt securities has limitations however. The possible growth of the US Treasuries and municipal bond market is constrained by the actual amount of government debt, while the agency bond market is mainly constrained by the size of the prime mortgage market, and the corporate bond market by long-term investment opportunities of companies. A further constraining factor for the supply of debt securities probably is that the conditions under which buyers accept different securities have tightened due to the institutionalisation of financial markets that includes stricter rules regarding accountancy, transparency and governance (for a more detailed analysis of the latter point see Lysandrou (2011b)). A lower interest rate might induce governments to increase debts to some degree, which in turn leads to increasing prime mortgage underwritings due to lower mortgage rates, and facilitates long-term investment from companies due to cheaper financing. It is nevertheless questionable to assume that the supply always can keep up with the demand – especially given that higher debt-ratios mean that government and corporations loose their good rating. Consequently, the reason for the 'bond yield conundrum' could be a search for safe 'wealth containers' in a world with limited supply.

This explanation seems indeed plausible, considering that the appearance of the 'bond yield conundrum' coincided with a marked upswing in the volumes of foreign inflows into the US bond market. Especially foreign official investor demand for US Treasuries began to increase after February 1994 when China devalued its currency, but the rate of increase in that demand accelerated even more sharply after 2003 when many emerging market economy governments sought to preserve part of their increasing commodity revenues and export surpluses in safe stores of value (see Figure 18). Therefore several econometric

studies tried to verify if an increase in foreign official demand contributed to the low long term US Treasury yields in the US. While some studies found no evidence of a long term demand impact on Treasury yields (e.g. ECB, 2006; Rudebusch *et al.*, 2006), the majority of studies have found evidence of a negative impact, albeit that the estimated size of the impact varied from study to study (e.g. Idier *et al.*, 2007; Bandholz *et al.*, 2009; Craine and Martin, 2009; Warnock and Cacdac Warnock, 2009, Bertaut *et al.*, 2011). Bernanke *et al.* (2011) therefore conclude that it is indeed likely that a considerable part of the downward pressure on US bond yields stemmed from an increase in investor demand for US debt securities.

Figure 18: US bond holdings from foreign governments (in US$ billion)



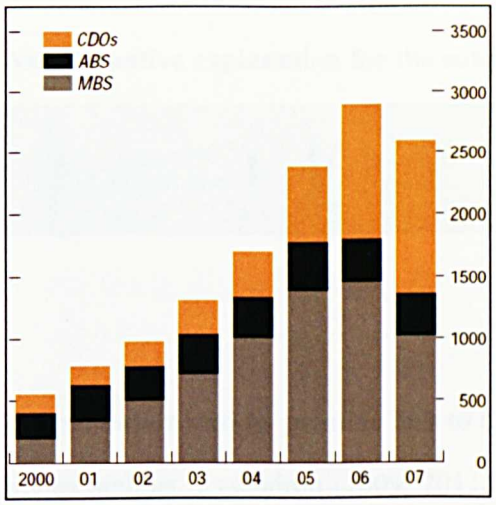
Sources: Sources: FR Statistical Release Z.1 (2010), TIC (2010)

The global increase in investor demand for investible securities and the historical low yields for traditional debt securities could also be reasons that the supply of ABS and especially CDOs grew so tremendously from 2002 onwards (see Figure 19): Although ABS "have been in existence for decades ... about one half of the total stock outstanding at the end of 2006 had been issued in the preceding five years" (Lysandrou, 2011a, p.333). The same is true for the CDO market that was only tiny before it grew twelvefold between 2002 and mid-2007. However, the majority view is still that there is no deeper causal link behind the correlation between US bond yields and CDO growth. Yields in the traditional US debt markets may have been unusually low in the immediate pre-crisis period and so investors would have been happy to accept the higher yielding CDOs[104], but this admission

[104] As Coval *et al.* (2009, p.4) state, by "mid-2007, there were 37,000 structured finance issues in the U.S. alone with the top rating ... By offering AAA-ratings along with attractive yields during a period of relatively low interest rates, these products were eagerly bought up by investors around the world."

aside, the general belief continues to be that greed, overconfidence and other failings on the part of the banks and their associates were the more important motivating forces behind the rapid acceleration in the ABS and CDO production prior to mid-2007. In other words, most theories are giving prominence to supply factors while they neglect the role of investor demand.

Figure 19: Issuance of Structured Credit Products (in US$ billion)

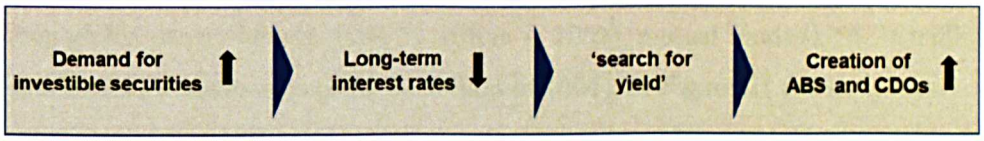


Source: IMF (2008)

An increasing number of authors (see e.g. Caballero and Krishnamurthy, 2009; Gros, 2009; Lysandrou, 2009; Caballero, 2010; Bernanke *et al.* 2011; Lysandrou, 2011a, 2011b) have advanced the complementary view though that there was in fact a line of causality running from the pressure of aggregate foreign and domestic demand on yields in the traditional US bond markets through to the CDO market. In their view the increasing demand for investible securities contributed to the low long-term interest rates which in turn led to the creation of ABS and CDOs, as investors were demanding more and more safe fixed income securities that were giving them better yields than US bonds (see Figure 20). In other words, while financial institutions may have profited handsomely from the creation and distribution of ABS and CDOs at the same time they probably were also under enormous external pressure to do all of this in order to make up for the shortfall in the supply of other US safe assets. One of the first that formulated this relationship was Mervyn King (2007, p.3): "Dissatisfaction with [the low long-term interest rates] gave birth to the 'search for yield'. This desire for higher yields could not be met by traditional

investment opportunities. So it led to a demand for innovative, and inevitably riskier, financial instruments and for greater leverage. And the financial sector responded to the challenge by providing ever more sophisticated ways of increasing yields by taking more risk. But some of those new instruments were so opaque and complex that investors lost sight of the risks involved. Until, that is, they were brought down to earth with a bump on August 9th 2007. However, although this demand side theory is brought forward by some prominent economists it has remained to date a minority view.

Figure 20: An alternative explanation for the subprime crisis



4.4. Absolute wealth concentration and its possible link to the subprime crisis

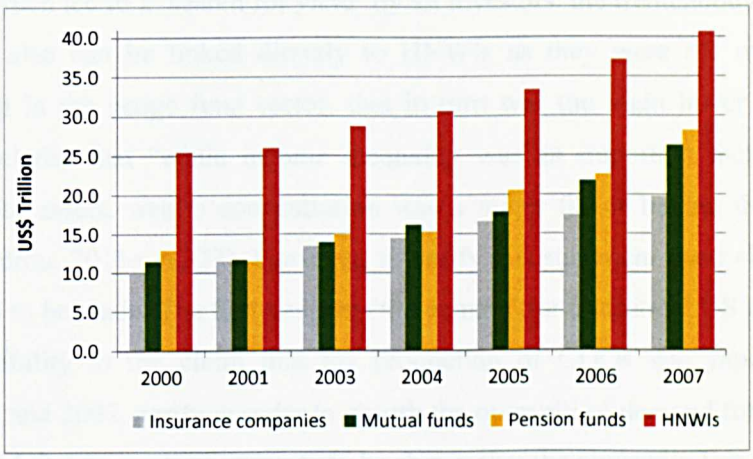
One of the aforementioned authors, Lysandrou (2009, 2011a, 2011b), argues that the increase in wealth inequality probably was an important contributing factor in the 'search for yield' by investors as HNWIs needed to store their vastly increasing wealth. The above discussed increase in absolute wealth concentration therefore might have helped to foster the financial innovation that produced securities which turned out to be too complex and consequently triggered the biggest financial crisis since the 1930s. Lysandrou's analysis represents a completely new inequality crisis theory approach[105]. Marx, Keynes, and their followers also have mentioned the potentially harmful effects of wealth concentration but they have not linked it to a possible excess demand for financial commodities. To be more precise, in contrast to the existing inequality crisis literature the focus of this new approach does not rely on the impact that changes in income flows might have on aggregate consumption and credit demand (see Chapter 3) but instead on the possible negative effects of an increasing rich individual's wealth stock on the demand for investible securities (i.e. the focus of the analysis does not rely on the poorer end of the population and their

[105] Milanovic (2011) makes a similar argument as Lysandrou but, as already noted before, he outlines his hypothesis only in a four and a half pages long vignette in a popular book which is primarily concerned with the global developments of income inequality, i.e. he is not backing up his argument with empirical data or an underlying theoretical framework.

reaction to increasing inequality but on the very rich end of the population and their reaction to increasing absolute wealth concentration).

According to the conservative estimates from CML (2008) the number of HNWIs was around 10 million in 2007. The supposition that these individuals could have had any significant impact on the US bond markets in the pre-subprime crisis era thus may seem incredible when one considers how small in number they were. However, this is not the case when one considers the amounts of wealth they concentrated in their hands and the forms in which this wealth was stored. The estimates from CML suggest that prior to the crisis HNWIs were the biggest global investor group with more AuM (US$ 41 trillion in 2007) than global pension funds (US$ 28 trillion in 2007), mutual funds (US$ 26 trillion in 2007) and insurance companies (US$ 20 trillion in 2007), as Figure 21 demonstrates.

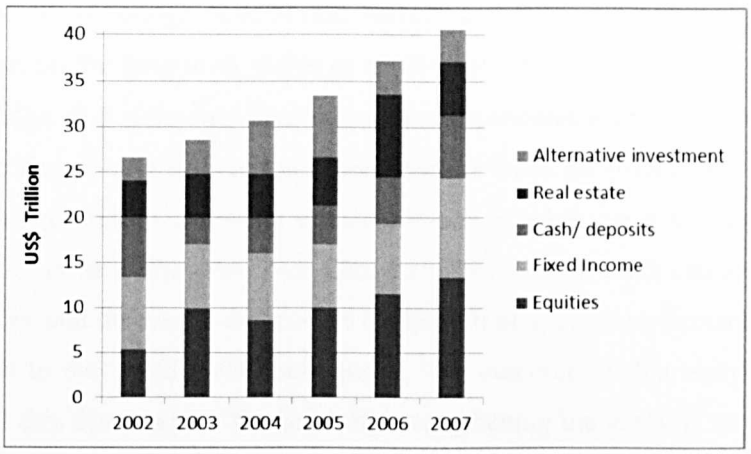
Figure 21: Private global AuM (in US$ trillion)



Source: IFSL (2008a)

The same estimates furthermore show that financial securities represented one of the dominant forms in which HNWIs stored their wealth, accounting for an average of 54% for the whole period from 2002 to 2007 (see Figure 22). Given that HNWI asset allocation to fixed income securities was at least US$ 11 trillion in 2007 (roughly 14% of the total global stock of debt securities in that year) it seems likely that a very important investor group is omitted in the 'search for yield' debate: HNWIs that were competing with other investor groups to find suitable investment opportunities for their vast amounts of surplus value.

Figure 22: Asset allocation of HNWIs (in US$ trillion)



Source: CML *(2005, 2008)*

Lysandrou also stresses that next to the HNWIs' possible contribution to the low long-term yields, which led to a 'search for yield' by all investors, the tremendous growth of the CDO market also can be linked directly to HNWIs as they were the most important investor group in the hedge fund sector, that in turn was the main buyer of CDOs. He therefore concludes that "while income inequality was an important factor behind the supply of those assets, wealth concentration was a major factor behind the demand for them" (Lysandrou, 2011a, p.323). However, to verify this statement three clarifications of channels need to be made. The first concerns the demand for traditional US debt securities. To give credibility to the claim that the production of CDOs was rapidly expanded between 2002 and 2007, partly in order to absorb the overspill of demand for yield flowing from the other US debt markets, it needs to be shown that the unusually low yields in these other markets over this same period was in large part caused by the pressure from investors. The second clarification concerns the contribution of rich individuals to the downward pressure on bond yields. This contribution needs to be separated out from the various other sources of US bond demand and quantified if the concentration of private wealth ownership is to be shown to have been a major driver behind the growth of CDOs. The third clarification concerns the unusual structure of the CDO market. As rich individuals along with certain other types of customers were excluded from this market, due to the highly complex nature of CDOs, the claim that the banks were under pressure to create these products can only hold up if there is a clear explanation as to exactly how that pressure was transmitted.

My PhD dissertation aims to help to clarify all of these three channels. The first, by testing empirically if foreign official and foreign and domestic private investors had a negative impact on the long-term yields of traditional US debt securities (see Chapter 5). To my knowledge, this is the first time that such an econometric analysis for all traditional US debt securities, taking into account the demand from all private sources, has been carried out. The second, by assessing via simulations to what extent US bond holdings of HNWIs changed prior to the crisis (see Chapter 6, Section 1). Such estimations have not been done before and the results are used to compute if an increasing demand from HNWIs has contributed to the 'bond yield conundrum'. The outcome of this analysis is the chief contribution of this dissertation. The third, by strengthening the analysis as to how exactly HNWIs helped to transmit pressure to banks to create ABS and CDOs (see Chapter 6, Section 2). A discussion of the exact methodology that is used to fulfil the two former objectives is presented in the following two chapters.

5. US bond demand and the 'bond yield conundrum'

"[T]he pronounced decline in long-term interest rates on U.S. Treasury securities ... is clearly without recent precedent. ... Moreover, ... yields for ... corporate bonds have declined even more than Treasuries over the same period." (Alan Greenspan, 2005).

The previous literature provides evidence that the increasing demand from foreign governments helps to explain the unexpectedly low Treasury yields prior to the crisis (see Section 5.1.2 for an overview). While these empirical findings represent a first step towards strengthening the demand-pull version of the CDO growth story they are not sufficient. CDOs are in the end 'second-floor' debt securities, securities backed by securities. Thus if credibility is to be given to the claim that the US CDO market was expanded just prior to 2007 partly in order to take the overspill of demand for yield flowing from the other US debt markets it helps to show that investors had a significant negative impact not only on the Treasury yield but also on the yields in the other 'ground floor' markets (those for corporate and municipal debt securities) and also on the yield in the 'first floor' market (that for agency debt securities). As there has been no such analysis yet, the aim of this chapter is to test empirically if a global excess demand for debt securities partly explains the low long-term yields in all of these traditional US bond markets. In other words, this chapter seeks to fill this gap in the literature by modelling the impact of foreign and domestic investor demand on AAA-rated US agency, corporate, and municipal long-term bond yields using autoregressive distributed lag (ARDL) based econometric models.

The layout of this chapter is as follows. Section one gives details of the model specification and selection, the data used and the chosen sample period. Section two presents and discusses the estimation results. Section three concludes the findings.

5.1. Model specification and model selection

5.1.1. Determinants for the long-term interest rates

Any attempt to quantify the impact of demand on bond yields has to begin with a specification of all of the major determinants of yields. According to recent research (see e.g. Rudebusch *et al.*, 2006; Wu, 2008) these determinants broadly divide into two groups, those relating to macroeconomic essentials on the one hand and those relating to financial

risk on the other. Apart from the short term interest rate, which is usually expected to influence nominal long term yields, inflation and the business cycle are also believed to be important determinants of these yields. Beyond these macroeconomic indicators changes in default risk, volatility, and the demand for bonds can also influence the long term yield (see Rudebusch *et al.*, 2006; Rudebusch and Wu, 2008; Bandholz *et al.*, 2009; Warnock and Cacdac Warnock, 2009)[106]. The reasons why changes in these determinants are influencing bond yields can be summarised as follows:

i. Short-term interest rate

Conventional wisdom assumes that changes in (expected) short-term interest rates, which are strongly influenced by the monetary policy, have a strong impact on long-term interest rates. According to the expectations theory, long-term interest rates are determined by two elements: an average of expected shorter-term interest rates plus a fixed liquidity term premium. An increase in (expected) short-term interest rates is therefore generally associated with an increase of long-term bond yields (see e.g. Wu, 2008) – even though some economists argue that changes in the monetary policy might not affect the expectations about future short-term interest rates and that in general financial innovation might have led to a decoupling of long-term rates from short-term interest rates (Stiglitz and Greenwald, 2003).

ii. Inflation

Apart from short-term interest rates, inflation is believed to be an important determinant for long-term nominal yields. Changes in actual inflation and in short-term inflation expectations can influence the expectations about the real value of the next coupon rate payments, the future federal fund rate and long-term inflation rates. Changes in long-term inflation expectations influence the expectations about future short-term interest rates and the real par value at maturity. Therefore, it is believed that a fall in actual inflation and

[106] It is likely that bond yields influence each other. For example, Treasury yields are often seen as a reference price for market participants and thus changes in Treasury yields are expected to influence the yields of other bonds. However, the different yields are determined by similar variables and so, arguably, the ultimate impact of a change in bond prices is not the change in the yield of another bond type as such but other changes that led to an increase of the other bond yield(s). In other words, in the end macroeconomic, financial risk and demand variables are the decisive factors to explain changes in bond yields. Moreover, the inclusion of bond yields in an equation with macroeconomic, financial risk, and demand variables would mean that these variables would be included twice, directly and indirectly. These considerations, and the existing degrees of freedom problem, are the reason why the four bond yields are modelled independently of each other –other existing macro-finance 'bond yield conundrum' models also do not include the yields of other bond types in their models, probably due to similar thoughts.

inflation expectations leads to lower nominal yields (see e.g. Warnock and Cacdac Warnock, 2009).

iii. Business cycle

The business cycle can have ambiguous impacts on long-term yields. In periods of high growth market participants often expect inflationary pressure and a rise in the federal fund rate to prevent an overheating of the economy and thus request higher yields. However, on the other hand the fiscal position often improves during a boom and uncertainty is reduced, which has a lowering impact on the yield. In contrast, in recessionary periods uncertainty increases and the fiscal position tends to deteriorate, while at the same time short-term interest rates and inflation expectations fall. Next to their influence on macroeconomic expectations, changes in the business cycle can have an impact on the demand for bonds. In a recession bonds are seen as safe havens while in boom times investors can be expected to switch their portfolio increasingly to stocks because they are then regarded as relatively safe and to earn significantly higher yields (Idier *et al.*, 2007). Overall, negative indications regarding the business cycle should lower long-term yields.

iv. Default risk

The default risk for government and governments sponsored bonds (i.e. agency bonds) depends on the (expected) fiscal position. The outcomes of various studies suggest that an increase of deficit and debt levels is followed by an increase of long-term yields due to an increasing risk premium.[107] This finding is partly confirmed by the events during the Euro Crisis. The default risk premium for corporate bonds depends on the expected default probability of corporations, which is influenced by the business cycle, market expectations, and the balance sheet of companies. An increase in the risk should lead to higher yields.

v. Volatility

Next to default risk, financial market volatility and macroeconomic volatility can have impacts on the long-term interest rate risk premium. A decrease in the volatility of bond yields lowers the risk for market participants and increases the attractiveness of bonds, and thus is expected to decrease the yield. Vice versa, an increase in stock market volatility might lead to an increase in the demand for bonds and hence might have a negative impact on bond yields. Moreover, a decrease in the volatility of short-term interest rates decreases

[107] An additional impact of changes in the fiscal position is that the supply of government bonds is increasing/decreasing which can lead to higher/lower yields (Côté and Graham, 2004)

the risk of bond holders and hence lowers yields. The same is true for reduced macroeconomic volatility because stable inflation rates and output expectations increase the attractiveness of fixed income securities in general (Rudebusch *et al.*, 2006).

vi. Demand

One decisive factor for the 'bond yield conundrum', which is often mentioned by investors and financial market experts, could be an increase in demand for fixed income securities (Rudebusch *et al.*, 2006). An increase in demand can lead to higher bond prices which in turn means lower yields. The inclusion of bond demand as a possible determinant of bond yields is not uncontroversial though. Investor demand should have no impact on yields in a world where financial markets are frictionless and all asset classes are perfect substitutes (ECB, 2006). However, I shall consider the alternative position that financial markets are not frictionless and that bonds have certain distinct properties that enable them to meet investors' needs in ways that other asset classes cannot (for a clear exposition of bond characteristics and their attraction for investors see e.g. Krishnamurthy and Vissing-Jorgensen, 2007; Greenwood and Vayanos, 2010)[108].

5.1.2. Rationale for the models

Although investor demand possibly is a crucial factor to explain the conundrum, many studies do not take into account changes in demand. For example, Taboga (2009), who uses a VAR-model with multi-equilibria, argues that the main reason for the fall of the long-term yield is a structural change that led to decreasing inflation expectations and a lower real natural rate of interest. De Graeve *et al.* (2009) also found that stable inflation expectations were the main reason for the conundrum, using a modified DSGE-model. Both studies state that while in former periods of tightening inflation expectations increased, in 2004 the expectations stayed relatively low. This finding however does not explain why the 10 year Treasury rate was actually falling after June 2004.

Results from affine financial factor models, moreover, do not support the finding that changes in the equilibrium interest rate or inflation expectations were responsible for the

[108] Recent research regarding the expectations hypothesis supports the view that it is possible that demand can influence long-term yields. Sarno *et al.* (2007), for example find that the expectation hypothesis can be rejected "throughout the maturity spectrum from one month to 10 years" (p. 82). Tang and Xia's (2007) research confirms this finding.

unusually low yield. Instead a lower term premium is seen to be responsible. Backus and Wright (2007) argue that the low term premium after 2004 can be most likely attributed to reduced inflation and macroeconomic uncertainty, and lower financial market risks. Kozicki and Sellon (2005) state that half of the decline in the term premium was due to lower uncertainty about the volatility of long-term inflation, while the other half was related to the reduction of the real term premium. Both authors agree that a change in the relative supply and demand of Treasuries could also be a force which was responsible for the reduction of the real term premium. Unfortunately, their models are not able to precisely identify the forces which lowered the real term premium.

Next to this research, extensive research has been devoted to the impact of foreign (official) demand on long-term Treasury yields. Although different measurement techniques are used, most studies that account for an increase in foreign official demand come to the conclusion that demand pressure has contributed to a great degree to the conundrum (Table 6). A recent study that researches the impacts of the Large Scale Asset Purchase programme of the Fed gives support to these findings. According to D'Amico and King (2010) this programme lowered long-term Treasury yields not only at the time of the purchase ("flow effect") but also led to persistently lower yields in the long-term ("stock effect").

Nevertheless, two studies found that an increase in demand had no long-term effect on the yields. These studies are from the ECB (2006) – which use an error correction model based on an ARDL – and Rudebusch *et al.* (2006) – which use a macrofinance vector autoregression (VAR) model. However, both studies have important shortcomings: The ECB study has (i) a small sample size (44 observations), (ii) only takes into account a part of the conundrum period (data until the end of 2004), and, most importantly, (iii) the ECB model is not able to explain the conundrum. In the model from Rudebusch *et al.* only a relatively small number of variables can be directly included and a no-arbitrage assumption is necessary. Furthermore, Rudebusch *et al.* use custodial data from the New York Fed (FRBNY) as proxy for foreign official holdings. This might not be the best approach because "... some foreign governments avoid the FRBNY and thus this source is best described as only partial" (Warnock and Warnock 2009, p. 905). More importantly the

outcomes of the model leaves "... about two-thirds of the bond yield conundrum yet to be explained" (p. 27) by future research[109].

Table 6: Estimated effects of foreign (official) demand on long-term US Treasury yields

Source	Approach	Reduction in bp
Merrill Lynch*	not published	30
JP Morgan Research	Regression on the impacts of changes in the current account balance of emerging economies on the real yield with the control variables: short-term interest rate, corporate financing gap, government deficit, and inflation volatility.	35
Goldman Sachs*	not published	40
Greenspan (2005b)	not published	<50
Bandholz et al. (2009)	Single equation error correction model taking into account foreign holdings as a percentage of total liabilities, the short-term interest rate, core price inflation, and the business cycle.	70
Edwin Truman*	General estimate based on assumed equivalence of reserve accumulation and reduction of fiscal deficit	75
Patrick Artus*	Regression of yield changes on fiscal deficit, current account and foreign net Treasury purchases	75
Craine and Martin (2009)	Regression which takes into account surprises in the target rate, macroeconomic surprises foreign demand and outstanding supply.	80
Warnock & Warnock (2009)	Regression estimated with ordinary last squares which accounts for foreign in-flows, the short-term interest rate, inflation, budget deficit and growth expectations, and the volatility of the interest rate. A vector error correction model with fewer variables confirms a negative effect.	80
Ben Bernanke et al.*	Regression of yield changes on intervention estimates, interpretation of yield disequilibria as a response to demand shocks	50-100
Bill Gross*	not published	100
Banque de France*	Error correction model estimating the long and short-term relationship between Treasury yields, fiscal deficit and measures of foreign official and foreign private net Treasury purchases	125
Stephen Roach*	not published	100-150
Nouriel Roubini et al.*	General estimate based on correction of conventional estimates taking into account possible downward biases stemming from methodological limitations to statistical analysis	200

*Note: For the sources marked with * the details are taken from ECB (2006)*

The first objective of my empirical analysis is therefore to verify if increased foreign official holdings have contributed to the conundrum in the Treasury market or not, by using a different modelling technique to Rudebusch *et al.* and Eijffinger *et al.* and consider more variables and a bigger sample size than the ECB. The second objective of my empirical analysis is to check if, in addition to foreign official demand, foreign and domestic private demand has depressed the yields of AAA-rated agency, corporate and

[109] A more recent and extensive study by Eijffinger *et al.* 2010, which does not take into account foreign demand, uses a similar method to Rudebusch *et al.* and consider some other variables (most importantly they test a wide spectrum of volatility measures). However, the study is also not able to explain the conundrum fully either.

municipal bonds in the US. Unfortunately previous studies have not considered the impact of private foreign and domestic demand on all bond yields[110]. As can be seen from Figure 23, the total demand for these bonds from foreign private investors, US institutional investors, US banking institutions and US individuals increased tremendously prior to the crisis – the foreign private inflows appear to have been due not only to inflows from Asian and other emerging market economies but also to inflows from Western European economies, albeit in their case leverage rather than export surpluses were the major source of funds (Bernanke *et al.*, 2011). Consequently, it is likely that not only foreign official but also foreign private and domestic private investors possibly pursued yields down.

In sum, my model can be represented by the following equation:

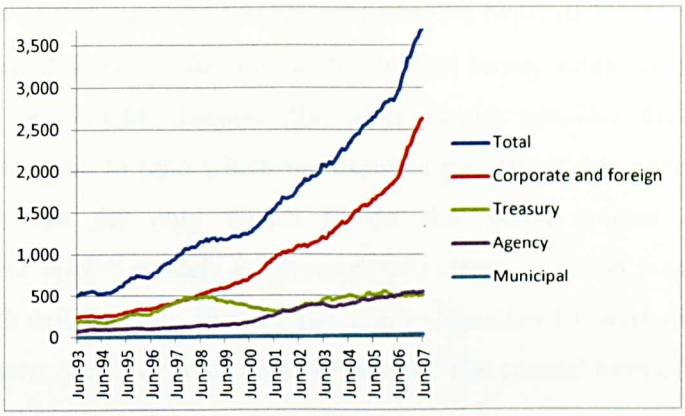
$$y^l = f(i^s, \pi, \pi^e, g^e, rp, d) \tag{13}$$

where y^l denotes the long term interest rate, i^s the short term interest rate, π current inflation, π^e inflation expectations, g^e growth expectations and rp is a risk premium for the expected default risk and macroeconomic and financial volatility, while d denotes investor demand for bonds.

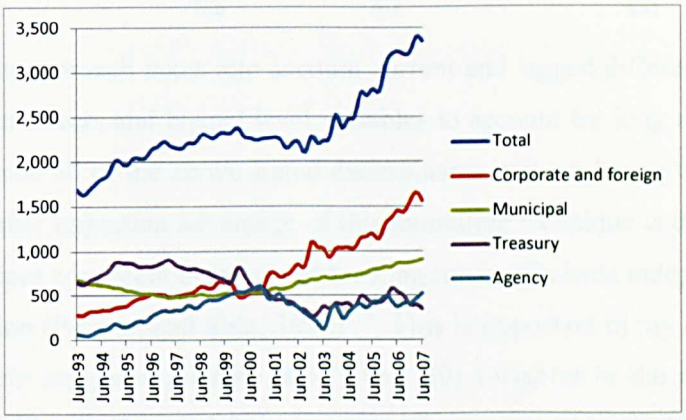
[110] To my knowledge nearly all existing studies on the 'conundrum' concentrate on the demand from foreign official sources on long term Treasury yields. Exceptions in this regard, which are however not all-encompassing as this study, are: ECB (2006) who test the impact of foreign official purchases on corporate bond yields and agency bond yields (without presenting their models in detail), Xiao and Xiao (2009) who test for the impact of pension funds on the yields of Treasuries and investment grade corporate bonds (without accounting for the demand from foreign sources and other domestic private investors), Warnock and Cacdac Warnock (2009) who test if the increase in Treasury purchases from foreign sources had a negative effect on the yield of corporate bonds and mortgage rates (without accounting for the demand for non-Treasury bonds), and Bertaut *et al.* (2011) who estimate the spillover impacts of foreign official purchases of Treasuries and Agency bonds on the 30-year fixed mortgage rate, Fanny Mae MBS yields and AAA-rated corporate yield, and the impact of foreign purchases of corporate bonds on the AAA-rated corporate bond yield (without accounting for private domestic demand).

Figure 23: US bond holdings from private foreign and domestic investors

a. Foreign private holdings (US$ billion)



b. US private investor holdings (US$ billion)



Sources: Sources: FR Statistical Release Z.1 (2010), TIC (2010)

Given that most of these variables are non-stationary according to unreported augmented Dickey-Fuller (ADF) unit root tests[111], stationary VAR and vector error correction models (VECM) are, in some senses, preferable to a single equation ordinary least squares (OLS) specification to assess their impact on bond yields. However, existing macro-finance models of the term structure that use VAR and new-Keynesian based modelling strategies (see Rudebusch *et al.*, 2006; Eijffinger *et al.*, 2010; Rudebusch, 2010) have been criticized because of their no-arbitrage assumption, the difficulty to optimize the likelihood function, the overfitting of risk, and the implied homoskedastic yields

[111] Even though the ADF test has low power, inspection of data plots and knowledge of the data suggest that most of my variables are intrinsically I(1). Exceptions are the (log of the) ISM-Index, the MOVE Index, and the corporate bond holdings ratio from US individuals, which are stationary according to ADF tests.

(Eijffinger *et al.*, 2010)[112]. Moreover, and most importantly, the application of the Johansen test for cointegration is impractical due to the large number of variables to be considered in the equilibrium and the large lag lengths required for monthly data (which make the degrees of freedom far too small). In this sense, single equation models are preferable to VARs/VECMs because the latter cannot consider the broad range of determinants that I seek to (and which represents a novelty of this paper). Hence, single equation models are the only means to do this given current data constraints. Consequently, four ARDL models in (unrestricted) error correction mechanism form are used to test which determinants, that are stated in in Equation 13, were mainly responsible for the low long term yields of AAA-rated US bonds. The general form of my models is:

$$\Delta y_t^l = \beta_0 + \sum_{i=0}^{p} \gamma_{1i} \Delta X_{1t-i} + \cdots + \sum_{i=0}^{p} \gamma_{Ki} \Delta X_{Kt-i} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i}^l + \alpha_0 y_{t-1}^l + \sum_{k=1}^{K} \beta_k X_{kt-1} + u_t \qquad (14)$$

This modelling approach takes into account current and lagged differenced variables to measure short run effects and lagged level variables to account for long run effects, and it allows us to include all of the above stated determinants without losing too many degrees of freedom. Another important advantage of this modelling technique is that, in contrast to VECMs, it produces consistent estimates of the long run coefficients independently of their order of integration (Pesaran and Shin, 1995)[113]. This is important in my application given that unit root tests suggest a mixture of I(1) and I(0) variables in the model. To assess whether the variables in the models cointegrate, Pesaran *et al.*'s (2001) bounds testing procedure (that corrects for weak endogeneity of regressors) is applied.

5.1.3. Data

For each of the above listed determinants a proxy is chosen that is either the same as or similar to that used in previous studies. Considering that most of the relevant data is not available on a daily or weekly basis, monthly data are utilized to ensure sufficient degrees

[112] To my knowledge macro-finance models of the term structure of interest rates were also not able to solve the 'bond yield conundrum'. For an in-depth discussion of macro-finance models of the term structure of interest rates see Diebold *et al.* (2005) and Rudebusch *et al.* (2006). See Kim (2007) for a thorough discussion of the shortcomings of this approach.

[113] The ARDL form that I adopt has additional advantages. First, it possesses small sample power dominance in terms of testing cointegration over Engle and Granger type tests and, second, the model corrects for any weak endogeneity of regressors – see, for example, Shin *et al.* (2011). A further point is that I can simultaneously estimate and test structural breaks in both the long run and short run components of the ARDL model in a simple manner.

of freedom[114]. As proxies for US long term interest rates of highly rated fixed income securities I take the 10-year Treasury yield (retrieved from the FR Statistical Release H.15), the 10-year agency bond yield, and the average yield of Moody's bond index for AAA-rated corporate bonds and for AAA-rated 10-year municipal bonds (all retrieved from Bloomberg).

To account for changes in the US short term interest rate the 3-month rate for Eurodollar deposits in London (FR Statistical Release H.15) is included. Following Warnock and Cacdac Warnock (2009), I see the Eurodollar rate as a preferable measure for changes in current monetary policy inasmuch as it varies more than the federal funds rate. As a proxy for current and expected inflation I include the trimmed personal consumption expenditure (PCE) deflator, following Bandholz *et al.* (2009), and the ten year CPI inflation expectations, as in Warnock and Cacdac Warnock (2009) – data are taken from the Survey of Professional Forecasters and the Philadelphia Fed respectively.

To capture the state of the business cycle, the purchasing manager index from the Manufacturing Survey of the Institute for Supply Management (ISM) is used, as in Bandholz *et al.* (2009). This is because "[f]inancial market participants have anxiously anticipated the ISM ever since Alan Greenspan once claimed ... that he placed great emphasis on this report" (Trainer, 2006, p. 211). When the ISM-Index is relatively high (> 50) market participants expect high growth figures and when the ISM-Index is relatively low (< 43) a recession is anticipated. As a proxy for changes in the stock market – which is seen as a good indicator of the business cycle and for shifts in portfolio preferences (Idier *et al.*, 2007) – I employ the Dow Jones Index (retrieved from yahoo finance).

I use the following data to measure changes in default risk perceptions, financial market volatility and macroeconomic uncertainty: Default risk is captured by using data about expected fiscal policy, which is measured by 5-year-ahead deficit-to-GDP expectations as in Laubach (2009)[115] (retrieved from the CBO Budget and Economic Outlooks) and the

[114] While monthly series do exist for most of the data some are only available on a quarterly basis and are therefore interpolated to monthly frequency with the "cubic match last" method, which is readily available in EViews. The variables which have been interpolated are: 10-year inflation expectations, domestic bond holdings, and the data on outstanding bonds (with the exception of Treasuries). The available data on the expected deficit-to-GDP ratio are only published twice each year by the CBO and are therefore also interpolated, in line with Warnock and Cacdac Warnock (2009).

[115] It can be difficult to measure the impact of the actual deficit-to-GDP ratio because automatic stabilizers lead to an increase of deficit levels in recessionary periods, while monetary easing can at the same time be

expected default risk of AAA-rated corporate bonds. The latter is proxied by the EDF for AAA-rated corporate bonds (kindly provided by Moody's Analytics UK) as in Krishnamurthy and Vissing-Jorgensen (2007). Analogous to Rudebusch *et al.* (2006) data from the Merrill Lynch Option Volatility Estimate (MOVE) Index, retrieved from Bloomberg, are used to account for financial market volatility[116]. Furthermore, the 24-month rolling standard deviation of the Eurodollar rate, the Chicago Board Options Exchange Volatility (VIX) Index (retrieved from Bloomberg), and two measures for macroeconomic uncertainty (the 24-month rolling standard deviation of the ISM-Index and of the ten year CPI inflation expectations) are tested for significance, similar to Rudebusch *et al.* (2006).

To measure the influence of changes in investor demand on bond yields, private and foreign official holdings as a ratio of total outstanding bonds are taken into account, as in Rudebusch *et al.* (2006) and Bandholz *et al.* (2009). The holdings ratio is preferable to mere flow or stock figures because demand pressure can be expected to take place only when investors increase their holdings disproportionally to newly available bonds (i.e. if their holdings ratio increases). The data for changes in the holdings from US banking institutions, US individuals and US institutional investors are retrieved from the Flow of Funds statistics[117]. The data for foreign official and foreign private long term holdings are taken from the Treasury International Capital Reporting System (TIC)[118] because the Flow of Fund statistics do not distinguish between official and private holdings. The amount of total outstanding bonds is retrieved from the Flow of Funds tables and from the Treasury Bulletins (outstanding notes, bonds and Treasury inflation protected securities).

5.1.4. Sample period

Most previous studies take the mid-1980s to mid-2000s as their sample period. In contrast, I limit my sample period to that spanning February 1994 to June 2007 (with the

expected to lower the long term yield. Laubach (2009) has therefore proposed using expected deficit-to-GDP ratios as these are more likely to mirror investor's expectations that are important for yields.

[116] For non-Treasury bonds the significance of the 24-month rolling standard deviations of the long term yields were tested, similar to Warnock and Cacdac Warnock's (2009) approach, but these proxies are insignificant.

[117] FR Statistical Release: Tables L209, L210, L211 and L212.

[118] Holdings in the TIC data are only reported semi-annually. Therefore, estimations from the Fed about monthly changes in holdings are used (http://federalreserve.gov/pubs/ifdp/2007/910/ticdata.zip).

exception of the agency bond model where the yield data are only available from 1995 onwards). February 1994 has been chosen as the starting point because the data on foreign official holdings show a structural break at that time – presumably the break can be attributed to the devaluation of the Renminbi from 5.8 ¥/$ to 8.7 ¥/$ between December 1993 and January 1994. Another reason is provided by Thornton (2007) who presents evidence that a structural break might have occurred in 1994 when the Federal Open Market Committee started to release policy statements after its meetings. This change has influenced expectations to a significant degree (Bernanke *et al.*, 2004). June 2007 has been chosen as the last observation because subprime "problems started to become evident on Wall Street and London in June 2007 [when] Bear Sterns' highly leveraged mortgage-backed securities funds lost virtually all their value and ultimately filed for bankruptcy" (Dwyer and Tkac, 2009, p. 1301).[119]

5.1.5. Model selection

Treasury yield model. — First, the 10-year Treasury yield based on the variables described above is modelled. Due to the multitude of potential variables that could be included, a model was constructed which incorporated contemporaneous differenced and level proxies of variables that were significant in the models of previous studies. Thus:

$$\begin{aligned}\Delta y_t^l = {} & \beta_0 + \beta_1(\Delta FO_t) + \beta_2(\Delta FP_t) + \beta_3(\Delta P_t) + \beta_4(\Delta i_t) + \beta_5(\Delta lism_t) + \beta_6(\Delta \pi_t) \\ & + \beta_7(\Delta \pi_t^{10}) + \beta_8(\Delta dow_t) + \beta_9(\Delta move_t) + \beta_{10}(\Delta def_t^5) + \beta_{11}(y_{t-1}^l) \\ & + \beta_{12}(FO_{t-1}) + \beta_{13}(FP_{t-1}) + \beta_{14}(P_{t-1}) + \beta_{15}(i_{t-1}) + \beta_{16}(lism_{t-1}) \\ & + \beta_{17}(\pi_{t-1}) + \beta_{18}(\pi_{t-1}^{10}) + \beta_{19}(dow_{t-1}) + \beta_{20}(move_{t-1}) + \beta_{21}(def_{t-1}^5) \quad (15)\end{aligned}$$

[119] To check for the robustness of my results (see Section 5.2) I also re-estimated my parsimonious models (reported in Table 8 and Table 9) over two different time periods: January 1996 to June 2007 and January 1994 to December 2005 (in the case of the agency bond yield January 1995 to December 2005). Overall the results are very stable: The 8 models with a shorter time period do not suffer from misspecification (with the exception of the Corporate Model January 1994 to December 2005, where BG(12) suggests autocorrelation problems). The signs of all 98 variables stay the same, and only 10 of the 96 individually significant variables change their significance. The most important change is that in the time period that ends in December 2005 (which I am least interested in) the sum of the lagged foreign private and foreign private break level variable in the Treasury Model and the sum of the lagged foreign private and foreign private break level variable in the Agency Model becomes positive; however, in both cases the long-run equilibrium impact is insignificant – the other 22 demand variables stay significant and have similar magnitudes in all three time periods. I am therefore confident that the overall results that investor demand is crucial to explain the 'bond yield conundrum' is not biased by the chosen time period. Indeed, when changing sample periods one would expect some changes in results, however, the issue is how major are these changes to the fundamental conclusions of the paper. I find that the changes that occur are relatively minor and do not alter the fundamental conclusions of the dissertation. Hence, I present my results as robust.

where $_t$ indicates the current period, $_{t-1}$ denotes a one month lag, Δ is the difference operator, y^l is the nominal 10-year Treasury yield, *FO* are foreign official holdings as a ratio of total outstanding long term Treasuries, *FP* are foreign private holdings as a ratio of total outstanding long term Treasuries, *P* are US pension funds holdings as a ratio of total outstanding long term Treasuries, *i* is the 3-month Eurodollar rate, *lism* is the log of the ISM-Index, π is the actual PCE inflation rate, π^{10} are 10-year CPI inflation expectations, *dow* is the value of the Dow Jones Index, *move* is the MOVE Index, and def^5 are 5-year deficit-to-GDP expectations.

However, when estimated this model suffered from autocorrelation suggesting that the yield might be influenced by some differenced variables with a time lag. The monthly frequency of my data suggests consideration of up to twelve lags of each of the variables. Consequently, I employed a general to specific approach to test which of the variables are significant. Not all twelve differences of all of the variables in Equation 15 could be included simultaneously, I therefore added the twelve lagged differences of just one variable to Equation 15 and, based on an F-test, excluded the jointly insignificant lags of the differences of this variable. This was repeated in turn for each of the variables in Equation 15, including the dependent variable, until a model that included only significant lags of the differences of all variables was obtained. Finally, all level variables which were not significant at the 5% level were removed from the model.

Variable addition tests were then conducted on the following variables not included in Equation 15: VIX Index and the 24-month rolling standard deviation of the Eurodollar rate, ISM-Index, and ten year CPI inflation – the first lagged levels and twelve lagged differences being considered for each factor. However, all of these variables are jointly insignificant at the 5% level, which is in line with the results of Rudebusch *et al.* (2006, p.25) who find that from the volatility variables "[t]he most significant and robust explanatory variable is the implied volatility on longer-term Treasuries." (i.e. the MOVE Index). The resulting model (reported as (i) in Table 8 in the Results section) shows no evident misspecification at the 5%-level in terms of autocorrelation (lags 1...12), non-normally distributed residuals and heteroskedasticity [Arch (lags 1...12) and White tests]. According to Ramsey's Reset test the appropriate functional form is linear and the Wu-Hausman test indicates that all contemporaneous variables are weakly exogenous. Further, the bounds test (with unrestricted intercept) – critical values are taken from Pesaran *et al.*

(2001) – confirms that the level variables are mutually cointegrated irrespective of whether the regressors are I(0) or I(1)[120]. Hence there is no issue of spurious regression and inference from the various statistics (including t-ratios) is valid.

However, unreported CUSUM and CUSUM of Squares Test indicate a structural break. This is in line with the findings of ECB (2006), which reports a structural change in 1999, and Wu (2005) who finds a structural break between 2000 and 2002. Therefore, a Quandt-Andrews breakpoint test (35% trimming) was undertaken. According to this test, the maximum likelihood for a break is in November 1998, although a break is only indicated at the 10% level. However, a Chow breakpoint test finds that a break occurred in November 1998 at the 5% level (Table 7, first column) – please note that according to the Chow test no structural break occurred in June 2004, when the conundrum period started. Considering all of these results and those of past studies I believe that it is reasonable to consider the possibility of a break in November 1998. The main reason for the break at this time probably is that in 1999 the "strong accumulation of reserves" started (ECB, 2006, p. 56) while at the same time the holdings ratio of foreign private investors declined (with the exception of the period October 1999 to January 2000).

Table 7: Results breakpoint tests

	Treasury model	Corporate model	Agency model	Municipal model
Quandt-Andrews unknown breakpoint test				
Max Likelihood Ratio F-statistic prob.	0.062	0.005	0.000	0.001
Max date	1998:11	1999:02	2001:04	2001:04
Chow breakpoint test				
F-stat. prob. at Quandt-Andrews max date	0.018	0.003	0.000	0.001
F-stat. prob. 2004:06	0.873	0.849	0.186	0.742

Note: This table shows the results of the Quandt-Andrews unknown breakpoint tests (35% trimmed data, probabilities calculated using Hansen's (1997) method) and the Chow breakpoint tests for all my models. The presented figures are F-statistic probabilities and dates.

To model the structural break, shift variables for all the significant independent variables were created with the value zero before the break and the original value of the

[120] The F-test applied with unrestricted intercept deletes all lagged level terms (but not the intercept) from the model – the number of lagged level terms (excluding y_{t-1}^{I}) determines the degrees of freedom. For the F-test and t-test the critical values corresponding to the I(1) bound are reported in the table because breaching these values confirms cointegration regardless of the variables' order of integration.

variable after the break[121]. All of these shift variables were jointly included in the model. The jointly insignificant variables were subsequently excluded (first the shift variables and then the non-shift variables) to obtain the final parsimonious model. This model (reported as (ii) in Table 8 in the Results section) has a superior fit to the model without a break, no misspecification is evident and its level variables are mutually cointegrated[122]. Further, the CUSUM and CUSUM of Squares Test indicate no other structural break after November 1998 (the Quandt-Andrews test cannot be effectively applied in this model because of the shift variables).

Agency, corporate and municipal yield models. — The model selection procedure for the other bond models is essentially the same as that for the Treasury yield model. In addition to the macroeconomic and risk variables that are significant in the Treasury model, the 24-month rolling standard deviation of changes in the long rates for each bond class and the EDF for AAA-rated corporate bonds were tested for significance (again with lags 1...12 for the differenced variables). Furthermore, I also controlled for an increase in foreign and domestic investor demand for each bond class[123]. Having established parsimonious models for agency, corporate and municipal bond yields, breakpoint tests were carried out. In line with the Treasury model, these tests indicated a structural break for each bond class (Table 7)[124]. Hence, for each model shift variables were tested for their significance in line with the above described procedure.

[121] I am aware that the switch from one regime to another may occur over a period of time, perhaps in a smooth transition. However, to model only a one time shift provides a better approximation than to not include a shift at all (which is a shortcoming in other recent studies on the topic, as will be discussed in more detail at the end of the next section). Therefore, I think that my work is an important development and it is the best I can do at the moment taking into account the degrees of freedom problem that I am facing.

[122] Because the shift variables are related to the non-shift variables the degrees of freedom for the cointegration test are uncertain. One could, for example, either treat the shift and non-shift components of a particular variable as one covariate or two separate variables for calculating degrees of freedom. Following Shin *et al.* (2011) I consider critical values using degrees of freedom calculated in both of these ways, thereby forming further upper and lower bounds of the test for the already existing upper and lower bounds (related to uncertainty over the variables' orders of integration). If the F-statistic (t-ratio) exceeds (is below) the critical value's bound for I(1) processes treating shift and non-shift components of a variable as one (two) covariate(s) there is unambiguous evidence of cointegration and I use these criteria in my application. I extrapolate some of the critical values reported in Pesaran et al (2001) when the number of variables used to calculate the degrees of freedom exceed [122] I also note that the use of this cointegration test in a model allowing for structural breaks represents one of the novelties of this dissertation.

[123] Only those investor groups that had significant holdings in June 2007 (i.e. only investor groups with a holdings ratio of above 1%) and that increased their holdings ratio in the respective bond class during the 'conundrum' period were included in each model.

[124] An intuitive reason why the breaks for non-Treasury yields occur later is that after the reserve holdings of Central Banks increased private investors changed their demand behaviour – i.e. they were forced more and more out of the Treasury market – which had a significant impact on the yield of non-Treasury bonds.

The resulting parsimonious models show no evident misspecification, the level variables are mutually cointegrated (reported in Table 9 in the Results section) and, in particular, the CUSUM and CUSUM of Squares Test indicate no further structural breaks. All of my favoured models for inference include shift variables and are discussed in the next section. Due to simplicity reasons only the models that account for the structural break are presented for the agency, corporate and municipal bond yields (all of these models have a superior fit compared to those without a break). The long run solutions for my favoured parsimonious dynamic models (with breaks) are reported in Table 10 in the Results section (the equilibrium coefficients standard errors are obtained as discussed in De Boef and Keele, 2008).

5.2. Results

5.2.1. Treasury yield model

The results of the Treasury model confirm previous findings that an increase in the demand from foreign governments had a negative impact on the long term Treasury yield. According to my favoured model for inference, Table 8 model (ii), an increase in foreign government demand had a consistently negative impact on the 10-year US Treasury yield throughout the whole sample period in the short and long run. That is, ceteris paribus, an increase of the foreign official holdings ratio by 1% point had a negative impact on the yield of around 9 basis points (bp) in the long run. This magnitude is similar to the 7 bp impact that Bandholz *et al.* (2009) and Bertaut *et al.* (2011) found in their models[125]. Foreign private investors also had a negative impact in the long run before November 1998 but their impact became insignificant thereafter. The most likely explanation for this change is that although between August 1994 and November 1998 the holdings ratio of foreign private investors increased steadily (by a total of 11% points), after the latter date it began to decline (for example, it declined by 3.5% points in the conundrum period June 2004 to June 2007). Hence, private investors put no further demand pressure on the yield in the post break period.

[125] Bandholz *et al.* (2009) use total foreign Treasury holdings as measurement and Bertaut *et al.* (2011) foreign official holdings of Treasuries and agency bonds.

Table 8: Parsimonious model of the nominal 10-year Treasury yield

	(i) without break		(ii) with break	
Δ(FOROFFICIAL)	-0.2174***	(-6.44)	-0.2155***	(-6.81)
Δ(FOROFFICIAL(-1))	-0.1273***	(-3.58)	-0.1325***	(-4.11)
Δ(EUR_DOL)	0.3279***	(3.42)	0.7202***	(4.38)
$\Delta(EURDOL)^{s11/98}$			-0.5256***	(-2.98)
Δ(EURDOL(-1))	-0.2459***	(-2.62)	-0.1630*	(-1.78)
Δ(LOGISM)	0.9202**	(2.31)	1.0200***	(2.65)
Δ(LOGISM(-1))	1.1464***	(3.17)	1.6376***	(2.86)
$\Delta(LOGISM(-1))^{s11/98}$			-1.2539*	(-1.80)
Δ(LOGISM(-4))	1.0097***	(2.83)	0.8844***	(2.66)
Δ(PCE)	0.5404***	(2.72)	0.5403***	(2.90)
Δ(PCE(-9))	-0.6486***	(-2.98)	-0.6432***	(-3.12)
Δ(DOW)	0.0001**	(2.36)	0.0001**	(3.14)
Δ(DOW(-1))	0.0001**	(2.50)		
YIELD(-1)	-0.2835***	(-6.13)	-0.3795***	(-6.63)
FOROFFICIAL(-1)	-0.0224***	(-3.46)	-0.0358***	(-4.67)
FORPRIVATE(-1)	-0.0252**	(-2.07)	-0.0909***	(-6.50)
$FORPRIVATE(-1)^{s11/98}$			0.0924***	(3.62)
EURDOL(-1)	0.0535***	(3.36)	0.1700***	(3.45)
$EURDOL(-1)^{s11/98}$			-0.1277***	(-2.73)
LOGISM(-1)	0.8877***	(2.91)	1.2634***	(4.69)
$LOGISM(-1)^{s11/98}$			0.3038**	(-2.29)
PCE(-1)	0.2431**	(2.28)	0.3578***	(3.28)
CPI10Y(-1)	0.3855**	(2.05)		
DOW(-1)	0.0001***	(3.53)	0.0002***	(5.88)
MOVE(-1)	0.0021**	(2.27)	0.0027***	(2.78)
adj. R-squared	0.58		0.64	
Schwarz criterion	-0.47		-0.54	
Sample: 1994:02 to 2007:06 (161 observations)				

(iii) equilibrium long-run effects of (ii)		
before the break		
FOROFFICIAL	-0.0944***	(-7.14)
FORPRIVATE	-0.2396***	(-5.82
EURDOL	0.4478***	(4.50)
LOGISM	3.3286***	(5.52)
PCE	0.9426***	(3.72)
DOW	0.0005***	(5.56)
MOVE	0.0070***	(2.88)
after the break		
FOROFFICIAL	-0.0944***	(-7.14)
FORPRIVATE	0.0038	(0.07)
EURDOL	0.1113***	(2.85)
LOGISM	2.5283***	(3.61)
PCE	0.9426***	(3.72)
DOW	0.0005***	(5.56)
MOVE	0.0070***	(2.88)

misspecification/cointegration tests	(i)	(ii)
BG(2) prob.	0.16	0.24
BG(12) prob.	0.25	0.36
Jarque-Bera prob.	0.44	0.26
Arch(1) prob.	0.90	0.56
Arch(12) prob.	0.56	0.49
White prob.	0.34	0.61
Ramsey LR prob.	0.87	0.15
Wu-Hausm. prob.	0.85	0.58
Bounds test F-stat.	6.44***	8.20***
Bounds test t-stat.	-6.13***	-6.63***

Note: This table summarizes the results of my ARDL-model for the nominal 10-year Treasury yield. Where Δ is the difference operator, the number of lags are indicated in parentheses as a suffix to a variable's name, $s^{11/98}$ indicates the shift component of a variable and the date of the structural break (i.e. after November 1998), *YIELD* is the 10-year nominal Treasury yield, *FOROFFICIAL* are foreign official holdings as a ratio of total outstanding long-term Treasuries, *FORPRIVATE* are foreign private holdings as a ratio of total outstanding long-term Treasuries, *EURDOL* is the 3-month Eurodollar rate, *LOGISM* is the log of the ISM-Index, *PCE* is the actual PCE inflation rate, *CPI10Y* are 10-year CPI inflation expectations, *DOW* is the value of the Dow Jones Index, and *MOVE* is the Merrill Lynch Option Volatility Estimate Index. Intercepts are not reported but are included in the models. In each column coefficients and t-statistics (in parenthesis) are reported. Probability values for all misspecification tests are reported in the section headed misspecification/cointegration tests, where BG(x) denotes the probability value of the Breusch-Godfrey test for x order correlation and Arch(x) the probability value of the Arch heteroskedasticity test with x lags. The 5% critical values for the bounds cointegration test with unrestricted intercept and no trend are (i) F=3.39, t=-4.72, (ii) F=3.50, t=-5.03 [(i) k=8, (ii) k=10 (t), k=7 (F)] – see Pesaran *et al.* (2001). The significance of a coefficient or test statistic at the 1%, 5% and 10% level of significance is indicated by ***, ** and *, respectively.

All the control variables have the expected signs and reasonable magnitudes. The short term interest rate has a positive impact in both the short run and the long run, but after November 1998 this impact becomes much smaller in both cases. This finding supports Stiglitz and Greenwald's (2003) argument that financial innovation fostered a decoupling of long term interest rates from short term rates. To be specific, I find that, ceteris paribus, before November 1998 a 1% point increase in the short term interest rate leads to a 45 bp increase in the Treasury yield in the long run, with this impact declining to 11 bp after this date. These magnitudes are in line with other studies, e.g. Warnock and Cacdac Warnock (2009) who find that the impact is 37 bp (but who do not consider a possible shift in the relationship between short term and long term interest rates).

Higher growth expectations are also found to lead to an increase in the Treasury yield, but here again the impact becomes smaller after the break: thus, ceteris paribus, in the conundrum period a 1% increase of the ISM Index raised the yield by about 2.5 bp. This result is similar to Bandholz *et al.* (2009) who report an impact of about 2 bp. In contrast, the long run impact of inflation, stock prices and the volatility of Treasuries on the yield remains unchanged throughout the whole period. Ceteris paribus, a 1% point rise in the PCE deflator increases the yield by 94 bp, a 1000 point increase in the Dow Jones Index raises the yield by 45 bp (in line with Idier *et al.* (2007) who find that a 1% increase in stock returns has an impact of 42 bp) and an increase of the MOVE Index by 10 points increases the yield by 7 bp in the long term.

In order to make these results more palpable and identify which of the variables included in the Treasury model (ii) were responsible for the 'bond yield conundrum' the marginal cumulative impact (MCI[126]) of each of these variables on the Treasury yield is used. June 2004 to June 2007 is chosen as the reference period for this exercise because it spans the beginning of US monetary tightening and the subsequent debate on the 'bond yield conundrum'. The MCI of each variable depends on the coefficients (including the changes due to the break where applicable) of the differenced and lagged level variables and on the changes in the data of the variable.

[126] The MCI is the difference in a particular variable's contribution to the yield in any particular period relative to a reference point (in my case May 2004).

Thus, the formula for calculating the MCI for each month is:

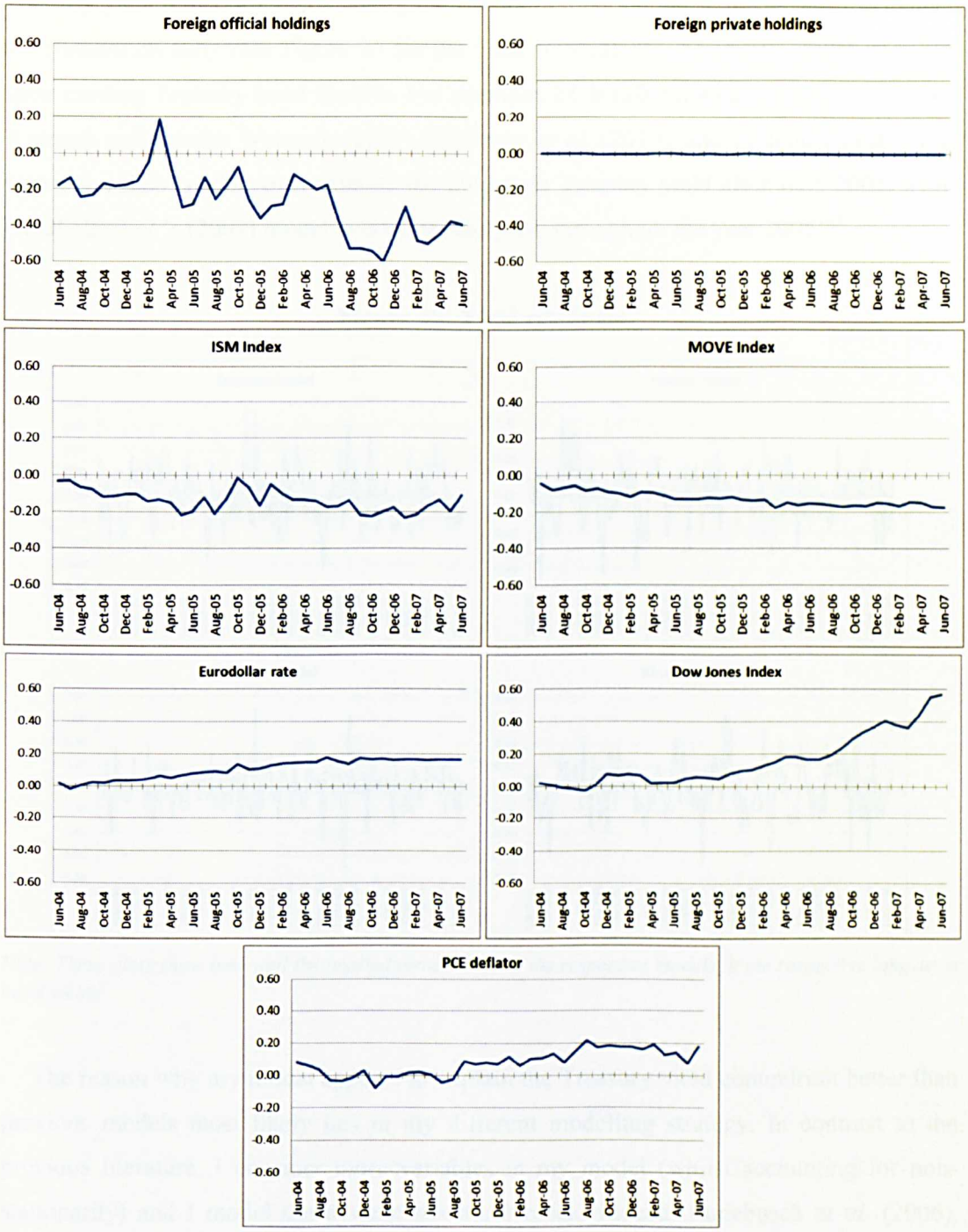
$$Impact_{\gamma t} = \beta_{\gamma 1}\Delta\gamma_t + \beta_{\gamma 1}^{shift}\Delta\gamma_t + \cdots + \beta_{\gamma 12}\Delta\gamma_{t-12} + \beta_{\gamma 12}^{shift}\Delta\gamma_{t-12} + \beta_{\gamma 13}\gamma_{t-1} + \beta_{\gamma 13}^{shift}\gamma_{t-1} \quad (16)$$

$$MCI_{\gamma t} = Impact_{\gamma t} - Impact_{\gamma 2004:05} \quad (17)$$

Figure 24 shows that foreign official demand has the largest negative MCI on the yield in the reference period, which can therefore be seen as mainly responsible for the conundrum, while foreign private demand by contrast had virtually no impact in this period. My model's finding that the increase in foreign official Treasury holdings depressed the yield by as much as 60 bp during the conundrum period is similar to previous findings: Bandholz *et al.* (2009) report an impact of 70 bp between 2003 and 2006, Craine and Martin (2009) one of 80 bp between 2004 and 2006, and Warnock and Cacdac Warnock (2009) one of 80 bp between 1984 and May 2005[127]. In addition to foreign official demand, pessimistic expectations about the business cycle (ISM Index) and a decrease of the implied yield volatility (MOVE Index) also had a negative impact on the Treasury yield of about 20 bp each and therefore also partly explain the conundrum. Counteracting these factors were the increases in short term interest rates and in core price inflation, both of which had a small positive impact of about 20 bp, and the rise in stock prices, which had a relatively larger positive impact of almost 60 bp.

[127] These reported impacts are of course influenced by the chosen reference point. If February 1994 is taken as the starting point foreign official demand will be found to have depressed the 10-year Treasury yield by as much as 128 bp in the 'conundrum' period. However, if January 2003 is taken as the starting point the size of the impact is 70 bp, exactly the amount reported in Bandholz *et al.* (2009).

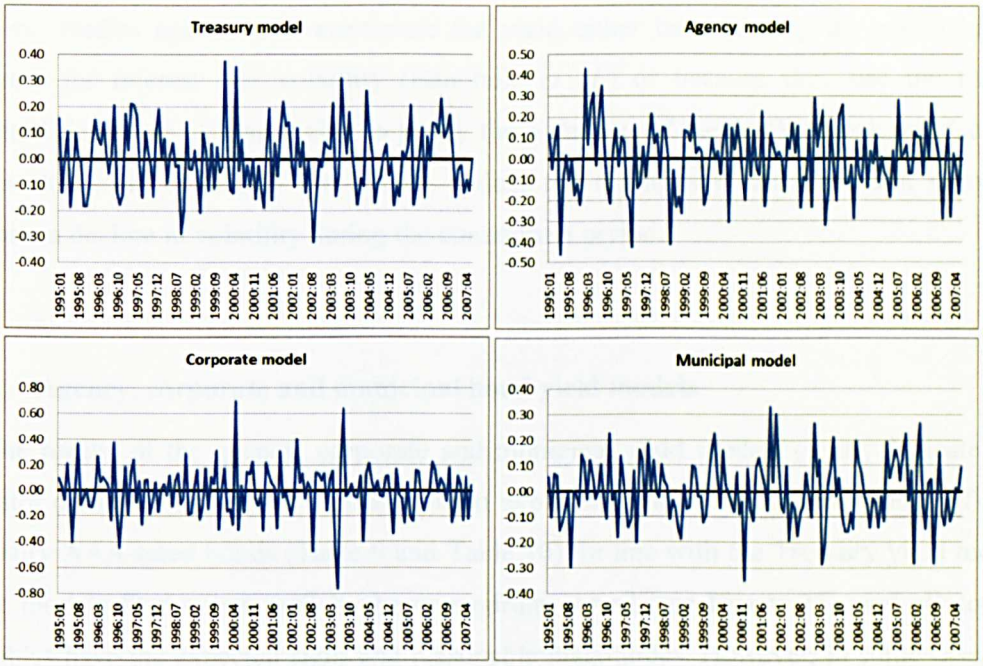
Figure 24: Variables' MCIs for the nominal 10-year Treasury yield



Note: These plots show the MCI of the demand variables on the nominal 10-year Treasury yield for each month during the conundrum period, according to the results of my Treasury yield model (see Table 8, column 2).

According to the implied yield of my favoured model for inference, which fits the actual Treasury yield remarkably well during the conundrum period, these forces seem to explain the conundrum fully (see Figure 25 for the yield residuals)[128]. Thus, my model improves upon existing Treasury bond models. For example, ECB (2006), Rudebusch *et al.* (2006), Warnock and Cacdac Warnock (2009), Eijffinger *et al.* (2010), and Rudebusch (2010) all report that their models overestimate the long term Treasury yield after June 2004, while Bandholz *et al.*'s (2009) model overvalues the yield throughout the year 2005[129].

Figure 25: Yield residuals



Note: These plots show how well the implied yield values of the respective models fit the respective long-term bond yields.

The reason why my model appears to explain the Treasury yield conundrum better than previous models most likely lies in my different modelling strategy. In contrast to the previous literature, I consider more variables in my model (whilst accounting for non-stationarity) and I model the evident structural break. Indeed, Rudebusch *et al.* (2006), Eijffinger (2010), and Rudebusch (2010) use a VECM model that does not directly include

[128] The residuals of the yield have been calculated as follows: *actual yield – fitted yield* (where *fitted yield = fitted Δyield + actual yield*$_{t-1}$).

[129] Not all existing studies report their model residuals, see e.g. Idier *et al.* (2007), and Craine and Martin (2009).

foreign official demand[130], which my model found to be the most important variable in explaining the conundrum. Furthermore, the above authors do not take into account the possibility that the impact of the short term interest rate on the 10-year Treasury yield during the conundrum period was smaller than before November 1998.

The incorporation of this possibility in my model also seems to provide a major explanation as to why it fits the yield better than the models of Bandholz *et al.* (2009) and Warnock and Cacdac Warnock (2009). The models of these authors attribute a higher impact than my model does to the short term interest rate during the conundrum period (with long run coefficients of 0.37 and 0.33, respectively). An additional point is that these authors' studies appear to overestimate the yield either because they do not include a measure for interest rate volatility (Bandholz *et al.*) or because they use the rolling standard deviation of long yields to proxy the volatility of yields (Warnock and Cacdac Warnock) – in contrast to the MOVE Index, the rolling standard deviation does not indicate a decline in volatility during the conundrum period.

5.2.2. Agency, corporate and municipal bond yield models

The results of the agency, corporate and municipal yield models clearly indicate that investor demand also played a major role in explaining the low long term yields of non-Treasury AAA-rated bonds (Table 9 and Table 10). In line with the Treasury yield model, these models fit the data well in the conundrum period (see Figure 25), and all control variables have the expected signs and reasonable magnitudes. However, in some cases the magnitudes differ significantly. Next to noise, the most likely explanation for this observation is that investors do not see these different bond classes as perfect substitutes and therefore ask for different adjustments in prices when conditions are changing. Indeed, previous studies confirm that investors value different bond classes differently even while they may carry the same credit rating (see e.g. Krishnamurthy and Vissing-Jorgenson, 2007).

[130] Rudebusch *et al.* (2006) test if foreign official demand is correlated with the error term of their model, and find no correlation (they use custodial data from the New York Fed (FRBNY) as a proxy for foreign official holdings; this seems not be the best proxy because "... some foreign governments avoid the FRBNY and thus this source is best described as only partial" (Warnock and Cacdac Warnock 2009, p. 905). However, this finding does not imply that the model results would be the same if the variable is fully incorporated in the model.

Table 9: Parsimonious model of the nominal long-term yields of AAA-rated non-Treasury US debt securities

(i) Agency			(ii) Corporate			(iii) Municipal		
Δ(FOROFFICIAL)	-1.7414***	(-5.68)	Δ(YIELD(-1))	0.0956	(1.61)	$\Delta(YIELD(-1))^{s04/01}$	0.4644***	(4.57)
Δ(FORPRIVATE)	-0.4600***	(-3.45)	Δ(FORPRIVATE)	-0.3983***	(-9.59)	$\Delta(YIELD(-1))^{s04/01}$	0.3334***	(3.59)
Δ(USINDIVIDUALS)	-0.1321***	(-2.98)	Δ(FORPRIVATE(-1))	-0.2464***	(-5.10)	$\Delta(YIELD(-3))^{s04/01}$	0.2833***	(3.22)
Δ(EURDOL)	0.4803***	(3.80)	Δ(US INDIVIDUAL(-1))	-0.1792***	(-5.90)	Δ(YIELD(-4))	0.2293***	(3.70)
Δ(LOGISM)	1.4678***	(3.11)	Δ(USBANK(-1))	-0.3478***	(-4.28)	Δ(YIELD(-5))	0.2166***	(3.62)
Δ(PCE)	0.6020**	(2.50)	Δ(EURDOL(-1))	-0.1658***	(-2.59)	Δ(EURDOL)	0.7231***	(8.42)
$\Delta(PCE(-2))^{s04/01}$	-0.8739***	(-2.82)	$\Delta(EURDOL(-8))^{s02/99}$	-0.3045***	(-4.24)	$\Delta(EURDOL(-2))^{s04/01}$	-0.3469**	(-2.34)
$\Delta(DOW)^{s04/01}$	0.0003***	(4.95)	Δ(EURDOL(-11))	0.1275**	(2.24)	$\Delta(EURDOL(-8))^{s04/01}$	-0.3734***	(-2.87)
$\Delta(MOVE)^{s04/01}$	0.0094***	(4.95)	Δ(LOGISM)	0.6734**	(2.39)	Δ(PCE)	0.9009***	(5.03)
YIELD(-1)	-0.4101***	(-7.87)	Δ(LOGISM(-1))	1.5553***	(3.82)	Δ(DOW)s04/01	0.0002***	(3.85)
FOROFFICIAL(-1)	-0.4626***	(-3.27)	$\Delta(LOGISM(-1))^{s02/99}$	-1.4720***	(-3.03)	Δ(DOW(-5))	0.0001***	(2.61)
$FOROFFICIAL(-1)^{s04/01}$	0.4027***	(3.32)	Δ(PCE)	0.4381***	(3.29)	Δ(MOVE)	0.0033***	(3.19)
FORPRIVATE(-1)	-0.2168***	(-3.11)	Δ(PCE(-9))	-0.4191***	(-2.91)	Δ(MOVE(-2))	-0.0027***	(-2.96)
USINDIVIDUAL(-1)	-0.0514***	(-3.54)	Δ(DOW)	0.0001***	(3.21)	YIELD10(-1)	-0.5913***	(-8.75)
$USPENSION(-1)^{s04/01}$	-0.1441***	(-3.07)	YIELD(-1)	-0.2273***	(-6.56)	$YIELD(-1)^{s04/01}$	-0.4765***	(-6.14)
EURDOL(-1)	0.2218***	(5.02)	FORPRIVATE(-1)	-0.2113***	(-5.37)	FOREIGN(-1)	-4.9958***	(-6.30)
LOGISM(-1)	1.3153***	(4.34)	$FORPRIVATE(-1)^{s02/99}$	0.1615***	(4.50)	$FOREIGN(-1)^{s04/01}$	4.1318***	(6.05)
PCE(-1)	0.8260***	(6.30)	EURDOL(-1)	0.0664***	(4.83)	USINDIVIDUAL(-1)	-0.1010***	(-4.27)
DOW(-1)	0.0002***	(4.53)	LOGISM(-1)	0.6125***	(3.51)	USINSURANCE(-1)	-0.0747***	(-2.60)
MOVE(-1)	0.0036**	(2.24)	$LOGISM(-1)^{s02/99}$	-0.5380***	(-4.33)	USBANK(-1)	-0.2470**	(-2.07)
$MOVE(-1)^{s04/01}$	0.0061***	(2.80)	PCE(-1)	0.1906***	(2.88)	EURDOL(-1)	0.2054***	(6.09)
adj. R-squared	0.63		CPI10Y(-1)	0.3002**	(2.29)	LOGISM(-1)	0.6388***	(2.73)
Schwarz criterion	-0.09		DOW(-1)	0.0001***	(5.61)	PCE(-1)	0.3050***	(3.66)
Sample: 1995:01 to 2007:06 (150 obs.)			MOVE(-1)	0.0016**	(2.34)	DOW(-1)	0.0001***	(3.71)
			EDFAAA(-1)	3.0898***	(5.60)	MOVE(-1)	0.0055***	(4.82)
			adj. R-squared	0.71		adj. R-squared	0.57	
			Schwarz criterion	-1.19		Schwarz criterion	-0.61	
			Sample: 1994:02 to 2007:06 (161 obs.)			Sample: 1994:02 to 2007:06 (161 obs.)		

Results misspecification/cointegration tests

BG(2) prob.: (i) 0.89, (ii) 0.65, (iii) 0.23 BG(12) prob.: (i) 0.26, (ii) 0.15, (iii) 0.10 Jarque-Bera prob.: (i) 0.44, (ii) 0.99, (iii) 0.54

Arch(1) prob.: (i) 0.61, (ii) 0.86, (iii) 0.41 Arch(12) prob.: (i) 0.56, (ii) 0.15, (iii) 0.87 White prob.: (i) 0.47, (ii) 0.31, (iii) 0.06

Ramsey LR prob.: (i) 0.16, (ii) 0.26, (iii) 0.23 Wu-Hausman Prob.: F-stat. (i) 0.46, (ii) 0.55, (iii) 0.86

Bounds test: F-stat. (i) 8.68***, (ii) 10.41***, (iii) 10.39***; t-stat. (i) -7.87***, (ii) -6.56***, (iii) -9.85***

Note: This table summarizes the results of my ARDL-models for the nominal 10-year US agency, and AAA-rated corporate and municipal bond yields, respectively. The table notes are the same as in Table 8, with the following exceptions: $s^{x/x}$ indicates the shift component of a variable with the date of the structural break indicated by *x/x* (i.e. after February 1999 and after April 2001), *YIELD* is the 10-year nominal yield of the respective bond class, *FOROFFICIAL* are foreign official holdings as a ratio of total outstanding bonds (i.e. the holdings ratio) of the respective bond class, *FORPRIVATE* is the foreign private holdings ratio of the respective bond class, *FOREIGN* is the foreign holdings ratio of municipal bonds, *USBANK* is the US banking institutions holdings ratio of the respective bond class, *USINDIVIDUAL* is the US individual holdings ratio of the respective bond class, *USINSURANCE* is the US insurance companies holdings ratio of the respective bond class, *USPENSION* is the US pension funds holdings ratio of the respective bond class, and *EDFAAA* is Moody's EDF for AAA-rated corporate bonds. The 5% critical values for a Bounds cointegration test with unrestricted intercept and no trend are (i) F=3.30, t≈-5.20 , (ii) F=3.39, t=-5.03, (iii) F=3.24, t≈-5.20 [(i) k=11 (t), k=9 (F) (ii) k=10 (t), k=8 (F) (iii) k=10 (F), k=11 (t)] – see Pesaran *et al.* (2001).

Table 10: Equilibrium long-run impacts on the nominal long-term yields of AAA-rated non-Treasury US debt securities

(i) Agency bond yield			(ii) Corporate bond yield			(iii) Municipal bond yield		
before the break			**before the break**			**before the break**		
FOROFFICIAL	-1.1282***	(-3.82)	FORPRIVATE	-0.9298***	(-5.39)	FOREIGN	-8.4493***	(-5.64)
FORPRIVATE	-0.5286***	(-3.43)	EURDOL	0.2923***	(5.18)	USINDIVIDUAL	-0.1709***	(-4.33)
USINDIVIDUAL	-0.1253***	(-3.93)	LOGISM	2.6953***	(3.24)	USINSURANCE	-0.1263***	(-2.83)
USPENSION			PCE	0.8387***	(3.15)	USBANK	-0.4178**	(-2.08)
EURDOL	0.5410***	(6.83)	CPI10Y	1.3207**	(2.42)	EURDOL	0.3473***	(8.47)
LOGISM	3.2074***	(4.80)	DOW	0.0005***	(5.56)	LOGISM	1.0805***	(3.17)
PCE	2.0143***	(7.82)	MOVE	0.0071**	(2.51)	PCE	0.5159***	(3.74)
DOW	0.0004***	(4.53)	EDFAAA	13.5957***	(6.33)	DOW	0.0002***	(3.36)
MOVE	0.0088**	(2.20)				MOVE	0.0093***	(4.63)
after the break			**after the break**			**after the break**		
FOROFFICIAL	-0.1462*	(-1.73)	FORPRIVATE	-0.2193***	(-5.63)	FOREIGN	-0.8091***	(-7.00)
FORPRIVATE	-0.5286***	(-3.43)	EURDOL	0.2923***	(5.18)	USINDIVIDUAL	-0.0946***	(-5.45)
USINDIVIDUAL	-0.1253***	(-3.93)	LOGISM	0.3282	(0.43)	USINSURANCE	-0.0699***	(-2.92)
USPENSION	-0.3514***	(-3.10)	PCE	0.8387***	(3.15)	USBANK	-0.2314**	(-2.18)
EURDOL	0.5410***	(6.83)	CPI10Y	1.3207**	(2.42)	EURDOL	0.1923***	(7.97)
LOGISM	3.2074***	(4.80)	DOW	0.0005***	(5.56)	LOGISM	0.5983***	(2.88)
PCE	2.0143***	(7.82)	MOVE	0.0071**	(2.51)	PCE	0.2857***	(3.94)
DOW	0.0004***	(4.53)	EDFAAA	13.5957***	(6.33)	DOW	0.0001***	(4.07)
MOVE	0.0237***	(5.91)				MOVE	0.0051***	(4.58)

Note: This table summarizes the equilibrium results of my ARDL-models for the nominal 10-year US agency, and AAA-rated corporate and municipal bond yields, respectively. The table notes are the same as in Table 8 and Table 9.

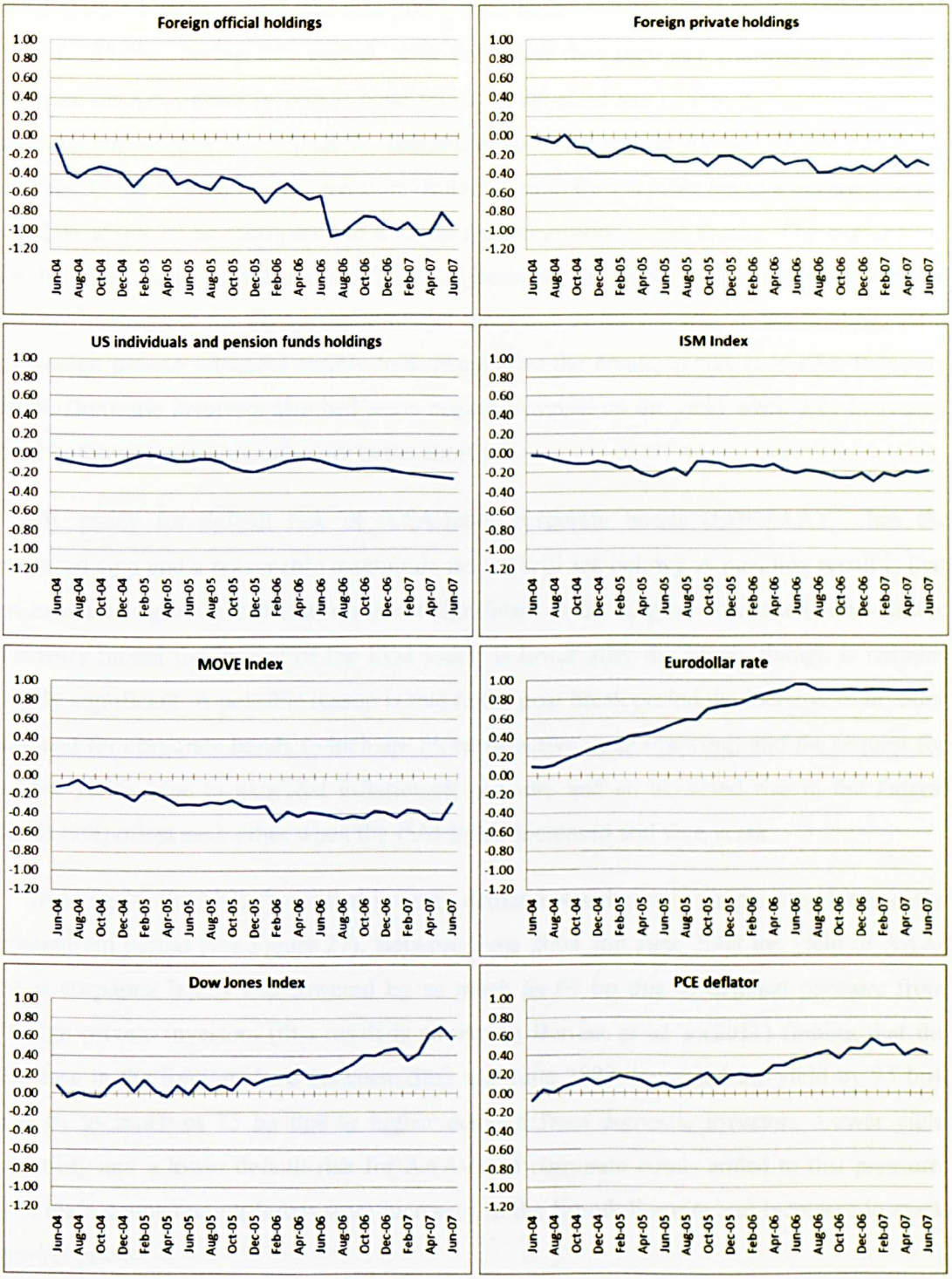
Agency bond yield. — Foreign official demand had a negative impact not only on the Treasury yield but also on the agency bond yield both in the short run (Table 9, column 1) and in the long run (Table 10, column 1). However, in contrast to the Treasury yield model, the long run magnitude of the impact declines after the break. This said, it appears that, ceteris paribus, from April 2001 onwards an increase in the holdings ratio by 1% point still reduced the yield by around 15 bp in the long run. The most probable explanation for the shift in the variable's coefficient is the change in the foreign official holdings ratio. While this ratio increased moderately in the pre break period, it increased considerably in the post break period (from 3% in April 2001 to 11% in June 2007). This development in turn helps to explain why market reactions to increases in foreign official holdings in the post break period were comparatively modest relative to the pre-break period given that there was now less scope for price increases (yield decreases) per unit of increase in the foreign official holdings ratio.

By contrast, the impact of foreign private and US individual investors on the long term agency bond yield remained stable throughout the whole sample period. Each 1% point increase in the foreign private holdings ratio led to a decline in the yield of around 53 bp in

the long run, while the same increase in the domestic individual holdings ratio lowered the yield by 13 bp. US pension funds only had an impact on the yield after the break: from April 2001 onwards the yield was depressed by 35 bp for each 1% point increase in the pension funds' holdings ratio. The shift in this variable took place because domestic pension funds only increased their holdings ratio significantly in the post break period. Two possible explanations as to why the magnitudes of the coefficients of these three investor groups were so different are, that they reacted differently to expected changes in the agency yield or that they had different expectations of future yields. US individual investors, for example, might have increased their holdings to a lesser extent than foreign private investors and pension funds when they (rightly) expected the agency yield to decrease and hence put less additional pressure on yields than their counterparts.

The MCI suggests that investor demand was also the main reason for the low long term agency yield during the conundrum period (Figure 26). This is especially true for foreign official investors who, according to my model, depressed the yield by as much as 107 bp. However, it is the case that private foreign and domestic investor demand also helped to reduce the yield, by around 39 bp and 26 bp respectively. This downward pressure on yields, further fuelled by pessimistic expectations about the business cycle and a lowering of the implied yield volatility, was mainly offset by the rise in the short term interest rate and by the increases in stock prices and in core price inflation.

Figure 26: Variables' MCIs for the nominal 10-year agency bond yield



Note: These plots show the MCI of each variable on the nominal 10-year agency bond yield for each month during the conundrum period, according to the results of my agency yield model (see Table 9, column 1).

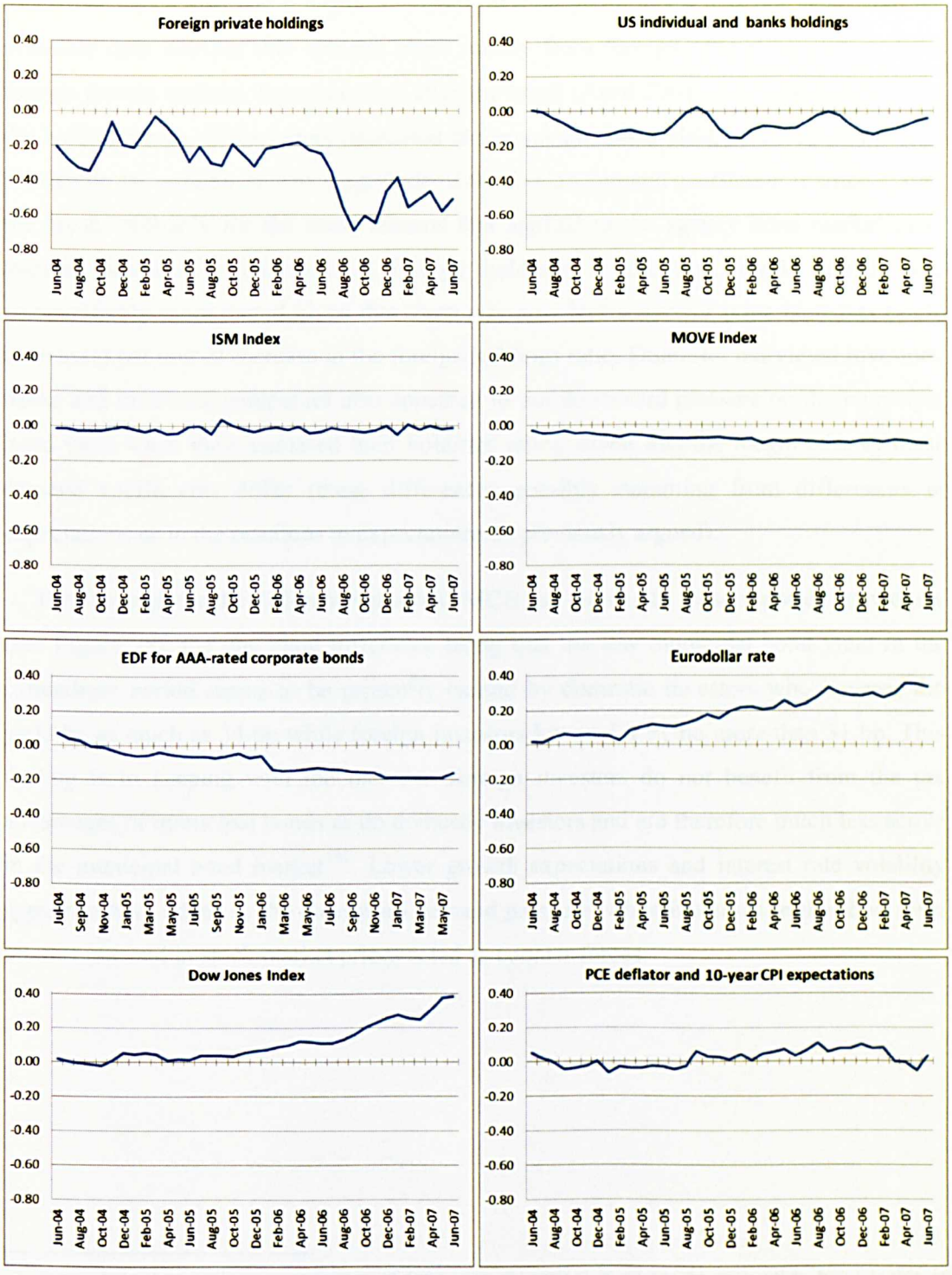
Corporate bond yield. — Foreign private investors invested heavily in the corporate bond market between 1994 and mid-2007, their holdings ratio more than doubling (from 11% to 24.5%) during this period, with the result that they put significant downward pressure on AAA-rated corporate bond yields in the short run (Table 9, column 2) and in the long run (Table 10, column 2). Regarding the long run, in the post break period an increase in the foreign private investors' holdings ratio by 1% point led to a decrease of the yield by about 22 bp (compared to a 93 bp reduction prior to the break). The explanation for the shift in the variable's coefficient is probably the same as that regarding foreign official holdings in the agency bond model inasmuch as the increase in the holdings ratio of foreign private investors mainly took place after the break, in this case after February 1999. Domestic investors also had some negative impact on the yield when they increased their holdings ratio, although only in the short run.

My proxy for default risk of AAA-rated corporate bonds (EDFAAA)[131] has the expected sign and a reasonable magnitude (as we will see below). A puzzling result is that an increase in growth expectations is not significant in the long run after the break – in the Treasury model the impact of the ISM Index is lower after the break, though it remains highly significant. A possible reason is that in the post break period the increase in investor demand for corporate bonds (which are more attractive in an upswing) and the request for higher yields (due to expected inflationary pressure and an expected rise in the federal funds rate) offset each other when the ISM Index increased and vice versa.

Once again, the MCI shows that investor demand was the main suppressing force in the conundrum period (see Figure 27). Between June 2004 and June 2007 the yield of AAA-rated corporate bonds was lowered by as much as 69 bp due to demand pressure from foreign private investors (this result is similar to Bertaut *et al.*'s (2011) finding that the increase in the foreign share between 2002 and June 2007 depressed the yield by 95 bp), and by as much as 15 bp due to higher demand from domestic investors. Lower yield volatility and a lower default risk for AAA-rated corporate bonds added to this pressure. The main counteracting forces were increases in the Eurodollar rate and increases in stock market prices.

[131] Corporate bonds are the only AAA-rated traditional fixed income asset class which is not directly (Treasuries and municipal bonds) or indirectly (agency bonds) backed by a governmental organization.

Figure 27: Variables' MCIs for the nominal AAA-rated corporate bond yield



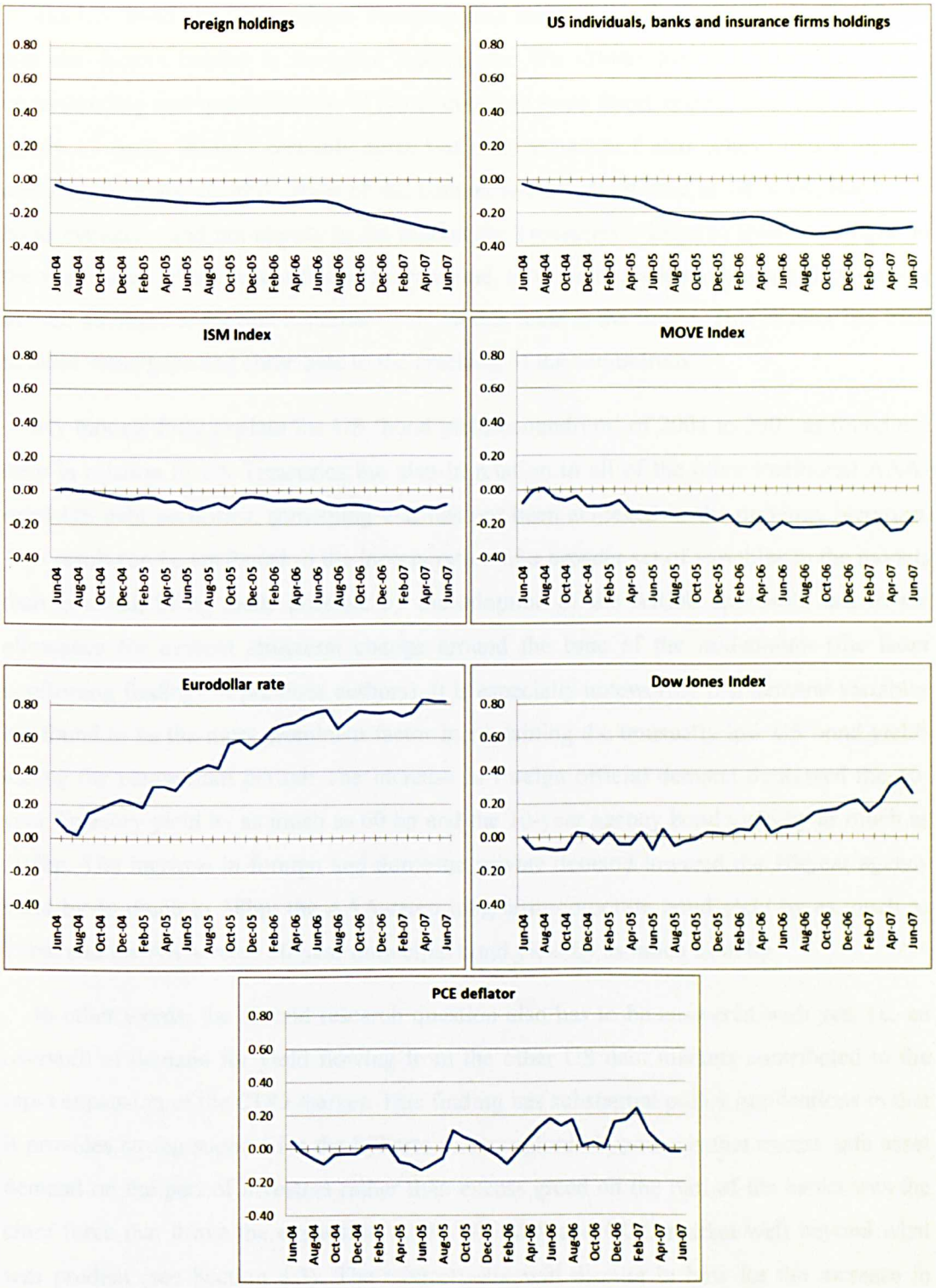
Note: These plots show the MCI of each variable on the nominal average AAA-rated corporate bond yield for each month during the conundrum period, according to the results of my corporate yield model (see Table 9, column 2).

Municipal bond yield. — Finally, an increase in foreign demand for 10-year AAA-rated municipal bonds also had a negative impact on their yield, albeit it is not clear from the available data whether this demand came mainly from foreign official sources or from foreign private sources. It appears that after the break (April 2001) a 1% point increase in the holdings ratio of foreigners decreased the municipal bond yield by 81 bp in the long run (Table 10, column 3). The magnitude of the foreign demand coefficient is smaller after the break, probably for the same reasons that applied to the agency bond market case: market reactions to increases in foreign holdings in the post break period were comparatively more muted given that there was now less scope for price increases (yield decreases) per unit of increase in the foreign holdings ratio. Domestic individual investors, banks and insurance companies also appeared to put downward pressure on the municipal bond yield when they increased their holdings ratios, albeit that the magnitudes of these demand coefficients differ (these differences possibly stemming from differences in expectations or in the reactions to expectations as previously argued).

The findings for the different variables' MCIs are similar to those reported previously (see Figure 28), the one main difference being that the low municipal bond yield in the conundrum period seems to be primarily caused by domestic investors who lowered the yield by as much as 34 bp while foreign investors lowered it by no more than 31 bp. This finding is in keeping with the fact that foreign investors do not benefit from the tax advantages of municipal bonds as do domestic investors and are therefore much less active in the municipal bond market[132]. Lower growth expectations and interest rate volatility appear to have added to the downward demand pressure, while increases in the short term interest rate and in stock market prices acted as counter forces.

[132] Please note that a direct comparison of long-term municipal bond yields with other bond yields is complicated because the income on most municipal bonds is tax-exempt. This special tax treatment of municipal bonds means that the average yield of municipal bonds is normally lower than that of Treasury, corporate and agency bonds with the same maturity, because "short-maturity municipal yields are equal to the Treasury yield multiplied by one minus the income tax rate, and the ratio between municipal and Treasury yields decreases with maturity." (Ang *et al.*, 2010, p. 566).

Figure 28: Variables' MCIs for the nominal AAA-rated municipal bond yield



Note: These plots show the MCI of each variable on the nominal 10-year municipal bond yield for each month during the conundrum period, according to the results of my municipal yield model (see Table 9, column 3).

5.3. Conclusion

The US 'bond yield conundrum' has generated much discussion regarding its magnitude and the factors behind it for good reason. As Wu (2008) has argued: "The correct understanding and quantification of the conundrum have direct implications for monetary policy..." (p.2). While I certainly agree with this argument I also believe that a 'correct understanding and quantification of the conundrum' as manifested in all of the major US bond markets – and not merely in the market for Treasuries – helps to shed more light on the root causes of the recent financial crisis and, in so doing, helps to guide policy makers in their attempts to prevent a similar crisis on this scale in the future. This chapter has tried to close some gaps and contribute to the cracking of the conundrum.

My models fully explain the US 'bond yield conundrum' of 2004 to 2007 as found not only in relation to US Treasuries but also in relation to all of the other traditional AAA-rated US debt securities, something that has not been achieved in the previous literature. This result can be attributed to the incorporation of a broader set of variables in the models than is usual, being made possible by the adoption of the ARDL approach, and to the allowance for evident structural change around the time of the millennium (the latter confirming findings of previous authors). It is especially noteworthy that demand variables are found to be the most prominent factor in explaining the unusually low US bond yields during the conundrum period: The increase in foreign official demand depressed the 10-year Treasury yield by as much as 60 bp and the 10-year agency bond yield by as much as 107bp. The increase in foreign and domestic private demand lowered the 10-year agency yield by as much as 58bp, the AAA-rated long-term corporate bond yield by as much as 73bp, and the AAA-rated 10-year municipal bond yield by as much as 60bp.

In other words, the second research question also has to be answered with yes, i.e. an overspill of demand for yield flowing from the other US debt markets contributed to the rapid expansion of the CDO market. This finding has substantial policy implications in that it provides strong support for the hitherto underexplored hypothesis that excess safe asset demand on the part of investors rather than excess greed on the part of the banks was the chief force that drove the expansion of the US ABS and CDO market well beyond what was prudent (see Section 4.3). The next chapter will discuss in how far the increase in absolute wealth concentration has contributed to the increasing investor demand.

6. The contribution of wealth concentration to the subprime crisis

"[C]onstantly increasing inequality of distribution appears as unjust, it is only then that appeal is made from the facts which have had their day to so-called eternal justice. From a scientific standpoint, this appeal to morality and justice does not help us an inch further; moral indignation, however justifiable, cannot serve economic science as an argument, but only as a symptom. The task of economic science is rather to show that the social abuses which have recently been developing are necessary consequences of the existing mode of production, but at the same time also indications of its approaching dissolution..." (Friedrich Engels)

The results from Chapter 5 not only appear to give solid empirical support to the claim that aggregate investor demand was a major source of the downward pressure on US bond yields in the pre-subprime crisis period, they also show that the increasing demand from foreign private[133] and US individual investors is important to explain the low long-term yields of non-Treasury bonds (see Table 11, row two and three). This latter observation raises the question as to how significant a proportion of this pressure on yields stemmed from an important subgroup of these two investor categories, namely that comprising of the world's high net worth individuals – as HNWIs were the most important investor group prior the crisis (see Figure 21 in Section 4.4), it is clear that a significant share of the foreign private and US individual investors were HNWIs. This chapter tries to verify the effect.

Table 11: Overview of the impact of investor demand in the conundrum period

Investor	10y Treasury	10y Municipal	10y Agency	AAA Corporate
Foreign Officials	negative	negative	-	-
Foreign Private			negative	negative
US Individuals	-	negative	negative	negative
US Banks	-	negative	-	negative
US Insurance Companies	-	negative	-	-
US Pension Funds	-	-	negative	-

Note: The available data impedes a distinction between foreign official and foreign private holdings of AAA-rated municipal bonds

[133] The category 'foreign private' entails all non-governmental holdings that were originated from outside the US by individuals, banks and institutional investors (i.e. insurance companies, pension funds and mutual funds).

This chapter has two parts. Part one presents new evidence on the impact of high net worth individuals on US bond yields; whilst part two specifies why US income inequality and global wealth concentration provided the all-encompassing framework for the mass production of ABS and CDOs.

6.1. The impact of HNWIs on US bond yields

There exists no precise information about the US bond holdings of HNWIs. However, some approximate estimates of the degree of HNWI involvement in the US bond markets in the immediate pre-2007 period can be extracted from the known HNWI investment figures presented in Chapter 4 – please note that only the CML Global Wealth Report estimates were used for this exercise as those estimates are the most conservative ones. As concerns the estimate for US HNWI holdings of US bonds, these are derived in two steps: (i) I know the amount of assets held by North American HNWIs (see Figure 15b) and I know from CS (2010, p. 82) that "...residents of the USA account for about 90% of the [HNWI population] figure for Northern America"; multiplying the resulting amount of US HNWIs wealth with the average global HNWI investment share in fixed income securities during this time (i.e. 23%) gave me the totals for US HNWIs global bond investments as listed in column 1 of Table 12; (ii) I know from CML (2006) that about 78% of US HNWI portfolio holdings are invested domestically, so I applied this ratio to the total US HNWI global bond investments to derive the approximate figures for US HNWI holdings of US bonds that are listed in column 2 of Table 12. These figures on average represent about 58% of all US individual investments in US bonds according to the Flow of Funds data presented in column 3 of Table 12[134]. The application of this 58% ratio to the Flow of Funds data on US individual holdings in each bond class enabled me to derive the equivalent estimated US HNWI holdings of Treasury, agency, corporate and municipal bonds, as listed in Table 13.

[134] This percentage seems very reasonable given that in the US the "ownership of any type of bond is concentrated among the highest tiers of the income and wealth distributions" (Bucks *et al.*, 2009, p. A22).

Table 12: Estimated bond holdings of US HNWIs (in US$ trillion)

	US HNWIs global bond investment	US HNWIs investment in US bonds	US individual investment in US bonds
Jun-04	1.93	1.50	2.48
Jun-05	2.11	1.65	2.82
Jun-06	2.34	1.82	3.24
Jun-07	2.42	1.89	3.35

Source: own estimates; column 3 FR Statistical Release Z.1 (2010) data

Table 13: Estimated US bond holdings of US HNWIs sub-divided by bond type (in US$ billion)

	US Treasuries	US agency bonds	US corporate and foreign bonds	US municipal bonds
Jun-04	238	176	604	420
Jun-05	238	247	691	460
Jun-06	316	215	844	502
Jun-07	202	305	908	530

Source: own estimates derived from FR Statistical Release Z.1 (2010) data

To calculate the rest of the world (ROW) HNWI US bond holdings some assumptions are again necessary. The first is that the total amount of fixed income holdings of ROW HNWIs is equal to total HNWI fixed income investment minus the amount of US HNWI global bond investment (see Table 14). The second assumption is that ROW HNWIs invested around 30% of their fixed income investment in foreign markets; according to data from Fidora *et al.* (2006) non-US investors on average placed around 70% of their investment in their home market. The third assumption is that ROW HNWIs investments in foreign bond markets are allocated according to their respective market sizes; thus multiplying ROW HNWI foreign bond holdings by the global market share of the US debt security market gives me the estimated amounts of ROW HNWI US bond holdings (see Table 15).

Table 14: Estimated global bond holdings of ROW HNWIs (in US$ trillion)

	HNWIs investment in fixed income	US HNWIs global bond investment	Investment of ROW HNWIs in bonds
Jun-04	7.37	1.93	5.44
Jun-05	7.01	2.11	4.90
Jun-06	7.81	2.34	5.47
Jun-07	10.99	2.42	8.57

Source: own estimates derived from CML (2006, 2008) data

Table 15: Estimated US bond holdings of ROW HNWIs (in US$ trillion)

	ROW HNWIs investment in foreign bonds	US debt securities / world total	ROW HNWIs investment in US bonds
Jun-04	1.63	39%	0.63
Jun-05	1.47	40%	0.59
Jun-06	1.64	39%	0.64
Jun-07	2.57	37%	0.96

Source: own estimates; column 2 data are derived from IMF Global Financial Stability Reports (2004-2008)

It is unlikely that the holdings of ROW HNWIs were split evenly between Treasury, agency, corporate and municipal bonds. Therefore, one last assumption is necessary to get an idea about the size of ROW HNWIs holdings in the different US bond markets. It is known that a significant amount of wealth from HNWIs is held offshore (see Tax Justice Network, 2005; Palan *et al.*, 2010; Shaxson, 2011; James, 2012). Consequently, it is reasonable to assume that the bond portfolio composition of ROW HNWIs is similar to the portfolio composition of foreign investors that bought Treasuries, agency and corporate bonds via tax havens and financial centres[135]. Furthermore, it can be assumed that a significant part of foreign municipal bond holdings (around one third) is held by HNWIs as these bonds are particularly attractive for individuals due to their tax status[136]. The resulting estimates of ROW HNWIs US bond holdings according to bond type are given in Table 16.

[135] Data regarding foreign private investors' use of tax havens and financial centres to invest in US Treasuries and in agency and corporate bonds are available from the Treasury International Capital System (TIC). Municipal bonds are not included in the TIC data (probably because only a relatively small amount is held by foreigners).

[136] The interest income of most municipal bonds is exempted from state and local taxes. Thus, the share of US individuals in total municipal bond holdings (around 36% in the conundrum period) was higher than in other bond classes.

Table 16: Estimated US bond holdings of ROW HNWIs sub-divided by bond type (in US$ billion)

	US Treasuries	US agency bonds	US corporate and foreign bonds	US municipal bonds
Jun-04	124	96	407	8
Jun-05	97	87	402	9
Jun-06	106	84	439	10
Jun-07	123	105	721	13

Summing across the estimated holdings of US bonds by US HNWIs and ROW HNWIs for the period 2004 to 2007, see Table 17, two distinct patterns become clear. The first is that HNWIs, along with other private sector investors, appear to have been partially squeezed out of the US Treasury market as a result of the steep increase in the foreign official holdings of Treasuries. The second is that HNWIs, again in common with other private sector investors, reacted to the partial squeeze out of Treasuries by shifting substantial amounts of funds into the other major US bond markets.

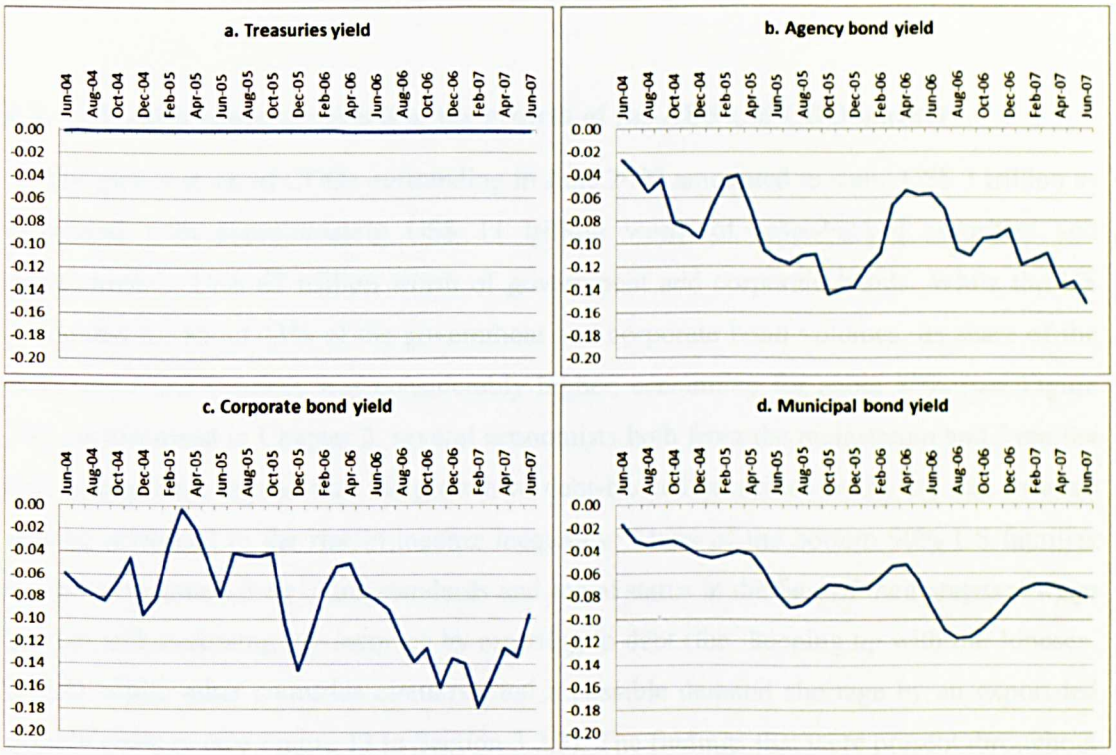
Table 17: Estimated holdings of all HNWIs in the US bond market (in US$ billion)

	total HNWIs investment in US bonds	US Treasuries	US agency bonds	US corporate and foreign bonds	US municipal bonds
Jun-04	2,073	362	272	1,011	428
Jun-05	2,231	335	334	1,093	469
Jun-06	2,516	423	299	1,283	512
Jun-07	2,907	325	411	1,629	542

According to the models presented in Chapter 5, private foreign and US individual investors put pressure on AAA-rated bond yields if they increased their holdings to a greater extent than the increase in the outstanding amount of these bonds. The same must be true for HNWIs because they are an important subgroup of private foreign and US individual investors as my estimates have shown. To obtain estimates for the impact of HNWIs on US long-term bond yields for the period June 2004 to June 2007 I therefore use the data contained in Table 13 and Table 16 and the MCIs of private foreign and individual investors. To be more precise, first the share of US HNWIs in total US individual holdings and the share of ROW HNWIs in total foreign private holdings is calculated for each bond class and then these shares are multiplied with the respective MCIs of US individual investors and foreign private investors (see Figure 24 - Figure 28) to obtain the MCIs of US and ROW HNWIs in each bond class; finally these monthly MCIs of US and ROW

HNWIs are summed to obtain the total estimated impact of all HNWIs in each bond class. These MCIs reveal that, as expected, HNWIs had no discernible impact on the Treasury yield (Figure 29a), while they did have a significant negative impact on the long-term yields of agency bonds (by as much as 15 bp, Figure 29b), of AAA-rated corporate bonds (by a maximum of 18 bp, Figure 29c) and of AAA-rated municipal bonds (by as much as 12 bp, Figure 29d). Generally speaking, HNWIs seem to have depressed US long-term bond yields to a similar degree as changes in business cycle expectations, interest rate volatility and default risk (see Figure 22 - Figure 26).

Figure 29: Estimated impact of HNWIs demand on AAA-rated US long term yields (in %-points)



Note: These plots show the MCI of HNWIs according to the sum of the shares of US HNWIs in US individual holdings and ROW HNWIs in foreign private holdings and the MCIs of US individual investors and foreign private investors (see Figure 24 - Figure 28).

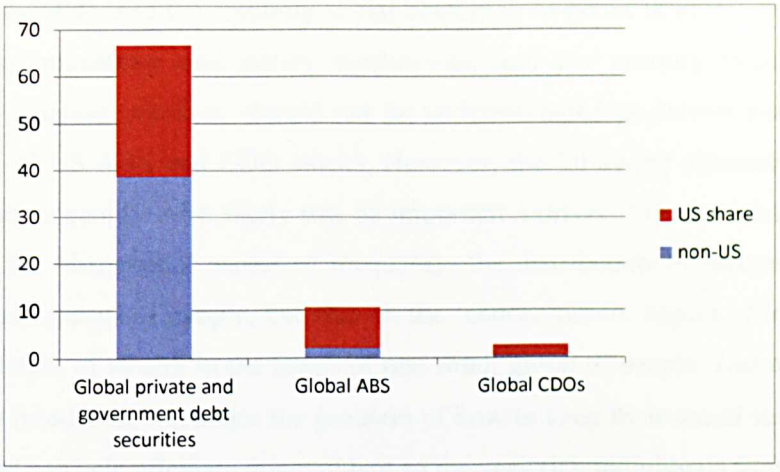
To sum up, apart from US Treasuries, HNWIs did have a consistently negative impact on US bond yields in the pre-crisis period according to the estimates presented in this dissertation. These are, I repeat, rough approximations. However, I believe that, while not totally accurate, these estimations are sufficiently accurate to validate the HNWI 'blocking' hypothesis. In the pre-crisis period this small group of individuals occupied enough space in the US bond markets so as to prevent them from being able to fully accommodate the demand pressure for debt securities stemming from other investor groups, a development that in turn helps to explain why the CDO market had to be rapidly expanded in this period in order to absorb the excess pressure. The precise mechanism through which the pressure for yield was transmitted to those institutions that created the CDOs is explained in the next section.

6.2. Wealth concentration and the growth of the ABS and CDO market

The global stock of CDOs outstanding in June 2007 amounted to some US$ 3 trillion as compared with approximately US$ 11 trillion worth of asset-backed securities and approximately US$ 67 trillion worth of government and corporate bonds. While the US accounted for about 43% of the government and corporate bond volumes, its share of the ABS and CDO volumes was considerably higher, accounting for about 80% (see Figure 30). As discussed in Chapter 3, several economists both from the mainstream and from the heterodoxy have argued that the growth of debt-backed securities in the US can in large part be attributed to the rise in income inequality: Many of the bottom 90% US families sought to maintain their living standards and social status in the face of their stagnant wage growth and increasing top-incomes by resorting to debt (the 'keeping up with the Joneses' effect), while other countries circumvented a possible demand shortage by an export-led growth strategy (see Figure 13 in Section 3.2.3). The findings that were present throughout Chapter 2 and 3 of this dissertation give a strong backing to this line of argument. However, these same findings also point to a problem in the income inequality argument, namely, one of mismatching time frames. The trend rise in income inequality began in the early 1980s but the growth of the US ABS and CDO market only began to accelerate after 2001 although they had been in existence for decades. Of the US$ 11 trillion outstanding ABS in mid-2007 over half (US$ 5.6 trillions) had been created in the previous four years. In the case of CDOs the acceleration in growth was even more remarkable in that of the

US$ 3 trillion outstanding in June 2007 over 90% of these products had been created in the preceding four years.

Figure 30: US market share of global debt securities prior to the crisis (US$ trillion)



Source: BoE (2007), Blundell-Wignall (2007b); SIFMA (2010; 2011); BIS (2011a; 2011b); own calculations

Proponents of the income inequality hypothesis have sought to get round this problem by arguing that prior to the stock market crash of 2001 low- and middle-income households were relying on rising stock prices, less saving, longer working hours and an increased women's participation in the work force to finance their consumption, and only began to rely more heavily on debt when these means were exhausted (see e.g. Palley, 2002; 2010; van Treeck and Sturn, 2012). However, while the 'keeping up with the Joneses' effect explains the post-2001 rise in household debt in the US, it does not explain the rise in the securitisation and re-securitisation of this debt. The same criticism can also be applied to the accompanying argument that financial inflows into the US from surplus countries (which also had rising income inequality and partly circumvented their domestic demand problem by increasing their exports) were particularly strong after 2001. These inflows into the US financial system certainly helped fuel bank lending to households but they still do not explain the securitisation of much of this lending.

In the end, the massive expansion in US ABS and CDO stocks in so short a time span helps to explain why the majority of both mainstream and heterodox opinion continues to trace the root cause of this expansion to a combination of regulatory failures (most notably, the official encouragement of the shift for an 'originate and hold' model of mortgage

lending to an 'originate and distribute' model, a shift that inevitably contributed to the drastic relaxation of risk controls in mortgage lending), monetary policy errors which led to a boom in mortgage lending that in turn fuelled a property price bubble (most notably the maintenance of the Federal Funds rate at an unusually low level between the end of 2001 and mid-2004), and the resulting social contagion of boom thinking and greed. The importance of regulatory and policy weaknesses, and the ensuing impact on social behaviour in financial markets, should not be underestimated as drivers behind the pre-2007 growth of US ABS and CDO stocks. However, the following discussion will show that economic inequality most likely was as important a driver if the attention is not only focussed on the 'dispersion' aspect of inequality, the distribution of income and wealth across different groups of people, but also on the 'concentration' aspect of inequality, the vast accumulation of wealth in the hands of one small group of people. Just as individuals with low and middle incomes face the problem of how to keep their social status and have to rely on credit to help alleviate this problem so the very rich individuals face the opposite problem of how to store their vast sums of wealth and have to rely on financial securities to help resolve this problem.

The rapid growth of US ABS and CDO stocks between 2002 and 2007 coincided with the prolonged maintenance of the Federal Funds rate at an unusually low level over much of this period but it also exactly coincided with the sharp upward spike in aggregate investor demand for these securities. The US banks and their associates certainly took advantage of lax regulation and monetary loosening to vastly increase the rate of supply of ABS and CDOs[137] and profited handsomely from this business but it seems that despite their best efforts they were unable to fully satisfy investor demand as attested by the historically low US ABS yields and anecdotal evidence of market participants. The executive director at Morgan Stanley on the residential mortgage trading desk (Mike Francis) stated for example in an interview: "We almost couldn't produce enough to keep the appetite of my investors happy. More people wanted bonds than we could actually produce. That was my difficult task, was trying to produce enough. They would call and

[137] In his testimony to the FCIC (2011, p.102), Charles Prince (ex Citigroup CEO) stated that "Securitization could be seen as a factory line ... As more and more and more of these subprime mortgages were created as raw material for the securitization process"; while David Sambol, the President and CEO of Countrywide (the largest mortgage originator in the US) admitted that in the run up to the subprime crisis the chief business purpose of his company was to be a "seller of securities to Wall Street ... originating what was salable in the secondary market.", a point exemplified by the fact that it "sold or securitized 87% of the $1.5 trillion in mortgages it originated between 2002 and 2005" (ibid, 2011, p.105).

say, we're looking for more fixed rate. What have you got? Do you have anything coming? What's going on? Tell us what you're trying to do. From my standpoint it's like, there's a guy out there with a lot of money. And we have got to find a way to become his sole provider of bonds, of mortgage bonds, to fill his appetite. And his appetite's massive." (This American Life, 2008). To be able to produce the huge quantities that were needed standards were lowered not only to bring more numbers of subprime borrowers into the mortgage market but also to speed up the whole mortgage origination process. Furthermore, it was not only poor households that were supplied with subprime loans; households with good credit scores were also "pushed into risky subprime loans [because] lenders or brokers aggressively marketed the loans, offering easier and faster approvals, [this] was fuelled with faxes and emails from lenders to brokers touting easier qualification for borrowers and attractive payouts" (Brooks and Simon, 2007)[138]. In other words, "[w]ith ready buyers for their own product, mortgage securitizers continued to demand loans for their pools, and hundreds of billions of dollars flooded the mortgage world. In effect the CDO became the engine that powered the mortgage supply chain. ... Just as mortgage-backed securities provided the cash to originate mortgages, now CDOs would provide the cash to fund mortgage-backed securities." (FCIC, 2011, pp.129-130)[139].

Once this demand pressure is brought more centrally into the story behind the growth of these two markets so also is wealth inequality because HNWIs constituted an important

[138] Schechter (2008) states that "63 percent of subprime borrowers would have qualified for conventional 'A' or 'A-' quality loans" (p.33) and that "Wall Street investment banks and wholesalers demanded ever more mortgages from even the least creditworthy" (p.43). Johnson and Kwak (2010, e-book without page numbers) confirm this finding: "Increased Wall Street demand for mortgages (to feed the securitization pipeline) funneled cheap money to mortgage lenders, who sent their sales forces out onto the streets in search of more borrowers".

[139] This view that it "was Wall Street's philosophy to give investors what they wanted" (Brummer, 2010, p.41) is also supported by several comments in popular books about the subprime crisis (investor demand is not a central theme in any of these books though). Tett (2009), for example, states that "[n]ot only was the competition demanding that [banks] become more aggressive, but low yields on the more traditional credit investments were fuelling the drive for higher returns" by investors (p.109) ... "In 2002 and 2003, single-tranche CDOs became all the rage. But insatiable investors quickly began demanding even better ways to juice up returns, so the banks produced a new twist on the CDO idea called a 'CDO squared'" (p.110) ... "By early 2006 ... there was such a frenetic appetite for more and more subprime loans to repackage into CDOs that the supply of loans had started to lag behind demand. (p.147) ... A bank or brokerage's ability to extend a loan no longer depended on how much capital that institution held; the deciding factor was whether the loans could be sold on as bonds, and the demand for those was rapacious. In this way, the lending of the mortgages began to be driven by the demand of endinvestors, in what would prove to be a vicious cycle." (p.112). Johnson and Kwak (2010, e-book without page numbers) argue similarly that "investor demand for higher-yield, higher-risk bonds remained strong – driving the recent boom in mortgage-backed securities, especially as returns on Treasury bonds fell to historic lows in the past decade ... In the 2000s, as demand from investors and Wall Street banks for subprime loans outstripped supply, credit default swaps were used to fill the gap."

source of demand for ABS and CDOs. As we have seen, HNWIs were directly involved in the ABS market to the extent where they had a discernible negative effect on agency bond yields. By contrast, while HNWI involvement in the CDO market was as important as that in the ABS market, the form of that involvement was a good deal more complicated. One complication concerns the complex nature of CDOs. For demand-pull pressure to be exerted in any product market the characteristics of the product in question have to be sufficiently transparent as to allow for a broad customer base. Ordinary government and corporate debt securities generally meet this criterion but so do asset-backed securities inasmuch as their backing collateral consists of a single, homogenous class of assets (e.g. mortgage loans, credit card loans and so on). CDOs by contrast do not meet this transparency criterion. CDOs may only be 'second-floor' securities, but the jump in complexity and opacity going from 'first-floor' ABS to CDOs is considerably higher than the jump going from the 'ground-floor' Treasury, municipal and corporate bonds to ABS. Normally different types of asset classes are mixed together in each CDO, so that the collateral that back CDOs are very diverse (see Section 1.2). This means that each CDO is a customized unique product whose price is negotiated over the counter by the seller and the buyer (i.e. CDOs did not have standard prices). Although large institutional investors such as pension funds have the expertise to handle this kind of product, regulatory and prudential constraints mean that they have to limit their exposure to these structured credit products[140]. Individual investors by comparison have no such expertise, a fact that explains their complete absence in the CDO market (Lysandrou, 2011a, 2011b). Given that HNWIs had no direct contact with CDOs between 2002 and 2007, the question arises as to how it was at all possible for these individuals to have been implicated in the rapid growth of these products over that period.

One suggested answer is to direct attention to hedge funds (Lysandrou, 2011-12). The acceleration in CDO production between 2002 and 2007 appears to have been very closely paralleled by an acceleration in the growth of the hedge fund industry. As shown in Figure 31a, hedge fund assets more than tripled between 2002 and 2007, rising from US$ 600

[140] For example, "Pension funds ... face ratings-based regulations. A recent survey of two hundred pension plan sponsors and investment managers in the US and Europe (Cantor *et al.*, 2007) found that 75% have minimum rating requirements for bond purchases and 50% set limits on portfolio distribution by rating class." (Benmelech and Dlugosz, 2009, p. 20). This meant that although ABS and CDOs were attractive for institutional investors and they did invested in both markets – according to Blundell-Wignall (2007b) 29% of CDOs were hold by institutional investors by mid-2007 – there were regulatory limits regarding their involvement.

billion to about US$ 2.2 trillion, while the number of hedge funds nearly doubled in the same period. The two drivers behind the growth of the hedge fund industry were the increasing amounts of wealth of HNWIs, which was partly channelled into hedge funds, and the 'institutionalisation' of the hedge funds' client base, i.e. the investment of institutional investors in hedge funds increased rapidly after 2002 (see Figure 31b). A likely motivating factor for the increasing funnelling of money into hedge funds was the above discussed 'search for yield' by these investors[141].

Faced with these large inflows of new money from clients that were demanding above average returns, hedge funds needed to change their strategy to ensure that they could deliver high yields[142]. Hedge funds employ a number of yield-generating strategies, but after 2002 the equity hedge strategy[143] quickly became the most popular one, accounting for about 30% of all hedge funds' assets in 2006 as compared with under 10% for macro hedge which was the main strategy in the 1990s (see Blundell-Wignall (2007a) and Lysandrou (2011-12) for an elaborated discussion about hedge fund investment strategies). This development was clearly powered by CDO purchases as indicated by the fact that by June 2007 hedge funds were the largest group of investors in CDOs (see Table 18), holding nearly a half of all these products (around US$ 1.4 trillion).

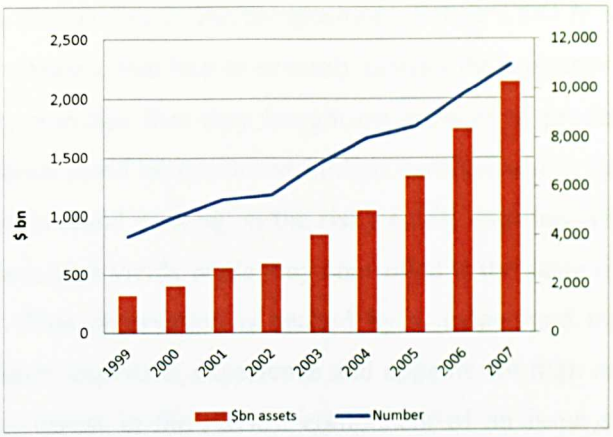
[141] The large institutional investors typically assign the majority of their assets to core portfolios that match expected returns with acceptable levels of risk (partly due to regulatory reasons). Having safely covered most assets under their management, these investors then typically assign a small proportion to the much riskier, but reputedly much higher yielding, 'alternative' investment classes such as private equity, hedge funds and CDOs. What appears to have happened from 2002 onwards is that the problem of yield on traditional assets became so acute that institutional investors were motivated to increase their exposure to the alternative investment classes by more than what was usual before.

[142] In 2001 and 2002 hedge funds returns were relatively low compared with other investment opportunities (6.3% and 0.1% respectively). Between 2003 and 2007 the return of hedge funds increased to an average of 11.6% (with some funds having much higher returns, which together with portfolio reasons explains the increasing amount of investment in hedge funds). Nevertheless, hedge funds were under constant pressure to increase these returns as the average S&P 500 return was 13.2% during the same period (IFSL, 2009).

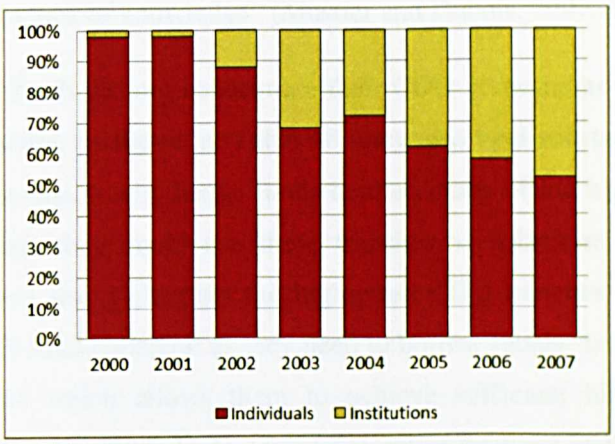
[143] An equity hedge strategy is based on stock and derivative investment.

Figure 31: Hedge Funds AuM, number, and source of capital

a. AuM (in US$ billion) and number



b. Source of capital



Source: IFSL (2008b)

Table 18: Holdings of CDO buyers by June 2007

CDO Tranche	Hedge Funds	Banks	Asset Managers	Insurance Companies
AAA	12%	15%	6%	7%
AA	4%	4%	4%	1%
A	5%	1%	3%	0%
BBB	4%	0%	4%	1%
BB	2%	0%	0%	0%
Equity	19%	5%	2%	1%
Total %	47%	25%	19%	10%
Total US$ bn	1,396	746	564	295

Source: Blundell-Wignall (2007b)

But, why did hedge funds find that one of the most effective ways of meeting the increased investor demand was through investments in CDOs, despite their illiquid and opaque nature? The answer lies in the composition of their CDO holdings. In contrast to institutional asset managers, that had to severely restrict the amounts of the high risk and unrated CDO equity tranches that they bought on account of prudential and regulatory constraints, hedge funds faced no constraint in their involvement in the CDO market. This meant that hedge funds could go long on the risky equity tranches which enabled them to take advantage of their high yields while they controlled at the same time the risk via CDS and put options [144]. This observation is backed by a hedge fund report that states, that "[h]edge fund managers expertise, experience and appetite for high returns provides them with an incentive to invest in the riskiest component of an issue such as CDO equity tranches ... Other investors, like most institutional investors, naturally avoid these areas due to regulation or a lack of knowledge" (Mustier and Dubois, 2007, p.89).

However, hedge funds did not concentrate their CDO investments solely on the equity and mezzanine tranches; as shown in Table 18, they also held substantial amounts of the senior tranches. The reason why hedge funds held so many of the highly rated but lower yield tranches is that they could use these tranches as substitute for other forms of collateral which gave less yield than the high-rated CDO tranches (e.g. traditional US bonds). Hedge funds need collateral as they need to borrow money from banks to leverage their clients' capital which allows them to achieve sufficient high returns on their investments (Farrel *et al.*, 2007)[145]. In contrast to other financial institutions (such as the bank-owned or sponsored conduits and special purpose vehicles) who principally relied on the issuance of short-term asset-backed commercial paper for their borrowing needs (see Acharya *et al.*, 2010), the hedge funds did most of their borrowing from their prime brokers and to keep the borrowing costs to a minimum they used the AAA-rated CDOs as collateral. Investment banks, the primary lenders to hedge funds, of course needed to accept these forms of collateral as they were among the main creators of this new financial product (Lysandrou, 2011-12).

[144] The reason why banks (via Special Purpose Vehicles) suffered much more losses than the hedge fund industry is that hedge funds were not only buying CDOs but at the same time were betting against them (i.e. they were insured against the default risk via CDS). A prominent example in this regard is the hedge fund Magnetar which only bought CDOs to bet against them. This practice was fuelling the demand for CDOs further (ProPublica, 2010).

[145] Hedge funds are not required to report their portfolio positions, and their leverage ratios depend on their investment strategy and change over time. Though, Blundell-Wignall (2007a) and McGuire and Tsatsaronis (2008) research suggests that the average leverage ratio of hedge funds most likely is around four.

Consequently, the explanation why hedge funds held so many CDOs, although their AuM were 'only' US$ 2.2 trillion, is that their holdings of CDOs were also financed with money borrowed from their prime brokers. Leverage was thus not only a key ingredient in generating the 11% average returns that were given back to investors in 2006 (Blundell-Wignall, 2007a) but also a key ingredient to explain the important role of hedge funds in the CDO process. In view of the increasing reliance on CDOs as a means by which hedge funds could generate yield for clients, it follows that HNWIs had to have been heavily, if unconsciously, implicated in CDO growth by virtue of having continued to increase their investments in hedge funds after 2002. Due to the existing regulations[146], individual investment in hedge funds came almost to 100% from HNWIs, which means that according to Figure 31 hedge fund assets from HNWIs were increasing from around US$ 0.5 trillion in 2002 (88% of hedge fund assets) to around US$ 1.1 trillion in 2007 (52% of hedge fund assets).

However, it is here that we come to another complication that marks off the role played by HNWIs in CDOs from that played by them in the ABS and other US debt securities markets. This concerns the distribution of wealth holdings amongst HNWIs. Far from being an even distribution, it describes on the contrary a reverse pyramid that is the inverse mirror image of the HNWI population ranked in terms of net wealth. Thus while the majority of relatively less wealthy HNWIs hold a minority of HNWI assets, at the other end of the scale a minority of HNWIs hold the majority of assets (see Chapter 4, Section 2). Despite this highly skewed distribution of HNWI wealth, it is permissible to include all 10 million or so HNWIs in calculating their impact on the other US debt securities markets because these markets allowed for a 'democratic' HNWI participation – not only on account of the transparency of the products but also on account of the low entry barriers to these markets. By contrast, the situation with CDOs is very different. While the complexity of these structured credit products barred all HNWIs from having any direct contact with them, the relatively high entry barriers into hedge funds effectively prevented a significant proportion of 'low wealth' HNWIs from having even an indirect effect on CDO growth via this intermediary channel.

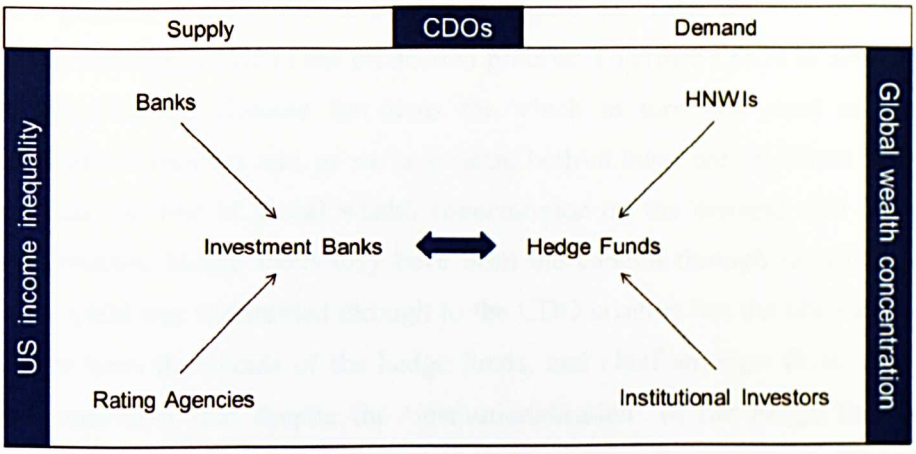
[146] According to SEC regulation only individuals with a minimum net worth of $5 million or in special cases with a net worth of $1 million and at least $200,000 in income in the last two years are allowed to invest in hedge funds. For funds of hedge funds the regulations are similar.

The response to these observations is to again evoke the 'blocking' hypothesis. Just as HNWIs taken as a whole occupied sufficient space in the traditional US debt securities markets in order to add to the downward pressure on yields and hence to the ensuing 'search for yield', so also did a proportion of these same individuals occupying sufficient space in the hedge fund client base so as to force hedge funds to resort to CDOs as a supplementary means of boosting yield. Two arguments can be advanced in support of this hypothesis. The first is that despite the increasing 'institutionalization' of the hedge fund client base between 2002 and 2007, HNWIs remained, as already noted, the largest source of hedge fund capital. The second argument concerns the skewed structure of the hedge fund industry. Although the number of hedge funds rose from about 5,000 to about 10,000 over the 2002-7 period, this rise did nothing to alter the hugely uneven distribution of capital amongst these funds. If anything, the steep rise in capital inflows served to further accentuate the concentration of capital investments amongst the largest hedge funds as evidenced by the fact that in 2007 around 80% of all hedge funds' assets were managed by the top 300 firms (IFSL, 2008b). It appears that HNWIs and institutional investors alike preferred to direct the bulk of their investments towards the large well-established hedge funds with a proven track record. The latter in turn, mindful of the increasing competition from other hedge funds, appeared to be reluctant to turn away new clients or to decline increased investments from established clients. Given the competitive pressure on the top hedge fund firms to find yield for their clients, and given the limits as to how much yield could be generated from traditional investment products and strategies, it is understandable why these firms would increasingly turn to CDOs for a solution to the yield problem.

In summary, hedge funds and wealth concentration were two of the key elements behind the importance of demand-pull factors in CDO growth after 2002. In light of the close correlation between low US bond yields and CDO growth in the 2002-2007 period, there has been no shortage of claims or suspicions on the part of academic economists and policy makers alike that the 'search for yield' was a major source of pressure on the US banks to create CDOs (see Chapter 4, Section 3). If, however, all of this has yet to undermine the widespread support for the supply-push version of the CDO growth this is because apart from Lysandrou's (2011-12) analysis there has been until now no clear specification of the transmission mechanism. The findings of this dissertation suggest that Lysandrou's analysis is correct and that a demand pressure mechanism indeed existed that

was transmitted through the close relation between hedge fund managers and investment banks, which were at the centre of the CDO creation process (see Figure 32).

Figure 32: Outline of the main forces in the CDO market



Source: Lysandrou (2011-12), with adaptations

While the relation between investment banks and hedge funds has always been close, it became even closer in the years prior to the crisis. One reason for the strengthening of this connection was the fact that investment banks themselves increasingly became active in the lucrative hedge fund industry. Another reason was the high turnover between investment bank managers and employees and hedge fund managers and employees. The main reason was however, that a growing amount of investment bank revenues came from hedge fund interest, commission and fee payments (in the pre-crisis period it was around a quarter according to Mustier and Dubois (2007)), while at the same time hedge funds were dependent on the prime broker and support services offered by investment banks. The mutually beneficial relationship between investment banks and hedge funds was therefore the perfect conduit through which the demand pressure for yield was passed on to the creators of CDOs. While the hedge funds needed to invest substantial amounts of their new AuM in CDOs, as those reduced leverage costs and at the same time increased returns, investment banks were happy to supply these CDOs (and to put other market participants under pressure to provide more raw material), as they could substantially increase their revenue with this new business (Lysandrou, 2011-12).

Understanding the pivotal role of the investment bank-hedge fund relationship in the production of CDOs is not just to understand the importance of the demand pressure for yield in that mass production; it is also to understand the importance of income inequality and wealth concentration in providing the all-encompassing framework for the CDO production process, a point also illustrated in Figure 32. Take the role of US income inequality on the supply side of the production process. To create CDOs in abundance you need an abundant US demand for loans for which in turn you need an increasing polarisation of US incomes and, as we have seen, both of these preconditions were met in full. Now take the role of global wealth concentration on the demand side of the CDO production process. Hedge funds may have been the conduit through which the demand pressure for yield was transmitted through to the CDO creators but the ultimate source of that pressure were the clients of the hedge funds, and chief amongst these clients were HNWIs – remember that despite the 'institutionalisation' of the hedge fund industry individuals accounted for around two thirds of hedge fund assets during the 2002 to 2007 period. Thus, the world's HNWIs growing wealth holdings contributed not only to the low long-term US bond yields but also to the pressure to create more and more CDOs to resolve this yield problem. The third, and last, research question of this dissertation therefore also has to be answered with yes.

7. Conclusions and policy recommendations

"[T]he day is not far off when these 99 per cent of the people shall absolutely depend upon the 1 per cent of the rich" (Basil A. Bouroff, 1900)

"We may have democracy, or we may have wealth concentrated in the hands of a few, but we can't have both" (Louis D. Brandeis, 1941)

This dissertation has provided evidence which supports the hypothesis that rising income inequality and rising wealth concentration were an important root cause of the subprime crisis. The exact findings of my research can be summarised as follows: The first finding is that relative inter-country income inequality was increasing until the late 1990s and then decreasing thereafter if the data are not adjusted for the country's population size. If the data are weighed by population size the picture is different: income inequality has decreased continuously since the 1960s. The main reason for the latter is the tremendous growth achieved by the Chinese economy over the last 30 years. In line with inter-country inequality global income inequality increased significantly between 1820 and the 1950s. The results for global inequality are mixed and depend on the methodology and data used for the time after 1960. All of the existing studies strongly suggest though that global inequality was very high prior to the crisis (at least 67 Gini points). Intra-country inequality, in contrast, has a clear upward trend on a global level since the mid-1980s. This is especially true for OECD and developing Asian and European countries, so that high intra-country inequality levels are becoming a global phenomenon (i.e. intra-country inequality levels are converging to some extent). With regard to relative wealth inequality much less data are available but the results are similar to the income inequality results: prior to the crisis intra-country wealth inequality has increased in most countries for which data is available, while global wealth inequality stagnated on a very high level (at least 80 Gini points).

Another finding is that although the income and wealth shares of the top 1% of the population have been increasing in most countries since the 1980s they have not (yet) reached the extremely high intra-country levels that were prevalent at the beginning of the 20th century (with the exception of the US). There is a broad consensus that one of the main reasons that the holdings at the top are lower than previously are higher tax rates. Less progressive taxation on the other hand is an important reason that both wealth and income concentration has increased from 1980 onwards. However, these findings remain

incomplete because none of the data sources are free from severe shortcomings. This is especially true for household surveys, which normally form the basis for the measurement of intra-country Gini coefficients. Household surveys not only differ in their inequality concepts and reference units, which means that it is difficult to compare the inequality between different countries, but they also suffer from sampling errors, non-response, underreporting, and misreporting. The result of the latter point is that most likely top-incomes and top-wealth holdings are underestimated[147] and very poor individuals are underrepresented. In other words, the 'true' pre-crisis levels of intra-country and global inequality were probably higher than the presented data suggest. The same is true for income and wealth concentration.

Even the most conservative estimates nonetheless suggest that absolute wealth concentration reached a historically high level prior to the crisis. The global wealth of high net worth individuals grew at least by a factor of 2.1 in the decade prior to the crisis[148], which meant that by 2007 HNWIs had at least around US$ 41 trillion AuM – more than global pension funds, global insurance companies, and global mutual funds. At the same time wealth holdings between HNWIs also became more concentrated, so that ultra-high net worth individuals with more than US$30 million AuM could increase their share on total HNWIs wealth to 37% in 2007 (US$ 15 trillion). This vast increase in absolute wealth holdings at the very top meant that Rockefeller – the richest man ever in relative terms – would not have been among the top 10 wealth holders of the Forbes global billionaire list of 2007.

Next to financial de-regulation, the underestimation of risk, policy errors and wrong incentives, this historical high level of absolute wealth concentration is crucial to explain why the CDO market could reach a proportion that was sufficiently large to endanger the global financial system when it collapsed in August 2007. Firstly, because the increasing asset demand of HNWIs helped to lower the yield of highly rated traditional bond classes, which put pressure on investors to seek alternative investment grade fixed income securities that were able to provide higher yields. Secondly, because HNWIs were the main investors in hedge funds, which, in turn, were the main buyers of CDOs. While the increase in wealth concentration explains to a large extend the demand for CDOs, the

[147] This is also the case if tax record data are used instead of HS data, as discussed in Section 4.1.
[148] Remember that this is a higher factor than that of GDP and total household wealth growth during the same period.

increase in income inequality is strongly related to the supply of the raw material to create these toxic financial instruments. On the one hand, the bottom 90% of the US households increased their borrowing to be able to keep up their social status relative to the richest segment of the population. On the other hand, the export-led growth strategy of other countries led to capital flows to the US which contributed to the housing market bubble which made the lending possible. Rising wealth and income inequality, witnessed on a global scale in the last two decades, is therefore not only questionable from an ethical viewpoint but also has destabilising effects on the global financial system: absent the large numbers of people who had low and stagnant incomes and you deprive the banks of the raw material they needed in abundance to create CDOs on a mass scale. On the other side of the equation, absent the huge concentration of personal wealth amongst a very few individuals and you remove a vital source of the pressure on the banks to create the CDOs on that mass scale (see Figure 32 at the end of Section 6.2).

The crisis therefore has shown that Marxist and post-Keynesian economists are correct in their view that the class struggle within the capitalist system and changes in the power relations between workers and capitalists are very important factors to explain the functioning of the economic system in which we are living. Moreover, the crisis has shown that markets by no means are perfectly efficient, that market participants do not have full information, and that market actor reactions are not always rational (at least in the way that is proposed by orthodox economists). Consequently, the answer to the economic problems that we are facing at the moment cannot be less government intervention, as is still proposed by many mainstream economists. Instead, the answer to the crisis needs to be more government intervention, to ensure that the economic system is as stable as possible and not only works for the benefit of a tiny minority of the global population[149]. This does not imply that all forms of government interventions are good or desirable, or that governments should increase their influence in all areas. What is however necessary are appropriate forms of intervention that give priority to income and wealth redistribution, and a strong regulation of the financial sector (including the cross-border movements of capital flows).

[149] Marxists might be right with their claim that regardless of the degree of government intervention the capitalist system sooner or later will experience crises due to the unlimited strive for surplus by the capitalist class which in the long-run inevitably will lead to "growing hardship for those at the bottom of the society" (Bellamy Foster and McChesney, 2010). However, until no better alternative to the current system is available, that is accepted/proposed by the majority, the aim should be to make the capitalist system as beneficial as possible for the majority of the people.

There has been an intense discussion and many proposals with regard to the re-regulation of the financial sector. One of the resultant consensus views is that the imposition of various new rules and restrictions on the financial sector's ability to create debt assets is necessary. The findings of my dissertation support the minority view though that this policy recommendation will not only "not help to deal with the structural problem of excess safe-asset demand" but will also have the opposite effect of worsening the safe asset gap, the potential "cost of this policy distortion [being] stronger headwinds for the recovery, and the risk that the same pattern of systemically-vulnerable safe-asset creation may migrate to somewhere else in the world that is even less prepared to absorb the systemic risk" (Caballero, 2010, pp. 6-7). To stabilise the system it is therefore necessary to either decrease the demand for safe assets or to increase their supply. This conclusion implies that the current aim to reduce the government debt levels in developed countries is counter-productive with regard to financial stability. If big countries (like the US, Germany, Italy, France and Japan) reduce their debt levels significantly even less investible securities will be available for global wealth holders which would increase the pressure to create other (more risky) assets that satisfy the existing investor demand. This conclusion also implies that private sector wealth needs to be more evenly dispersed (i.e. more evenly distributed) to decrease the pressure to find suitable 'wealth containers' for the vast amounts of accumulated wealth that exist today.

While this dissertation has provided substantial evidence to show that the current level of inequality is not only difficult to justify in moral terms but also endangers the future stability of the global financial markets, other research suggests that additional negative consequences are (i) lower global growth (recent research by Onaran and Galanis (2012) found that aggregate global demand is wage-led and not profit-led); (ii) negative impacts on efficiency and innovation because mainly the rich have access to the best education and not the most talented (due to the fact that governments claim that they have not enough money to provide free education), because the "[p]ossession of capital wealth is a disincentive to effort" (Yunker, 1997, p.417), and because resources are not distributed to the most productive sectors but to the most powerful as a result of the lobbying power of the wealthy (Esteban and Ray, 2006); and (iii) a decrease of fiscal stability and ability of the state to fund social programmes (taxes for the rich in OECD countries on average have

more than halved since 1980, due to their increasing lobbying power[150]). The clear implication of all of these findings is that it is necessary to reduce the current levels of economic inequality. The question is: how can this aim be achieved?

To start with, the post-Keynesians view that it is necessary to 'restore the link between real wages and productivity growth' by strengthening the workers' bargaining power and the implementation of a reasonable minimum wage (see e.g. Lavoie, 2006; Palley, 2010b; Onaran, 2010a, 2010b; Setterfield, 2010; Hein, 2011; Stockhammer, 2012) definitely is a step in the right direction. However, a policy that solely prevents a further deepening of the exploitation of the bottom 90% is insufficient. Firstly, because it would not change the existing high levels of income inequality and thus the 'keeping up with the Joneses' desire of the bottom 90% of the population and underconsumption problems would prevail. Secondly, and probably more importantly, because it would not prevent a further rise of the absolute concentration of wealth on which the investment demand depends – a billionaire who has an income of more than US$ 500,000,000 needs to find new investible securities to store his/her increased wealth, irrespective of changes in the wealth holdings of poorer parts of the population (i.e. irrespective of the stableness of relative wealth inequality).

It is therefore additionally necessary to reduce the actual level of absolute wealth concentration and net income inequality (i.e. income inequality after taxes and transfer payments) by applying progressive tax and social policies as proposed by many hetereodox economists (see e.g. Lysandrou, 2011a; Onaran, 2010b, 2011; Hein and Mundt, 2012; Stockhammer, 2012a). To be more precise, to stabilise the economic system taxes for rich people should be increased, tax avoidance and evasion opportunities should be closed off, and the accruing new government revenues should be used for "services like education, child care, nursing homes, health, community and social services" and for public infrastructure and green investment (Onaran, 2010a). Hence, the following proposals should be considered by policy makers to increase the stability of the economic system:

[150] The average OECD central government top marginal wage income tax rates decreased from 58% in 1981 to 35% in 2010, while the average OECD net top statutory rate on dividend income decreased from 57% in 1981 to 21% in 2010. The top 400 taxpayers in the US pay only 16.6% as effective income tax rate (Tax Justice Network 2010).

i. a 10/70 income tax rule – a progressive income tax with the highest marginal tax rate of 70% for income above 10 times the median income (e.g. above 250,000 Euro in Germany),

ii. a 100/10 wealth tax rule – a 10% wealth tax on all personal net wealth, excluding primary residence, that is above 100 times the median wealth (e.g. above 1.5 million Euro in Germany)[151],

iii. a 100/90 inheritance tax rule – an inheritance tax with the highest marginal tax rate of 90% for net wealth above 100 times the median wealth,

iv. the reduction of low and middle income taxes and value added taxes (for goods that are not considered as luxury goods and that are not carbon intensive), and

v. tougher regulations to close loopholes for tax avoidance, the allocation of more resources to prevent tax evasion, and harder punishment for tax evaders[152].

The advantage of having tax rules that are linked to median incomes and wealth holdings is that bracket creeps (i.e. the movement in higher tax brackets due to inflation) are avoided and, more importantly, rich individuals have an incentive to be in favour of income and wealth increases for the bottom 50% of the population (as this will rise automatically the tax thresholds) – for low income countries the factors of course need to be different to ensure that only very rich individuals are affected by these high tax rates. These proposals might seem very radical at first sight, but they are not. In the four decades before Margaret Thatcher came to power the UK had a top marginal income tax rate of well above 70%, and between the mid-1930s and 1981 (one year after Ronald Reagan took office) the US had a top marginal income tax rate of at least 70%. Moreover, the suggested thresholds are high enough to ensure that effort and major achievements still can be sufficiently incentivised, and that good private retirement provisions can be made[153]. Due to the increasing globalisation of the HNWI population and their high mobility, these

[151] It is estimated that in Germany a capital levy with a rate of 5.3% on all personal net wealth above 1 million Euro would yield 100 billion Euro revenue. This tax would only concern the top 0.6% of Germany's population (Bach *et al.*, 2011).

[152] Palan *et al.* (2010) estimate that tax avoidance by HNWIs via tax havens leads to a global annual tax loss of around $250 to $300 billion.

[153] If an interest rate of 4% is assumed, a person with wealth holdings of EUR 1.5 million would have an average yearly income of around EUR 60,000. This income would be four times higher than today's average pension in Germany.

policies will only be effective though if they are implemented on a global scale or at least on a regional scale (e.g. in Europe).

The likelihood of a successful implementation of such progressive policies is therefore unfortunately not very likely in the near future – especially given that huge parts of the ruling elite would mount a strong resistance to these proposed changes. Consequently, it can be expected that the plutocracy that has evolved in recent years continue their reign for some more time and that the existing social abuses persist and even worsen. Ultimately, however, the system most likely will become so unstable that the global 99% will not obey any longer and instead (forcefully) request a massive change. The creation of the social welfare system in Europe and the US was a response to such a threat of a revolution by the deprived (Kapstein, 1999) and history has shown several times that democratic regimes "fail if income discrepancies and redistributive tensions between the different social groups become too large" (Jung and Sunde, 2011, p.37)[154]. The question that therefore remains open is whether the necessary changes that were outlined in this concluding chapter will be implemented soon enough to avoid similar crises and a massive upheaval on a global scale, or not...

[154] Various other authors also report that inequality has destabilising effects: Dutta and Mishra (2005) report that high levels of inequality destabilise the political system and lead to revolts, like happened for example in Colombia, El Salvador or Guatemala; Chester (2011) states that one of the main driving forces for the "Arab spring" and the demonstrations in Gabon, Malawi, and Uganda was economic inequality; and Ponticelli and Voth (2011) show that there is a clear positive correlation between budget cuts and social unrest in Europe since 1919. High wealth concentration might also lead to unaffordable energy and food prices (Wray (2008c) and Caballero *et al.* (2008) find that investor demand was the main reason for the increasing commodity prices in recent years) and housing costs (in large cities, e.g. London (Heywood, 2012) and Berlin (Hollersen and Mingels, 2012), real estate prices have increased significantly recently due to a growing demand by investors).

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