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BNP PARIBAS

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world

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The Earth is warming up. According to NASA/GOSS, 17 of the 18 warmest years in the 136-year record all have occurred since 2001, with the exception of 1998. The year 2017 ranks as the second warmest on record, after 2016. This is almost certainly related to the growing presence of greenhouse gases, mostly due to human activities.¹ Recent research estimates that human-induced warming reached 0.93°C ($\pm 0.13^\circ\text{C}$; 5-95 percentile range) above pre-industrial levels in 2015, and is currently increasing at almost 0.2°C per decade.²

This had led to changes in the frequency of extreme weather events, such as increases in tropical cyclones, heavy precipitation, and periods of drought. In the insurance industry, weather-related catastrophe losses have increased by 2% each year since the 1970s in addition to changes related to accumulated wealth, inflation and population growth/movement.³ The re-insurance company Munich Re reported that total insured losses from natural disasters amounted to USD 135 bn in 2017, higher than ever before. Including uninsured losses this totalled USD 330 bn or 0.4% of world GDP.⁴ As temperatures continue to rise, losses from extreme weather could increase rapidly in a non-linear manner during the coming decades. The Stern Report estimates that without mitigation efforts, damages could reach 20% of world GDP by the end of the century.⁵

Growing concern of the consequences of climate change has made it possible to reach a milestone agreement among 196 countries at the COP21 in Paris in December 2015. The aim is to limit global warming to 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. This should be done by reducing net emissions of greenhouse gases. The treaty has already been ratified by 175 parties, including the EU. Unfortunately, the US, world's largest producer of CO₂ gases announced in June 2017 to leave the agreement. For the moment, the treaty is not very restrictive and based on voluntary declared commitments, the so-called Nationally Determined Contributions (NDCs).

Even before the conclusion of the Paris climate deal, growth in global carbon emissions was slowing and clearly decoupled from GDP growth. The Global Carbon Project estimates that they increased by around 2% in 2017 after having stabilised at 36 Gt during the period 2014-2016. It is expected that emissions over the next few years will level off or only grow slightly, as countries implement their pledges.

However, more efforts are needed as, taken together, the NDCs are insufficient to reach the climate objectives of the Paris Agreement. Hence, in the coming decades, climate mitigation measures have to be stepped up. This may be much more difficult to achieve than in the past, as countries have first implemented the easy cuts, the so-called low hanging fruits such as the replacement of coal power stations by cleaner natural gas plants, nuclear reactors, PV solar or wind farms. In addition, countries have to spend more on climate adaptation to deal with the already observed effects of global warming.

Uncertainty about climate sensitivity

Over the past decades, considerable insight has been gained in the effect of carbon emissions on global warming and the economy by using sophisticated climate models. Nevertheless some important hiatuses remain, such as possible feedback effects and the possible existence of tipping points. The rising temperature can provoke serious economic losses through the negative impact on agriculture output, flooding, increased frequency of tornados and heavy precipitation, the rise in climate-related morbidity and migration.

The value of the long-term damage done by releasing an additional tonne of carbon dioxide (CO₂) in the atmosphere is called the Social Cost of Carbon (SCC). This concept is important in the design of climate policies. In a standard cost-benefit analysis, the marginal benefit of reducing carbon emissions should equal the SCC. The social cost of carbon is not readily observed but estimated, by so called Integrated Assessment Models (IAM), which link climate models with economic models. The three best known models are William Nordhaus' DICE model⁶, Richard Tol's FUND model⁷, and Christ Hope's PAGE model⁸. According to the US Environmental Policy Agency (EPA), the SCC amounted to USD 36 in 2015 (in 2007 dollars and a 3% discount rate

¹ The three main greenhouse gases are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Other less prevalent greenhouse gases but with a far greater global warming potential are sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). In order to calculate the impact on global warming, all these gases are converted, according to their warming potential, into CO₂ equivalents or CO₂eq.

² Millar et al. (2017)

³ Millar et al. (2008)

⁴ Total losses, insured and uninsured, was even slightly higher in 2011, USD 354 bn (in 2017 prices), because of the Tohoku earthquake in Japan.

⁵ Stern, N. (2007)

⁶ Nordhaus (2016)

⁷ <http://www.fund-model.org/>

⁸ <http://www.climatecolab.org/wiki/PAGE>



Box

Climate sensitivity

The relationship between CO₂ and global warming is called climate sensitivity. Two types of climate sensitivity are used. The transient climate response (TCR) considers temperature changes that would occur if CO₂ levels increase by 1% (compounded) per year from pre-industrial levels (280 parts per million, ppm) until they double. This would take about 70 years. The TCR is the global temperature increase that would have occurred at that point in time.

Temperatures would still increase even if CO₂ levels would stabilise at double the pre-industrial level, as it takes a long time for the oceans to heat up. The equilibrium climate sensitivity (ECS) is the amount of warming achieved when the entire climate system reaches a stable temperature in response to a doubling of CO₂. This can take hundreds, if not thousands, of years.

Climate sensitivity can be estimated by using:

1. climate models
2. information from distant past climates, such as from the last ice age (palaeoclimatology).
3. data on how global temperature responds to the outbursts of large volcanoes.
4. recent climate trends.

Source: Colman and Braganza (2013)

for estimating the present value of future damages). Moreover, an increasing number of companies use an internal price for carbon pollution to weigh the risk and opportunities related to climate change. The Exxon Mobil Corporation uses USD 80 for a tonne CO₂ in 2040, which actually exceeds the EPA estimate for that year (USD 60).

Probability density function for climate sensitivity Stabilisation of CO₂eq concentrations at 560 ppm

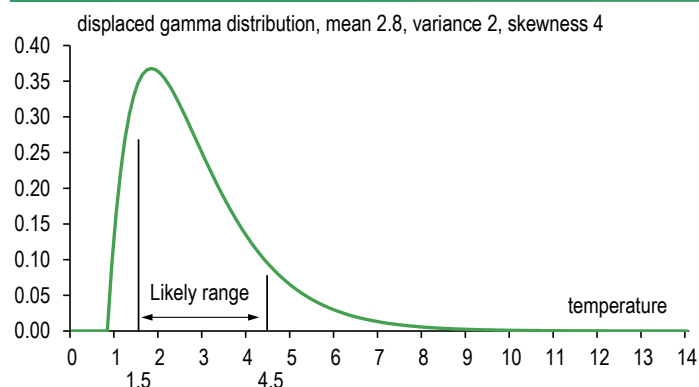


Chart 1

Source: BNP Paribas

A major uncertainty in the calculation of climate change damages is related to uncertainty about the magnitude of climate sensitivity (see box). The climate sensitivity rate λ , expressed in °C/(Watt/m²) is a

parameter that links the equilibrium temperature change T to the radiative forcing (RF) at carbon concentrations in the Earth's atmosphere (E):

$$T(\lambda, E) = \lambda * RF(E)$$

Climate scientists have obtained estimates for λ by running climate models thousands of times. The pattern that emerges is a right-skewed distribution similar to a lognormal or gamma distribution (see Lindsey, 2010). Few of the simulations result in less than 2 degrees of warming, but some result in significantly more than 4°C. Following Pindyck (2012) we have used a displaced gamma distribution (see Chart 1). The results are in line with estimations by the Intergovernmental Panel on Climate Change (IPCC), a UN sponsored body for the study of climate change. In its Fifth Assessment Report, the Panel estimates that the equilibrium climate sensitivity is likely in the range 1.5°C to 4.5°C, and very unlikely greater than 6°C.⁹ That range has persisted almost all of the past four decades.¹⁰

As policy makers would want to avoid major climate catastrophes, the right-hand tail of the distribution of T may matter most for them. It is what economists call "tail risks", the probability that equilibrium climate sensitivity will be above 4.5°C. It is very hard to get precise knowledge about the form of the tail, as, fortunately, extreme events fall well out of the range of experience. In such situations one has to rely on *a priori* beliefs in the form of a prior probability distribution.

The tail of the climate sensitivity distribution

CO ₂ eq/ppm	400	500	600	700	800	900
Pareto distribution						
Prob [$T \geq 5^\circ\text{C}$]	1.5	6.5	15	25	38	52
Prob [$T \geq 10^\circ\text{C}$]	0.2	0.83	1.9	3.2	4.8	6.6
Normal distribution						
Prob [$T \geq 5^\circ\text{C}$]	1.E-06	2	14	29	42	51
Prob [$T \geq 10^\circ\text{C}$]	1.E-30	1.E-10	1.E-05	0.1	0.64	2.1
Gamma distribution*						
Prob [$T \geq 5^\circ\text{C}$]	1.7	5.6	11.6	19.9	26.7	35.5
Prob [$T \geq 10^\circ\text{C}$]	0.0	0.0	0.3	0.8	1.9	3.4

Table 1

Sources: Weitzman (2011), *calculations BNP Paribas

Table 1 illustrates the problem. The higher the level at which carbon emissions stabilise, the greater the risk for catastrophic climate change. For the moment, the objective is to keep greenhouse gas concentration below 450 ppm. The average warming at that level is around 2°C and the risk that it will increase above 5°C is, at less than 5%, relatively low. However, assuming that the tail follows a gamma distribution, the probability that temperatures increase by more than 5°C would be higher than 10% if greenhouse gas concentrations exceed 580 ppm. For prudent policy makers, that would be a considerable risk. The

⁹ IPCC (2014). In the IPCC terminology, "likely" signifies a level of confidence of more than 66% and "unlikely" a level of less than 10%.

¹⁰ The 1979 Charney Report of the US National Research Council estimated this interval for the first time.



benefit of strong climate action can thus be viewed as an insurance premium against the risk of such a situation.

From global warming to future damages

The increase in global temperatures has a direct impact on GDP, in particular for agriculture output. Although a small increase might be beneficial for economies in moderate zones because of better harvests, globally output losses are likely to dominate because of production falls in the rest of the world. In addition, output will be damaged by changes in weather conditions, such as heavy precipitations in one place and long periods of drought elsewhere.

Distribution of warming costs by percentile of climate sensitivity

Percentile (midpoints)	Stabilisation at 450 ppm		Stabilisation at 550 ppm	
	Temperature °C	Damages %GDP	Temperature °C	Damages %GDP
2.5	0.8	0.0	1.0	0.0
7.5	1.0	0.0	1.2	0.0
12.5	1.1	0.0	1.4	0.1
17.5	1.2	0.0	1.5	0.2
22.5	1.4	0.1	1.7	0.4
27.5	1.5	0.2	1.8	0.6
32.5	1.6	0.3	1.9	0.9
37.5	1.7	0.4	2.1	1.2
42.5	1.8	0.6	2.2	1.6
47.5	1.9	0.8	2.4	2.2
52.5	2.1	1.2	2.5	2.9
57.5	2.2	1.6	2.7	3.7
62.5	2.3	2.1	2.9	4.9
67.5	2.5	2.9	3.1	6.3
72.5	2.7	3.8	3.3	8.2
77.5	2.9	5.2	3.6	10.8
82.5	3.2	7.2	3.9	14.6
87.5	3.5	10.5	4.3	20.6
92.5	4.1	16.7	5.0	31.8
97.5	5.1	35.1	6.3	64.7
Average	2.0	1.0	2.4	2.5

Table 2

Source: BNP Paribas

The results of stabilising greenhouse gas concentrations at 450 ppm and 550 ppm are summarised in table 2. If CO₂eq concentrations could be stabilised at 450 ppm, the temperature increase is likely between 1.5°C and 4°C. The mean value is 2°C, in line with the minimal objective of the Paris agreement. Moreover, it is very unlikely that global temperatures increase by more than 4°C (column 2). However, if greenhouse gas concentrations stabilise at 550 ppm, the picture is much bleaker. The mean increase in global temperatures is 2.4°C, but the

probability that temperatures increase by more than 4°C is 17.5% (column 4).

To analyse the severity of the damages, we could calculate the present value of the stream of losses. However, that would immediately pose the question about the discount rate to use. Following Quiggin (2017), we avoid this important question and evaluate the losses at some future date, say around the end of the century.

Damages are estimated by the loss function $L(\lambda, E)$, representing the percentage of GDP lost by the warming of the globe:

$$L(\lambda, E) = \{T(\lambda, E) - T_0\}^\kappa * L_0$$

where T_0 is the warming that can be sustained with minimal damages, L_0 a constant equal to the damages at T_0+1 and $\kappa > 1$, representing the convexity of the loss function. In our example, κ is set at 2.5.

The results are presented in Table 2 columns 3 and 5. If the world succeeds in keeping damages below 1.5°C, the aim of the Paris climate agreement, damages should be negligible. However, according to the IPCC, that is unlikely to happen. If greenhouse gas concentrations stabilise at 450 ppm and the average temperature increase is at 2°C, damages could be limited to around 1% of GDP. The IPCC warns that without additional efforts to reduce greenhouse gas emissions beyond those in place today, CO₂eq concentration levels could attain more than 1300 ppm by 2100 and the increase in global mean surface temperature could range between 3.7°C and 4.8°C. In such a scenario, losses could amount to around 20% of production without global warming. This is in line with the calculations in the Stern Review.

Can we wait?

A crucial question is how much income current generations are willing to sacrifice for the next generations in order to avoid catastrophic losses. Given the uncertainties, some argue that we should undertake a lot of action in order to make sure that global warming stays below 2°C. Others prefer waiting till more insight has been gained on the consequences of global warming to avoid unnecessary expenses.¹¹

A simple example two period model proposed by Summer and Zeckhauser (2008) may illustrate the problem. The two periods might be thought of as 10 year or 20 year periods. Environmental damages are experienced in the second period, due to greenhouse gases released in the first and second period.

In the absence of any abatement, emissions amount to 100 units in each period. The problem is to determine r_1 and r_2 , the abatements to be undertaken in period 1 and 2, respectively, expressed in percentages of total emissions. Emission reductions are not costless.

The cost function for either period is

$$C(r_i) = \gamma r_i^a$$

where $i=1,2$ and $a > 1$, implying increasing marginal costs and γ , a are constant.

¹¹ The problem is similar to the irreversible investment problem. See for example Dixit and Pindyck (1994).



Damages are determined by a stochastic binary variable d , which may be either high (H) or low (L) with equal probability. The mean value is 1, implying that $L=2-H$ and $1 \leq H \leq 2$.

At the end of the first period, the expected damages from emissions are learned, which will inform the level of reduction required in second-period emissions.

Losses at the end of period 2 are

$$L(r_1, r_2, d) = \{d(200 - r_1 - r_2)\}^q$$

The overall objective function at the start of period 1 is

$$\text{Minimize } \gamma r_1^a + 0.5 * (\gamma r_{2H}^a + \gamma r_{2L}^a) + 0.5 * \{[d(200 - r_1 - r_{2H})]^q + [d(200 - r_1 - r_{2L})]^q\}$$

Chart 2 shows the results for $q=1$ and different values of a , the parameter of the cost function. The lines demonstrate how the relative abatement effort in period 1, $R_1 = \frac{r_1^*}{(r_1^* + E([r_2^*]))}$ varies as a

function of uncertainty about damages in period 2 (H). Summers and Zeckhauser show that the results are very similar for $q=2$.

Early pollution abatement is optimal in case of high marginal costs and uncertain damages

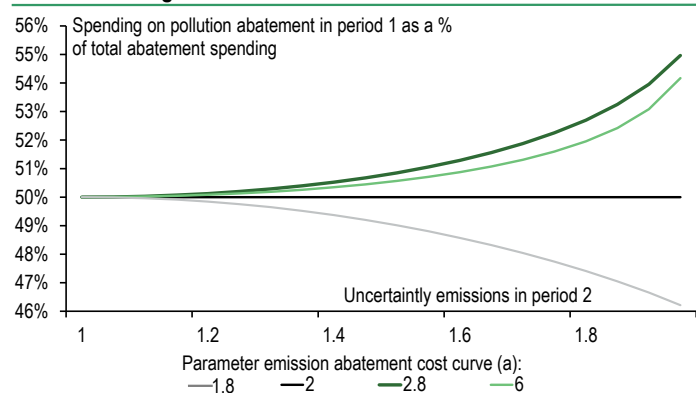


Chart 2

Source: BNP Paribas

An important question is whether more uncertainty leads to a larger or smaller fraction of total emissions reduction to be undertaken in period 1. Uncertainty is represented by the spread between H and L. It turns out that a , which determines marginal abatement costs, is a crucial parameter. If marginal abatement costs are low, it might be desirable to wait. However, if they rise rapidly ($a > 2$), as is assumed in most models, it becomes more attractive to do more abatement in the first period. The reason is that if damages turn out to be high, making all the abatement effort in the second period could become very expensive because of rising marginal abatement costs. In that case, it might be useful to prepare for climate change well before the effects of greenhouse gases are being felt.

Understanding tail risk

It is now widely agreed among climate scientists that the emission of greenhouse gases is the main driver behind the observed changes in global temperatures. What is less understood is how to deal with tail risks, rare events that have a catastrophic impact.¹² As we have seen, even when society succeeds in keeping the concentration of greenhouse gases below 450 ppm, the probability that temperature rises beyond 4°C, which could have catastrophic consequences, is not zero.

Economists often assume that people make rational decisions by maximizing a (collective) utility function. The psychologists Daniel Kahneman and Amos Tverski have studied human reactions. Their research shows that human decisions are likely to be directed by a set of inbuilt and largely intuitive mental shortcuts, what they call cognitive biases.¹³ They discovered that, unlike rational decision makers, people are more willing to gamble to avoid a loss than to obtain a benefit. In Kahneman's words: When offered the following: incur a loss of USD 900 for sure or take a 90% chance to lose USD 1000, then people take the gamble. But when offered the choice: Get USD 900 for sure or a 90% chance to get USD 1000, people opt for the sure reward of USD 900.

This sounds remarkably similar to the suggestion in the Nicolas Stern' report: "Using the results from formal economic models, the Review estimates that if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more. In contrast, the cost of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around 1% of global GDP each year."¹⁴ On these grounds, one may fear that people are willing to take a chance with climate change, rather than adapting their lifestyles.

Professor Jonathan Wiener identifies three main sources for the neglect of tail risks.¹⁵ The first source is **unavailability**. Research has shown that people tend to underweight the chances for common accidents and overweight the probability of severe accidents. Many people are more concerned about being involved in a plane crash or a terrorist attack than in a car accident. However, the former are much less common than often assumed. Moreover, serious accidents are often followed by inquests, which may result in new regulations to prevent a repeat. A mining accident might lead to a new set of underground safety rules. However, public health risks related to coal combustion, which actually claim a much higher death toll, are often underrated.

Despite their concern about serious accidents, the public is much less concerned about catastrophic risk, such as abrupt climate change, killer viruses, and large asteroid collisions. Policy makers have to set priorities in addressing all these dangers. For example, in 2009, despite

¹² This is sometimes called the "tragedy of the commons". See Wiener (2016).

¹³ Kahneman (2011)

¹⁴ Stern (2007), page 14

¹⁵ Wiener (2016)



warnings by public health authorities, an outbreak of H1N1 virus was shrugged off by the public. The reason for this attitude is a fortunate lack of experience of catastrophic risks. Movie theatres are among the few places where catastrophic risks are depicted. However, as movies are associated with amusement, this does little to heighten public awareness.

A second reason is the **large magnitude** of the impact of catastrophic risks. Research has been done in how much people are willing to pay for saving other people from risks. One would expect that the willingness would rise with the number of people involved. Researchers found indeed that the willingness rises, albeit at declining rate until it levels off. If the number of victims becomes very high, the willingness to pay declines. The psychologist Paul Slovic terms this “psychic numbing”¹⁶. A reason might be that people feel overwhelmed by the numbers. The public might have a strong emotional response to an identified individual, but not to a large and unidentified population. For this reason, NGOs often make use of a poster person in their funding campaigns. Lastly, the public may also be eager to combat an identified villain rather than a faceless natural disaster or a ubiquitous social problem.

A third reason for the neglect of tail risks is **under-deterrence**. Traditional legal systems have difficulties in handling mega-catastrophes. After a major disaster, institutions might break down, making it difficult to hold people responsible and force them to repair the damage. For this reason insurance against such mega disasters does not have any practical meaning. Policyholders do not want to pay premiums if they fear that the insurer will not be able to pay claims or even might not exist anymore after a mega disaster.

Framing climate policy

Public authorities have been much more aware of the reality of tail risks than the public at large. Since 1990, the US military authorities considered climate change as a “threat multiplier,” that could threaten operational effectiveness. In 2015, President Obama even identified climate change as one of the top strategic risks.¹⁷ This was subsequently scrapped from the list by President Trump in December 2017. In a 2014 report by the Center for a New American Security on the relation between national security and the risk of climate change, retired US general Gordon Sullivan notes: “Speaking as a soldier, we never have 100 percent certainty. If you wait until you have 100 percent certainty, something bad is going to happen on the battlefield.”¹⁸

A major challenge for climate policy is to overcome public resistance. As we have seen, people care much more about losses than about gains. However, keeping carbon concentrations at relatively safe levels may imply changes in lifestyle. Sacrifices have to be made for people living in poorer parts of the world to help them in investing in sustainable energy and in dealing with the already observed consequences of

climate change.¹⁹ Moreover, it is also about our willingness to invest for the coming generations. As long as climate change does not seem a very pressing problem, it is very tempting to become free-riders and let the coming generations make most of the effort in cutting back on greenhouse gas emissions. That would be a terrible mistake. For example, investment in energy infrastructure is an important determinant of carbon emissions in the decades to come. By investing now in sustainable energy sources we could considerably reduce greenhouse gases for future generations.

To convince the public of the need of avoiding climate change, environmental policies need to be appropriately framed. In the Stern Review, it is argued that for ethical reasons, intergenerational neutrality, the discount rate should be set close to zero for the optimisation of social welfare among generations. It is one of the reasons for the substantial differences between the Stern Review and earlier studies. This position has been heavily criticised. Nordhaus argued that the criterion of intergenerational neutrality is not as universal as the authors of the Stern Review would have us believe.²⁰ His main criticism is that this approach does not touch on structure of actual intertemporal decision-making. Each generation cannot decide for the coming generations how to act. Instead, he considers each generation as members of a relay team, “handing off the baton of capital to the next generation and hoping that future generations behave sensibly and avoid catastrophic choices by dropping or destroying the baton.” Summers and Zeckhauser (2008) make a similar argument by comparing policies to valuable antiquities, handed down between generations. “Each generation has the choice to sell the furniture but may think it may be optimal to continue, trusting that successive generations would see matters the same way.”

The Paris climate deal could be seen as a policy that can be handed down to the next generations. At the moment, the countries are negotiating on procedures for ratcheting up of the abatement objectives. A decision should be taken at the COP24 in Katowice (Poland) in December 2018. The Paris agreement and procedures (the so-called toolkit) are the policies that can be passed on to the next generations. Countries can drop out, as is already to be the case with the US, but they are also aware of their responsibilities. It will be extremely difficult to negotiate again a new carefully crafted document. Hence, it might be better to stick with the existing agreement and hope that the US will re-join at a later stage.

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¹⁶ Slovic (2010)

¹⁷ <http://nssarchive.us/wp-content/uploads/2015/02/2015.pdf>

¹⁸ CAN Military Advisory Board (2014)

¹⁹ In the Paris climate agreement, the developed country promised to make available funds amounting to at least USD 100 bn each year from 2020 onwards to assist the poorest country in adaptation and mitigation policies.

²⁰ See, for example, Nordhaus (2007).



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The fate of Fannie Mae and Freddie Mac is not yet sealed

Céline Choulet

None of the legislative proposals to reform the US mortgage market has yet come into force. Most of them start from the same position: although government guarantees are essential in ensuring a liquid and stable mortgage market, the Federal government should not be the sole party exposed to payment default risk, especially as this is transmitted through two agencies, Fannie Mae and Freddie Mac, that are in financial difficulties. In the absence of legislation, the regulator of the two agencies has sketched out the foundations of a reform, by developing a program to transfer “non-extreme” credit risk to the market.

The US mortgage market, which was at the centre of the 2007-2008 financial crisis, has so far been spared deep-seated reform. The vast majority of residential mortgages are still incorporated into securities¹, particularly by two companies - Fannie Mae and Freddie Mac - which are facing significant financial difficulties and still remain in conservatorship. These securities are then sold on the market, with a public guarantee against any payment default.

These two major mortgage refinancing agencies alone guarantee more than USD 4,500 billion of residential mortgage loans (nearly half of the outstanding loans), but at the same time have a core capital deficit of around USD 235 billion.

Before the crisis, securities issued by Fannie Mae and Freddie Mac were not guaranteed by the Federal government. However, for various reasons² the idea that these government-sponsored enterprises (GSEs) enjoyed an “implicit” federal government guarantee took hold. This implicit guarantee underpinned the value of the guarantee that the GSEs themselves offered investors. It allowed them to occupy a dominant position in the secondary mortgage market and ensure its liquidity.

It is clear that decisions taken at the height of the crisis allowed, for the short term at least, the systemic risks posed by the two big GSEs to be confined. At the beginning of September 2008, faced with rising

payment defaults, they were saved from bankruptcy by the US Treasury and placed under the conservatorship of the Federal Housing Finance Agency (FHFA). The Treasury subscribed for USD 187.5 billion in senior preferred stock from the two agencies and guaranteed all their obligations (debt securities and mortgage-backed securities). Since then, the securities issued by the two main GSEs have enjoyed an “effective” guarantee from the Federal government. In the wake of the Lehman Brothers collapse in the autumn of 2008, increased tensions nevertheless made it hard for them to refinance and increased the cost of doing so (Frame, Fuster, Tracy and Vickery, 2015). Having reached the limits of conventional monetary policy, and fearing that the “flight to liquidity” would drive up mortgage rates, the Federal Reserve launched a massive asset purchase program (quantitative easing). Between January 2009 and October 2014, the Fed bought nearly USD 1,800 billion of mortgage-backed securities (MBS) issued by Fannie Mae and Freddie Mac and agency debt³. Meanwhile, the Treasury bought USD 220.8 billion of MBS issued by Fannie Mae and Freddie Mac between September 2008 and December 2009.

Given the size of the US mortgage market (nearly USD 10,000 billion), it was inevitable that Fannie Mae and Freddie Mac would be bailed out. Putting the two GSEs into conservatorship helped stabilise the mortgage market and, by protecting investors, avoid the devastating effects for the whole financial system that would surely have followed their collapse⁴. However, this conservatorship was intended to be temporary – a “time out” as recommended by former Treasury Secretary Henry Paulson – providing breathing space for Fannie Mae and Freddie Mac to be restructured. However, nearly ten years later none of the legislative proposals⁵ seeking to finally determine their

¹ Securitisation of loans consists of transforming “immobile” or relatively illiquid assets, generally at fixed interest rates, into variable rate assets traded on financial markets. In the absence of any external guarantee (from the government or an insurer), an internal structuring, or tranching, of loans is used to create more or less high-risk securities (with the “equity” tranche carrying greater risk than the “mezzanine” tranche or the “senior” tranche). Securitisation offers banks an alternative to holding the loans they issue on their balance sheets (enabling a reduction of balance sheets and of the leverage constraint) and gives institutional investors (pension funds, insurance companies and asset managers) access to underlying assets which would be inaccessible in their original form as loans.

² This perception was based in particular on their legal status, the specific advantages they enjoyed, their designation as “government-sponsored enterprises”, the treatment of their securities as “agency securities” (alongside those of Ginnie Mae) and on two previous episodes where the Federal government provided support to GSEs in difficulty. This implicit guarantee allowed them to finance their activities at a reduced cost and offer investors an attractive risk/return profile. Choulet and Shulyatyeva, *History and major causes of US banking disintermediation*, BNP Paribas, Conjoncture 16-01, January 2016

³ <https://www.newyorkfed.org/markets/domestic-market-operations/monetary-policy-implementation/agency-mortgage-backed-securities>

⁴ Due particularly to the significant ownership of these securities (17% in June 2008) by commercial banks, which were already weakened by the crisis, to the widespread use of such securities in the short term repo markets, and due to the risk of widespread mistrust in US debt securities amongst non-resident investors (the non-resident sector owned 30% of agency securities and Treasuries).

⁵ See Scharfsstein and Swagel (2016), SFIG (2014), Wachter (2015), Zandi and deRitis (2011) and Zandi and deRitis (2014) for discussion of draft measures in H.R.2767, 2013



future and to reform the mortgage market more generally have come into force.

Since 2008 the role of the guarantors of the three big mortgage guarantee agencies (Ginnie Mae, Fannie Mae and Freddie Mac) has barely changed. The two GSEs have, however, and under the direction of the FHFA, introduced various instruments to shift mortgage credit risk. Without negatively affecting the liquidity and stability of the secondary market for loans, these programs have helped create a new market for pricing and trading mortgage credit risk.

The main principles that could govern a reform of the housing finance system are beginning to become clear. Since 2009 various reform projects have been presented, but no real consensus has emerged. All proposals have shared the same ambition: reducing the exposure of taxpayers to mortgage credit risk whilst maintaining a framework to encourage the supply of credit. However, opinions vary widely as to the role of the Federal government, with some (mainly from Democrats) suggesting that the big two agencies be replaced with targeted guarantee mechanisms (Obama administration white paper, February 2011), whilst others (from Republicans) argue for the relaunch of a private secondary market through the removal of agencies and government guarantees.

Over time, the idea of withdrawing all government guarantees from the US mortgage market has fizzled out. It has gradually lost ground to the (no doubt more realistic) view that liquidity and stability in this market can only be ensured at the cost of a government guarantee against “extreme” credit risks.

Recent proposals have argued for a convergence towards a hybrid financing model where private financial institutions and the Federal government share mortgage credit risks. Under this approach, secondary market liquidity would be supported by an “explicit” government guarantee for securitised loans in return for a commission. At the same time, credit risk transfer programs would be more broadly deployed. To ensure the stability of the market, only “non-extreme” risks would be sold to private investors.

The status of the new “guarantors” continues to be debated, but everyone seems to agree that the main imperfections suffered by the GSEs prior to the crisis should be stripped away: the moral hazard created by the implicit guarantee from which they benefited at no cost; the contradictions between their goal of profitability and their public service purpose; and their insufficient levels of capital given their risk exposure. The scale of the private capital that would be required for these reforms to succeed looks colossal.

Federal agencies at the heart of the mortgage market

As discussed in our earlier article⁶, US housing policies enacted after the Great Depression and then throughout the two decades from 1960 to 1980 gradually transformed the way in which the mortgage market was financed and, more broadly, the US economy. The creation by the US Congress of agencies responsible for stabilising the financing of the real estate market and promoting access to mortgage credit, particularly among low- and moderate-income households was the keystone of this transition.

The business model of the mortgage refinancing agencies

Ginnie Mae, Fannie Mae and Freddie Mac as we know them today were set-up 50 years ago.

Ginnie Mae

The Government National Mortgage Association (GNMA), or Ginnie Mae, is the only agency wholly-owned by the government (*government-owned enterprise*). As such it enjoys an explicit “full faith and credit” guarantee from the Federal government. Ginnie Mae is not permitted to originate or purchase loans, nor to issue MBS; it only fulfils the role of guarantor.

Financial institutions (banks and non-banks) approved by Ginnie Mae originate loans under the framework of a federal program (Figure 1). These “non-conventional” loans come with a federal agency guarantee (most often from the Federal Housing Administration (FHA) or the Department of Veterans Affairs (VA)) against any risk of default by the borrower. For a fee, Ginnie Mae guarantees timely payment of principal and interest on MBS collateralised by these non-conventional loans (most often issued by the lenders themselves).

Ginnie Mae MBS do not expose investors to any credit risk (which is covered by the FHA or VA) or any counterparty risk (the default risk of the lender-issuer is covered by Ginnie Mae). Ginnie Mae securities are the only MBS to carry an unconditional federal guarantee. As it does not guarantee the underlying loans in an MBS, Ginnie Mae has no exposure to credit risk. All credit risk on non-conventional loans is borne by the Federal government through the FHA and VA guarantee agencies.

(PATH Act), S.1217 in 2013 (Corker-Warner Bill) and the amendment to the S.1217 draft in 2014 (Johnson-Crapo Bill).

⁶ Choulet and Shulyatyeva, *History and major causes of US banking disintermediation*, BNP Paribas, Conjoncture 16-01, January 2016.



Ginnie Mae

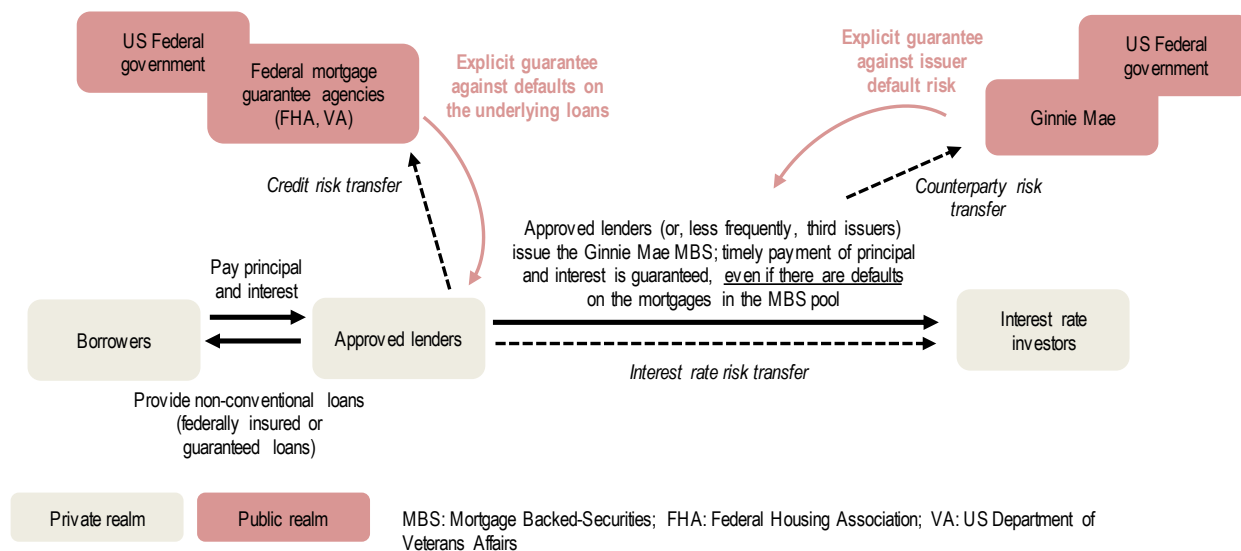


Figure 1

Source: BNP Paribas

In 2017, residential mortgage-backed securities (RMBS) guaranteed by Ginnie Mae represented 34% of agency RMBS issuance (from Fannie Mae, Freddie Mac and Ginnie Mae) and 32% of total RMBS issuance (by agencies and private issuers - Chart 1). At the end of 2017, Ginnie Mae RMBS outstanding totalled more than USD 1,900 billion, or 16% of outstanding home loans (whether securitised or not), 28% of agency RMBS and 25% of total RMBS (Chart 2).

Lack of recovery in private secondary market

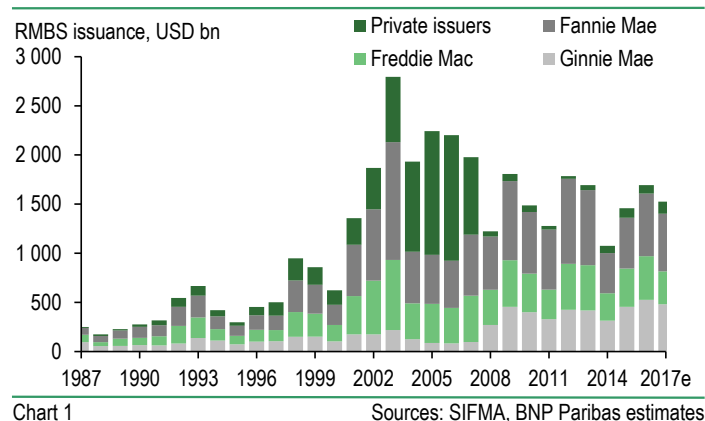


Chart 1

Fannie Mae and Freddie Mac

The two big GSEs – Fannie Mae (Federal National Mortgage Association, FNMA) and Freddie Mac (Federal Home Loan Mortgage Corporation, FHLMC) – are federally chartered private corporations. By law, they are limited to operating in the secondary “conforming” mortgage market⁷.

Agency RMBS account for 90% of RMBS outstanding

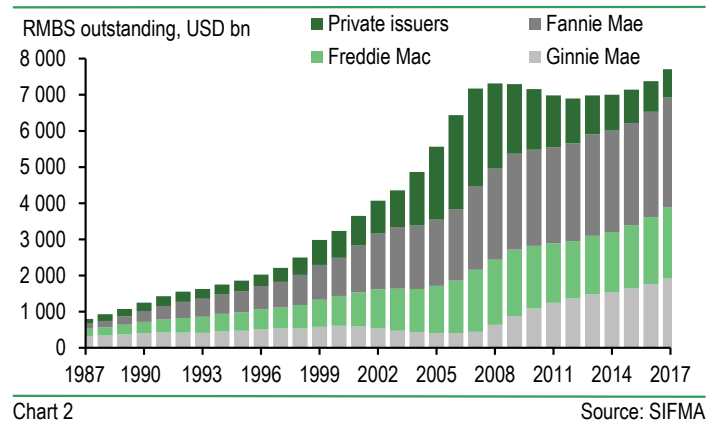


Chart 2

⁷ In order to be “conforming”, a mortgage loan must meet certain criteria for size and quality: the conforming loan limit is USD 453,100 in most of the US in 2018, minimum credit ratings (FICO scores) are between 620 to 640, minimum down payment is required and maximum debt-to-income (DTI) ratio is set at 41%.



Fannie Mae and Freddie Mac before 2008

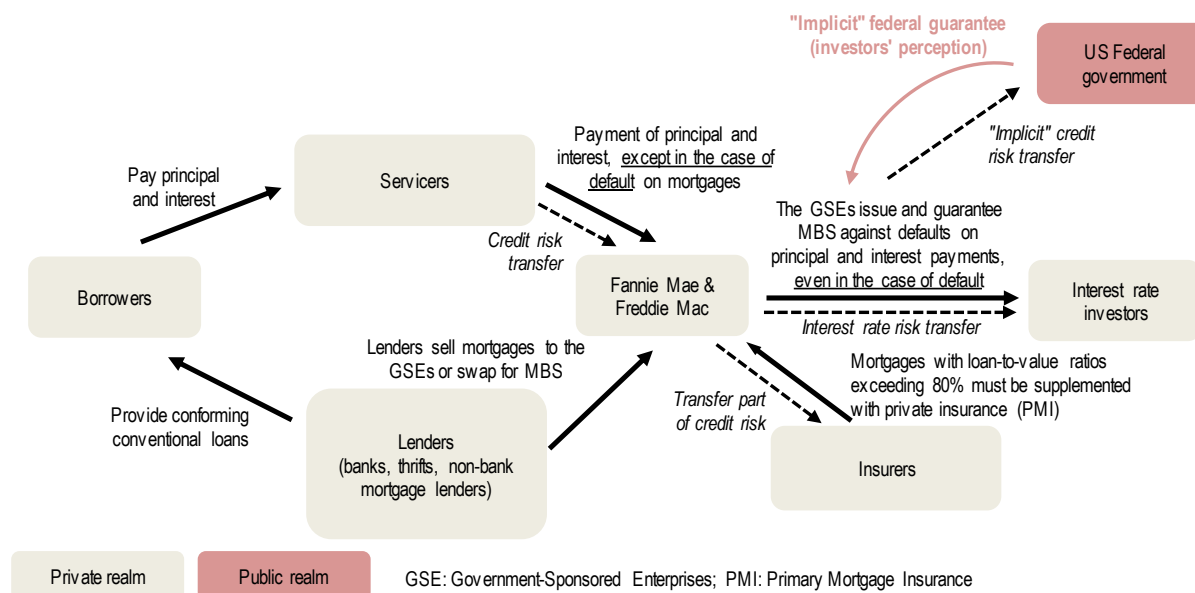


Figure 2

Source: BNP Paribas

As Ginnie Mae, they are not allowed to make loans themselves. They can, however, buy loans (subject to certain criteria) from banks, credit unions, or non-bank mortgage lenders, and then combine these into securitisation issues. The MBS they issue are sold to investors⁸, together with a GSE guarantee against all payment defaults (principal and interest) on the underlying loans. This guarantee serves to separate interest rate and prepayment risks, borne by investors, from the risk of default on the underlying loans, borne by the GSEs (Figure 2). In exchange for this guarantee, the originator of the loan pays a periodic commission to the agency responsible for its securitisation (this insurance premium comes out of the borrower's interest payment). GSE guarantees on loans meeting the conforming loan limit, but for which the borrower's down payment is less than 20% of the value of the property, must be supplemented with private Primary Mortgage Insurance (PMI).

The guarantor role of Fannie Mae and Freddie Mac has barely changed since they were placed into conservatorship, but since this move, the MBS they issue have enjoyed an "effective" federal government guarantee. However, their investment capacity has been limited: the FHFA has set them the target of reducing their portfolios of loans and securities held for investment purposes (non-securitised loans, retained securitisations, MBS acquired from other issuers) to less than

USD 250 billion each by the end of 2018. This would represent a total reduction in the value of their portfolios since 2008 of around USD 500 billion each⁹.

In 2017, issuance from Fannie Mae and Freddie Mac accounted for 60% of total RMBS issuance. At the end of 2017, Fannie Mae and Freddie Mac RMBS outstanding totalled more than USD 5,000 billion, or 42% of outstanding home loans and 65% of total RMBS. Agency RMBS (Fannie Mae, Freddie Mac and Ginnie Mae) represented 92% of RMBS issuance and 90% of RMBS outstanding (Charts 1 and 2).

Agency exposure to mortgage credit risk

Before accounting for credit risk transfer programs (see below), we estimate that in 2016, Fannie Mae and Freddie Mac had on their balance sheets (in the form of loans or securities backed by loans) or guaranteed nearly USD 4,600 billion in conventional housing loans, or 47% of total outstanding loans. This estimate is the sum of: 1. the stock of MBS issued by Fannie Mae and Freddie Mac and sold to third parties; 2. the MBS retained by the GSEs (to avoid double counting,

⁸ Agency securities are traded on the To Be Announced (TBA) forward market. On this market agencies and MBS investors agree upon only general parameters of the securities to be delivered (issuer, maturity, coupon, price, amount and settlement date) before the issuance of securities. In most cases, the underlying loans have not even been originated as of the trade date. The characteristics of the portfolio of underlying loans are not known in advance: they satisfy the agencies' eligibility criteria, but may differ in terms of prepayment risk or geographical diversification.

⁹ The reduction in investment portfolios and the increase in commissions since 2012 have contributed to a radical modification in the structure of net interest income at the two GSEs. At the end of 2017, the value of the investment portfolio at Fannie Mae was USD 230.8 billion (from USD 761.4 billion at end-September 2008), whilst at Freddie Mac it was USD 253.5 billion (from USD 695.1 billion), or a 67% reduction in the size of the two portfolios over nine years. Meanwhile, guarantee fees on newly acquired loans have increased, on average and for all types of loan taken together, from 21 basis points, to 36bp in 2012 and 57bp in 2016. Thus, whereas in 2010 the bulk of net interest income at the two GSEs (more than 95%) was generated from their portfolios of securities and loans, by 2016, 67% of net interest income came from their guarantor business (guarantee fees are recorded as interest income in the agencies' accounts).



cross-holdings are excluded¹⁰); and 3. the portfolios of loans and securitisations from private issuers purchased by the GSEs for investment purposes. Including the credit risk transfer programs (see below) only reduces this proportion to 45% (Chart 3).

Fannie Mae and Freddie Mac guarantee 45% of household mortgage debt

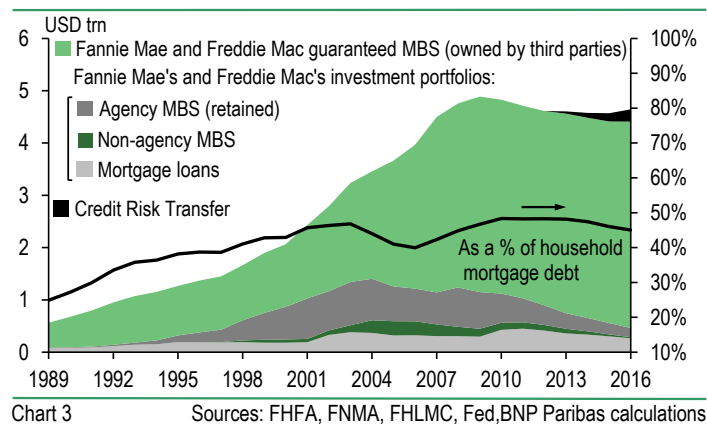


Chart 3 Sources: FHFA, FNMA, FHLMC, Fed, BNP Paribas calculations

In total, the three main mortgage refinancing agencies, whether public (Ginnie Mae) or under Treasury protection (Fannie Mae and Freddie Mac), guarantee or hold on their balance sheets nearly USD 6,200 billion in mortgage loans (conventional and non-conventional), or nearly two thirds of total outstanding loans (62% – Chart 4).

Tools for sharing credit risk

Since 2013, under the direction of the FHFA, Fannie Mae and Freddie Mac have experimented with a range of different risk transfer instruments.

Primary Mortgage Insurance (PMI)

As mentioned above, the GSEs are not exposed, in certain cases at least, to the entirety of the credit risk on the loans they acquire. Where the loan-to-value ratio (LTV) is greater than 80%, borrowers must take out a private PMI, covering initial losses. Standard PMI coverage requirements (between 12% and 35%) and their cost to the borrower vary as a function of LTV (Goodman and Kaul, 2017)¹¹. From 2013 to 2017, the GSEs have transferred a combined risk in force of about USD 246 billion to primary mortgage insurers, or 25% of the USD 972 billion of loans covered by PMI (Charts 5 and 6).

On average, 19% of single-family loans guaranteed by the GSEs are covered by PMI (Chart 7). Although PMI reduces the GSEs' exposure to credit risk, it has the disadvantage of exposing them to significant

¹⁰ MBS issued by Fannie Mae and held by Freddie Mac or vice versa.

¹¹ A 30-year mortgage loan with an LTV of 97% requires 35% PMI coverage; for a 95% LTV loan, standard coverage is 30%; for a 90% LTV loan, it is set at 25%; and for a 80.01-85% LTV loan, it is 12%.

counterparty risk, especially given that private insurers are collectively exposed to the same risks as the GSEs (falling real estate prices and/or deteriorating solvency of borrowers). Certain PMI providers were unable to meet their risk coverage commitments in full at the height of the 2007-2008 crisis (Bhutta and Keys, 2017).

Two-thirds of home mortgage debt is backed by a federal guarantee

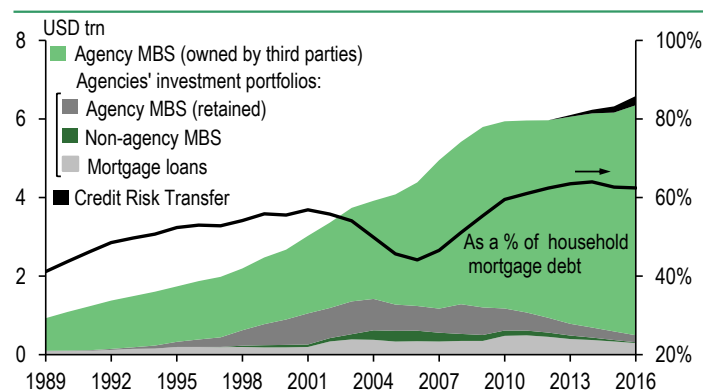


Chart 4 Sources: FHFA, SIFMA, FNMA, FHLMC, Fed, BNP Paribas calculations

Risk in force transferred through PMI

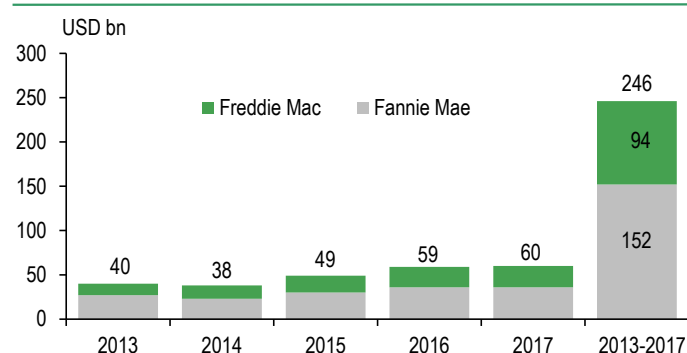


Chart 5

Source: FHFA

Reference pool of single-family mortgages with PMI

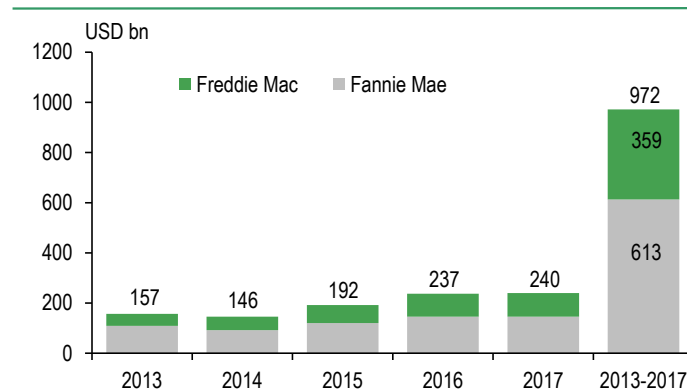


Chart 6

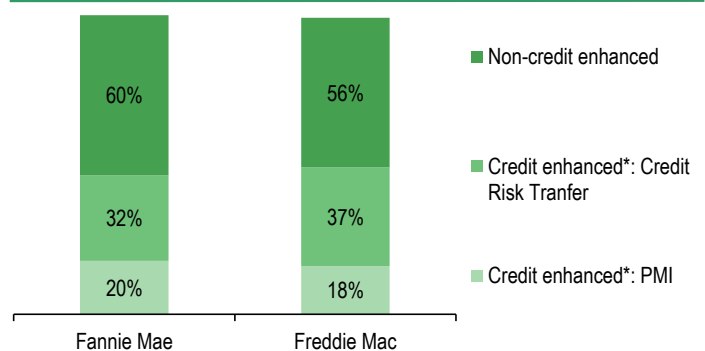
Source: FHFA



The Credit Risk Transfer program

Under the initiative of the FHFA, since 2013 the GSEs have also been testing other mechanisms for transferring credit risk to a more diversified pool of counterparties under the Credit Risk Transfer (CRT) program (Figure 3). The loans targeted are single-family fixed-rate mortgages with an LTV of more than 60% and an original term greater than 20 years¹². Since 2015, this category of loans has represented more than half of the loans purchased each year by the GSEs (62% in June 2017, from 35% at the beginning of 2013)¹³. At the end of 2017, between 32% (Fannie Mae) and 37% (Freddie Mac) of outstanding single-family mortgage loans guaranteed by the GSEs were covered by the CRT program (Chart 7).

GSEs' single-family credit guarantee portfolios (as of December 31, 2017)



*The credit enhanced categories are not mutually exclusive

Chart 7

Sources: FNMA, FHLMC

Credit risk transfer instruments

Structured debt issuances (the Connecticut Avenue Securities (CAS) program for Fannie Mae and Structured Agency Credit Risk (STACR) program for Freddie Mac) are the main vector of risk sharing: on average, they account for nearly three-quarters of the credit risk transferred through CRT programs (Chart 8).

CAS and STACR securities are unguaranteed, unsecured, floating rate bonds¹⁴. They are similar to securitisations¹⁵: principal and interest payments to the investor are tied to the credit performance of a reference pool of loans (recently purchased and securitised by the

issuing agency); in addition, the transaction involves a senior/subordinate structure (credit protection is provided by the more junior notes to the more senior notes in priority order)¹⁶. Issues are relatively rare (Fannie Mae has announced six for this year, Freddie Mac five) but they are backed by relatively large portfolios¹⁷. Reference pools for each transaction are divided into two loan groups based on original LTV ratios: one group includes loans with LTVs between 60.01% and 80.00%; the second with LTVs between 80.01% and 97.00%¹⁸.

Structured debt issues, the first vector of risk sharing (as % of risk in force transferred through CRT programs, H1 2017)

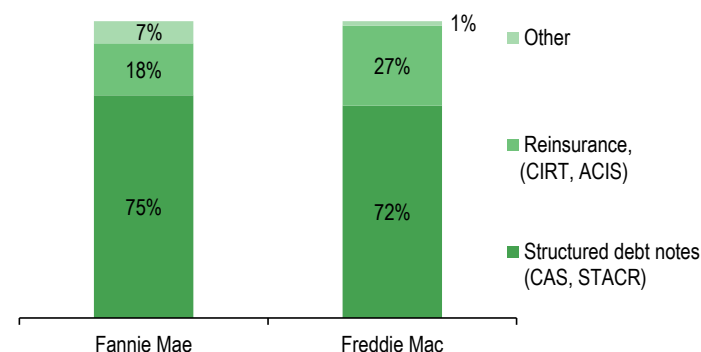


Chart 8

Source: FHFA

CAS and STACR securities are recognised as unguaranteed, long-term debt by the GSEs. These transactions do not expose GSEs to any counterparty risk. Any credit loss on the reference portfolio reduces the associated outstanding debt, and thus the amount due to investors. Each issue is structured into five or six tranches of debt¹⁹. The senior tranche (labelled "A") is not issued: the agencies retain the least risky tranche, which is least likely to suffer losses. In other words they assume the entirety of the credit risk considered implicitly as "extreme"

¹⁶ In their standard MBS issuances, the two GSEs issue only one tranche. They offer all investors a guarantee against the risk of borrower default. Their securitisations thus simply dissociate credit risk from interest rate risk.

¹⁷ Between 2013 and 2017, Fannie Mae conducted 23 CAS issues and Freddie Mac 31 STACR transactions.

¹⁸ CAS and STACR transactions are designed to be transparent. Detailed information is provided on the nature of the underlying loans (average credit rating, average LTV, average DTI). The introduction of the CRT program has also been an opportunity for the agencies to communicate more widely about the past and recent performance (default probabilities and losses in the event of default) of portfolios of guaranteed loans by year of acquisition. By way of example, for each of their issuances the agencies provide information to investors (in B2, M2 and M1 securities) on the potential loss given default (LGD) and probability of default (PD) intervals. PD is the product of initial assumptions on the probability of default and the rate of prepayment. The higher the expected rate of prepayment, the lower the probability of default and the smaller the proportion of losses transferred to investors (particularly if prepayments occur well before any payment defaults; see Zandi et al., 2017).

¹⁹ Revenue from the loan portfolio is first used to pay holders of senior debt. Once all payments on senior debt have been made, payments due to holders of mezzanine debt are carried out. Once all other payments have been made, the balance of revenue is paid to the equity tranche. In the event of payment defaults, holders of equity debt are the first not to receive payment. If the equity tranche cannot absorb all of the default, holders of the mezzanine debt suffer the loss. Holders of senior debt are therefore the best protected. They are only exposed to the residual losses that the lower tranches cannot absorb.



(see below). However, they issue a large proportion of the “equity” tranches, labelled B1 (and B2 in the case of Freddie Mac)²⁰, and intermediate risk tranches, labelled M1 and M2. They retain a minimum of 5% of each tranche issued. In our focus, we illustrate the maximum proportion of risk transferred to investors, using as an example the latest issue from Fannie Mae (CAS 2017-CO7) in November 2017.

For the most recent issues, M1 tranches have had credit ratings between BBB- and BBB, whilst M2 mezzanine tranches have been rated between B and B+ (Fitch rating)²¹. Equity tranches are not rated.

The main investors in CAS and STACR tranches are asset managers²². Such investors have subscribed for more than two-thirds of M1 mezzanine tranches and nearly half of M2 mezzanine and B2 equity tranches, alongside hedge funds and private equity funds. The involvement of insurers and Real Estate Investment Trusts (REIT) remains limited (between 10% and 15% of subscriptions to M1 and M2 tranches respectively). The removal of a number of uncertainties around the designation of securities issued under the CRT program (CRT securities hereafter) and the associated registration requirements will help expand the range of investors²³.

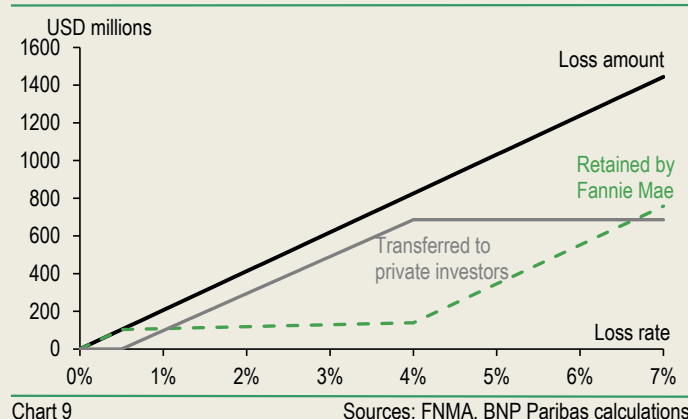
Focus

Risk sharing in Fannie Mae's CAS 2017-CO7 transaction

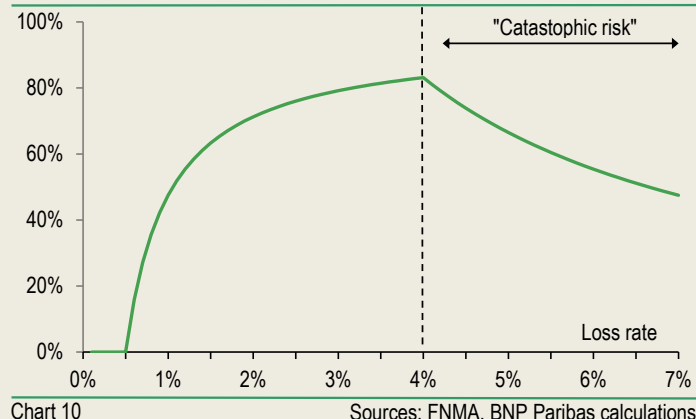
The first segment of this transaction (CAS 2017-CO7, group 1) involved the issuance of securities backed by more than 88,000 residential mortgages, with a total value of USD 20,628 billion and a 60.01%-to-80% original LTV. The second segment (CAS 2017-CO7, group 2) involved more than 56,000 mortgage loans, with a total value of USD 13,333 billion and a 80.01-to-97% original LTV. In the first segment (backed by group 1 loans), Fannie Mae retained 100% of the risk of losses not exceeding 50 basis points of outstanding loans, 5% of the next 350bp and 100% of losses exceeding 400bp of the outstanding amount. In the second segment (backed by group 2 loans), Fannie Mae retained 100% of the risk of losses not exceeding 50 basis points of outstanding loans, 5% of the next 375bp and 100% of losses exceeding 425bp of the outstanding amount.

The black line in Chart 9 shows, for loss rates between 0% and 7%, the potential losses on a portfolio of USD 20,628 billion of loans to which Fannie Mae would be exposed in the absence of the first segment of CAS 2017-CO7. The other two lines show the risk sharing under the CAS transaction for various assumptions on loss rates: in green the risk (outstandings) retained by Fannie Mae, and in grey the risk (outstandings) transferred to investors. For a loss rate of less than 0.5%, Fannie Mae bears all losses; above this, and for all loss rates up to 4%, the proportion of losses transferred to the market rises (Chart 10). Investors bear 48% of losses (with Fannie Mae bearing the remaining 52%) when the overall loss rate reaches 1%, 71% when it reaches 2%, 79% at 3% and 83% at 4%. The transaction does not expose investors to losses of more than 4% of the total outstanding amount, so that beyond this point, the share of losses borne by investors declines gradually as the loss rate rises (in other words, investor exposure is capped at $95\% \times (4\% - 0.5\%) \times \text{outstandings}$). The worse the situation becomes, the greater the cost to Fannie Mae. Investors bear 67% of total losses for a loss rate of 5%, falling to 55% when the loss rate rises to 6%. For a loss rate of 7% the proportion of losses borne by the market is the same as that for a loss rate of 1%, i.e. 48%. Assuming a loss rate close to that seen on average for loans originating between 1999 and 2005 (1.1%), the proportion of losses transferred to the market would be 52%; with a loss rate equal to the average observed since the crisis (less than 0.1%), it is zero.

Maximum investor exposure to potential losses, CAS transaction 2017-CO7



Share of potential losses borne by the market, CAS transaction 2017-CO7



²⁰ Fannie Mae does not issue the first equity tranche (labelled B2).

²¹ Yields are indexed on the 1-month Libor rate: +55-130 basis points for M1 tranches, +220-365bp for M2 tranches, and +360-575bp for B1 tranches on the most recent transactions.

²² The breakdown of investors is only available at the time of issuance of the securities.

²³ The involvement of REITs is likely to increase following the SEC's decision to give CAS and STACR securities the status of “real estate-type securities” (with the associated reduction in registration requirements; Finkelstein et al., 2018).



In addition to structured debt issuances, the subscription of insurance policies (whether or not in combination with PMI), under the Credit Insurance Risk Transfer (CIRT) at Fannie Mae and the Agency Credit Insurance Structure (ACIS) at Freddie Mac, represents the second vector of risk sharing: on average 22% of risk is transferred in this way (Chart 8). In contrast to PMI, such policies cover very large loan portfolios. More marginally, other solutions such as the retention of a share of credit risk by the originator of the loan, the issuance of unguaranteed MBS tranches and enhanced insurance policies (deeper PMI) are also being tested²⁴ (5% of risk transferred – Chart 8).

The volume of the risk transferred

Between 2013 and 2017 the two GSEs transferred USD 69.5 billion of credit risk, a figure corresponding to 3.3% of the USD 2,126 billion of loans covered by the program (Charts 11 and 12).

Risk in force transferred through CRT programs

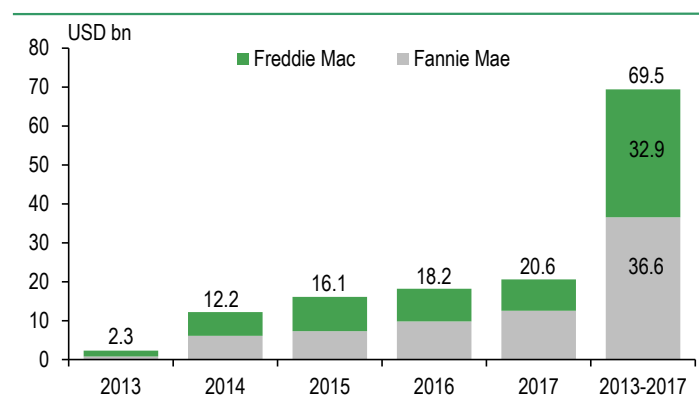


Chart 11

Source: FHFA

Reference pool of single-family mortgages covered by CRT programs

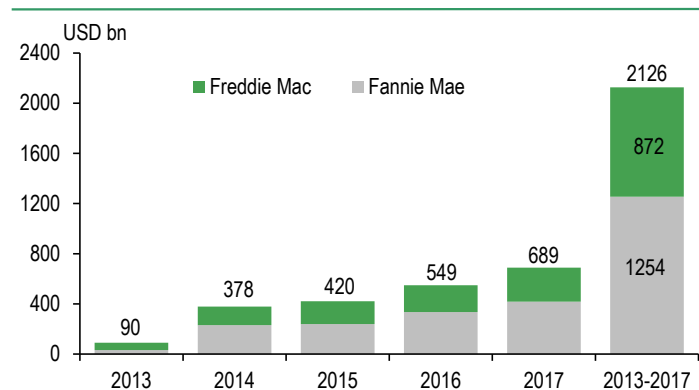


Chart 12

Source: FHFA

²⁴ Retention of risk limits moral hazard, by encouraging the originators and/or issuers of structured securities to respect conservative criteria for loan origination and/or security structuring.

As the issuance of CRT securities only relates to new loan production, these volumes appear modest on the scale of the overall exposure of the two GSEs to mortgage credit risk (black area of Chart 3). The FHFA's aim is not, however, so much to transfer the largest possible share of credit risk to the market so much as to transfer the largest possible proportion of "unexpected" credit risk. The FHFA classifies credit risk into three categories: "expected credit loss" (covered by provisions); "unexpected credit loss" (credit loss that is not expected but is plausible in the event of a deterioration of economic conditions, covered by capital); and lastly "catastrophic credit loss" (losses which are considered highly unlikely and associated with a severely degraded economic situation). GSEs are expected to transfer a "significant" share of unexpected credit risk on 90% of those newly acquired loans that are eligible for the CRT program²⁵. CRT securities have become the main instrument of market exposure to mortgage credit risk: since 2015, the volumes of credit risk transferred each year via the CRT program have exceeded the volume of jumbo prime RMBS issues²⁶.

Towards a redistribution of credit risk

The idea of basing mortgage market reform on CRT programs appears to be attracting growing support. This said, the precise contours of any reform remain to be defined. In this second section we will examine three recent proposals: the first from the Mortgage Bankers Association (MBA, 2017); the second from Parrott et al. (2016a) of the Urban Institute; and the third from Bright and DeMarco (2016) of the Milken Institute. They differ in certain technical aspects (notably the status to be given to the "guarantors" responsible for structuring loans) but all start from the same position: although government guarantees are essential in ensuring a liquid and stable mortgage market (particularly in periods of crisis), the Federal government should not be the sole party exposed to payment default risk, especially as this is transmitted through agencies that already face significant financial difficulties. Figure 4 summarises these proposals²⁷.

²⁵ Risks may be transferred before, at the same time as or after the acquisition of loans by the GSEs. Arrangement of CAS and STACR issue programs and CIRT and ACIS insurance or reinsurance policies generally occurs only after the acquisition of loans by the GSEs (six months or one year later). The additional "deeper mortgage insurance" covering individual loans and the structures for sharing risk with the originator are put in place before or at the time of the acquisition of loans by the GSEs. The FHFA believes that these structures only create a low level of counterparty risk for the agencies as they are, in the majority of cases, collateralised.

²⁶ Private issuers of securitisations have not been very active since the financial crisis, issuing just less than USD 380 billion of RMBS between 2013 and 2017 (excluding CRT tranches issued, see Note 15). However, these have mostly related to higher risk loans (notably "scratch and dent" loans for USD 160 billion) and re-securitisations (USD 70 billion). Private RMBS issues backed by high-quality loans that exceed the conforming loan limits (jumbo prime loans) have totalled USD 57 billion.

²⁷ Based on Parrott (2017)



Fannie Mae and Freddie Mac since 2013

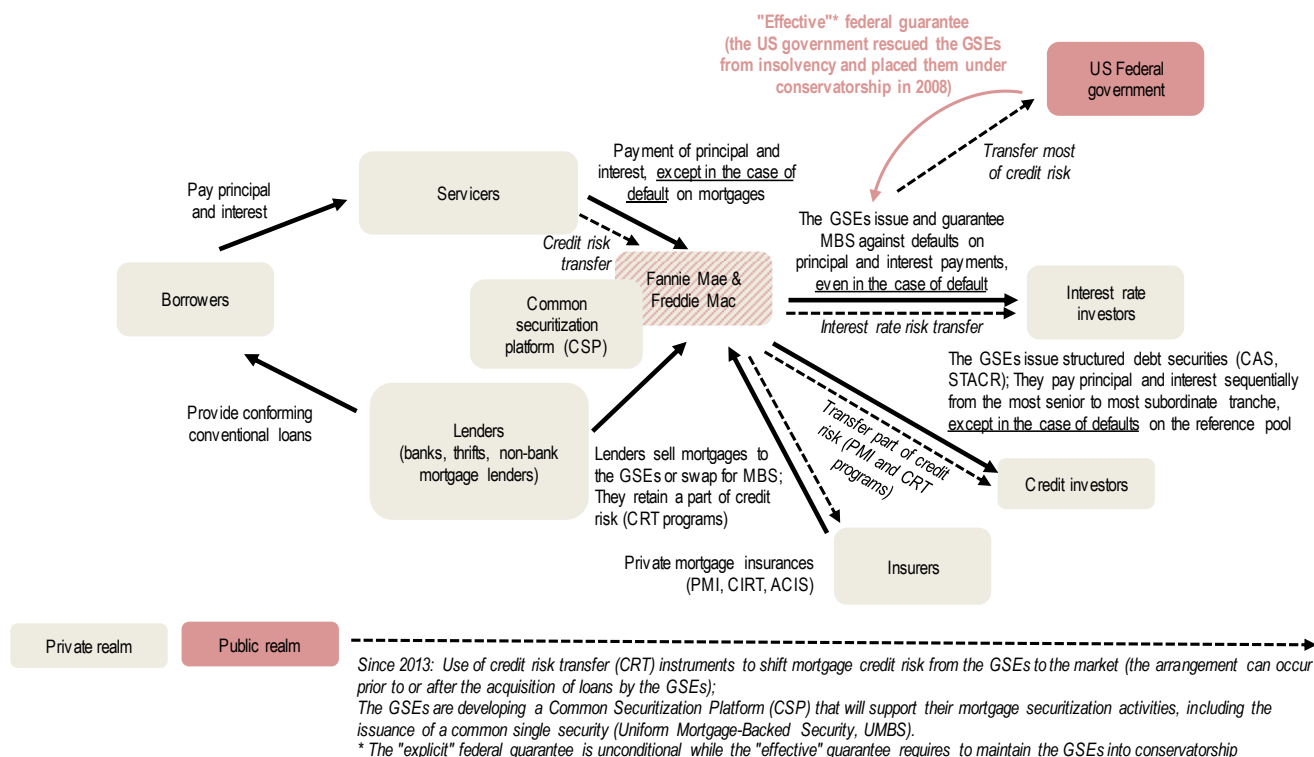


Figure 3

Source: BNP Paribas

An explicit public guarantee for all MBS

Under all three proposals, MBS issued would have a "full faith and credit" guarantee from the Federal government (as is the case for Ginnie Mae MBS at present). To eliminate moral hazard, the "guarantors" would pay for this guarantee. Other sources of support for the liquidity of the MBS market and the supply of long-term loans (20 or 30 years) at fixed rates, namely the uniform eligibility criteria and trading of MBS on the forward TBA market (see Note 8)²⁸, would be maintained and even strengthened through the development of a "Common Securitization Platform" (CSP)²⁹. In order to preserve the separation of interest rate risk and credit risk (as is the case for current agency MBS),

²⁸ Paradoxically, the incomplete nature of the information available on a TBA market contributes to its liquidity by increasing the fungibility of securities and reducing the information acquisition costs borne by investors (Vickery and Wright, 2013). Today, the registration waiver under the 1933 Securities Act allows contracts for the sale of MBS by agencies to be negotiated in advance of their delivery, and even in advance of the origination of the loans to be used as underlying assets (which prevents the registration of the full details of the MBS at the time of their issuance). Without this dispensation, it would no longer be possible to sell MBS on the forward TBA market.

²⁹ The effective launch of this platform and the issue of a single security (Uniform Mortgage-Backed Security, UMBS), which are both currently being trialled, are expected in the second quarter of 2019 (FHFA, 2015).

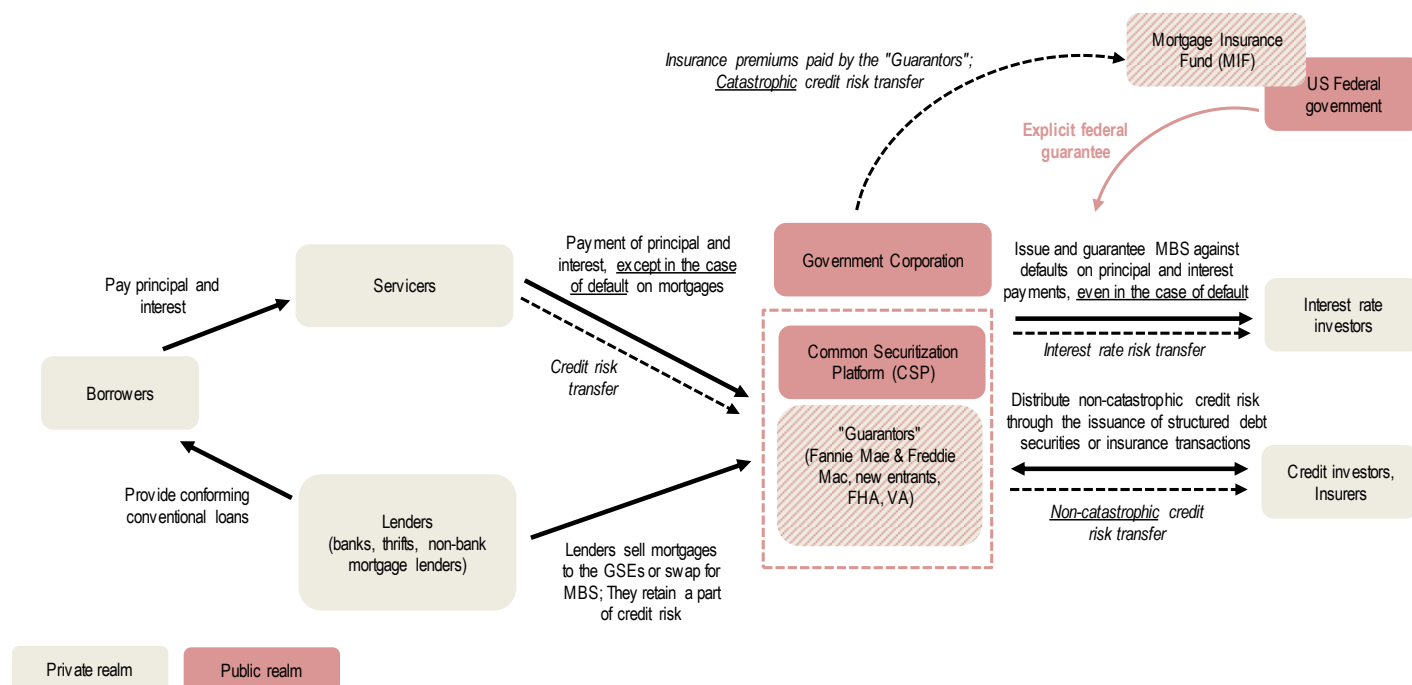
a single securitisation tranche would be issued³⁰. Investors in MBS would only be exposed to interest rate and prepayment risks, whilst the default risks on underlying loans would be fully covered by the Federal government.

The Milken Institute recommends replicating on a larger scale the Ginnie Mae securitisation model (multiple originators, multiple issuers) but by enlarging the spectrum of credit enhancers (to the private sector). Ginnie Mae would provide its guarantee (the government guarantee) to securitisations backed by federally insured or guaranteed loans (FHA or VA loans) and to securitisations backed by loans covered by an FHFA-approved private guarantor. Ginnie Mae would thus be exposed to greater counterparty risk but the system would allow a better dispersal of risk, according to the Milken Institute. The Urban Institute, however, suggests retaining only a single public issuer combining the GSEs, the CSP platform and, potentially, Ginnie Mae.

³⁰ Securitisations remain non-deconsolidating for the "guarantors" (GSEs and/or new entrants).



Three examples of proposed reforms



The Urban Institute Proposal: A government corporation (the National Mortgage Reinsurance Corporation, NMRC, where the CSP and the GSEs are combined), issues MBS, guarantees the timely payment of principal and interest on these securities and transfers all non-catastrophic credit risk on loans backing these securities to a broad range of private entities (enlargement of PMI & CRT programs); its MBS are backed by the full faith and credit of the US government, for which it charges an explicit guarantee fee; the FHFA manages a mortgage insurance fund (MIF) funded by those g-fees; once the NMRC is established, it could also purchase, pool and securitize loans insured by the FHA and the VA (for these loans, it would be unnecessary to share the credit risk, as those federal agencies bear the non-catastrophic credit risk already).

The MBA Proposal: Multiple "guarantors" replace the GSEs and operate as privately-owned utilities; these guarantors acquire eligible mortgages and issue MBS "wrapped" with an explicit guarantee provided by the federal government; the CSP becomes an independent, government-owned corporation and must be made available to new "guarantors" once chartered; the federal guarantee is funded by insurance premiums paid by the "guarantors" to a dedicated mortgage insurance fund (MIF); the GSEs' credit risk transfer programs are expanded upon and form an important source of private capital to bear non-catastrophic risk; during the transition, the FHFA manages the transfer of GSE assets and liabilities to the new "guarantors" (the GSEs are transformed into privately-owned guarantors with new charters and requirements); in the case of catastrophic losses, the taxpayers are at risk only after all layers of private capital (including guarantors' capital) and the MIF are exhausted; future "guarantors" are tapped with higher insurance premiums to reimburse taxpayers and rebuild the MIF reserves.

The Milken Institute Proposal: The proposal builds on the Ginnie Mae infrastructure and processes (multiple lenders and MBS issuers) but enlarges the range of credit enhancers; Ginnie Mae is taken out of the Department of HUD and becomes a standalone government corporation with authority over its own budget; Ginnie Mae provides a full faith and credit wrap on MBS issued by Ginnie Mae-approved issuers where the loan pools are credit-enhanced either by a government program (such as FHA or VA) or by FHFA-approved credit enhancers; the GSEs are passed through receivership and reconstituted as entities mutually owned by their seller-servicers; the lender-owned mutuals (old GSEs, new entrants) operate like mortgage insurers, guaranteeing the principal and interest payments to the MBS holder (they would be permitted to be aggregators and issuers of a government-backed security only for loans they purchase from smaller and mid-sized lenders for cash); CRT programs are expanded to shift the first 300 to 500 basis points of loss on roughly 80% to 90% of annual loan production; a mortgage insurance fund (MIF) is established and managed by the government as a catastrophic risk pool.

Figure 4

Source: BNP Paribas

Protection against "extreme" credit risk

In parallel with the securitisation of loans, credit risk transfer programs will be reinforced, and in particular, unguaranteed structured debt issuances (CAS and STACR). The bulk of "non-extreme" risk would thus be transferred to the market.

A new market for pricing credit risk

The central attraction of these structures lies in the fact that they have allowed the opening up of a new financial market where mortgage credit risk can be traded and priced without disrupting the liquidity of the secondary mortgage market. In some way, the GSEs play the role of a central counterparty between investors in MBS and investors in CRT securities (Finkelstein, Strzodka and Vickery, 2018).



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CRT securities thus play the role of credit derivatives (CDS)³¹: the GSEs use them to purchase protection against default risk. The comparison between the guarantee fee charged by the GSEs (57 basis points in 2016) and the market-implied guarantee³² helps verify that the GSEs are correctly pricing the credit risk with regard to the risk of non-payment as perceived by the market. In the early 2000s, the formation of the real estate bubble was obscured, in particular, by the illusion that the increase in real estate prices, which was artificially depressing LTV ratios, would be lasting. Neither MBS yields nor CDS prices provided warnings on the rise in risk.

The sharing of detailed information on the nature of the loans used as underlying assets for CRT securities, and on the risk-sharing rules in the event of default, aims to enable investors to better evaluate their maximum exposure to the risk of losses. The standardisation of CRT securities, their trading on an open and liquid market (rather than on over-the-counter market) and the reduction in moral hazard and counterparty risk will all also work in favour of more accurate risk pricing (Wachter, 2018).

Definition of “extreme” risk

The “guarantors” only purchase protection against “unexpected”, but plausible, risk. The government will cover “extreme” losses, ideally by using the resources of a guarantee fund that will have been built up (see below). Thus the government would only cover rare events at the tail of the expected loss distribution, that is to say losses of considerable intensity but little probability of occurring.

The threshold for government intervention is not clearly defined in any of the reform proposals. According to the Urban Institute, the context could be considered as critical if the return on capital demanded by investors equalled a given multiple of that required during normal circumstances (2.5 for example, giving returns of 25% rather than 10%). According to the MBA and the Milken Institute, the losses observed during the financial crisis of 2007-2008 could be considered as “extreme”. This is the assumption implicitly incorporated into the most recent CAS and STACR transactions. In the CAS 2017-CO7 transaction for example, a loss rate of over 4% is implicitly defined as “extreme” for loans in group 1 (above this level, losses are borne in their entirety by Fannie Mae), with a figure for group 2 loans of 4.25%. On the basis of the historical performance of the loan portfolios guaranteed by Fannie Mae, the assumption might not, at first sight, seem particularly conservative. Among loans with LTV ratios of less than 80%, the maximum loss rate observed during the last financial crisis came on loans originated in 2006: this reached 4.5% (with an average probability

of default of 8.8% and a loss on default of 51.5%)³³, or 5.7% if one takes account of lost interest on loan rescheduling (Chart 13). However, Fannie Mae estimates that the average loss rate on loans originated in 2006 would have been much less (3% or 3.8% after rescheduling), despite the rapid deterioration of the economic climate, if the loans had had the same credit quality (notably in terms of credit ratings and LTV) as the CAS 2017-CO7 issue (Chart 14). In view of these estimates, it seems as though the senior tranche was calibrated to absorb only those losses associated with an extreme deterioration in economic conditions.

Assuming first that the CRT program covers the entirety of the outstanding loans guaranteed by the two GSEs and secondly that the threshold for “extreme” risk is losses of 4% or more, the nominal value of CRT instruments would be around USD 193 billion (three times its current level).

The creation of a guarantee fund

To limit taxpayer exposure to credit risk – including in “extreme” conditions – a mortgage insurance fund (Mortgage Insurance Fund, MIF, or Federal Mortgage Insurance Corporation, FMIC) would be created and paid into by the “guarantors” (these commissions would then be charged to borrowers). This fund would guarantee payments due to holders of MBS in the event of substantial payment defaults once private resources (funds raised through the issue of structured debt and the equity capital of guarantors) had been exhausted. The gradual build-up in this fund would, over time, smooth the cost of the guarantee provided by the government.

Over time, the cushion of resources created to protect taxpayers could represent, depending on which proposal one takes, between 8% (Milken Institute) and 8.5% (Urban Institute) of outstanding loans. Initial losses would be covered by holders of CRT securities (up to 3.5%-4% of outstandings), with any additional losses borne by the guarantors themselves (2%-2.5% of capital, see below). Lastly, for loss rates of over 6%, the resources of the guarantee fund would be used (2%-2.5%). Any further contribution from the government would later be repaid by new contributions to the guarantee fund. With these ambitions, one year after the fund is created and assuming first annual loan origination of around USD 1,700 billion (the observed average since the crisis)³⁴ and secondly coverage of nearly half of new loan production (the proportion currently guaranteed by the two GSEs), or even 70% (proportion guaranteed by the two GSEs and the FHA and VA federal agencies), a cushion of some USD 60 billion to USD 100 billion of private capital could be created to serve as coverage of credit risk.

³¹ The derivatives market regulator, the Commodities Futures Trading Commission (CFTC), considers them as such (Finkelstein et al., 2018).

³² Defined as the sum of operational and fiscal costs, the cost of capital and issuance costs for CRT securities; estimated in the second quarter of 2017 at 43-54bp for CAS and STACR transactions (FHFA, 2017).

³³ The average loss rate on the portfolios of 2006-2007 loans guaranteed by Freddie Mac was also 4.3%, but with an average default probability of 12.1% and a loss on default of 35.4%. For both GSEs, the loss rate on subprime, Alt-A and interest-only loans was significantly higher, but if reforms are successful, such loans are unlikely to be used as underlying assets for structured debt issues.

³⁴ Our calculations are based on gross figures, ignoring repayments, disposals and write-offs of loans.



Historical performance of Fannie Mae's guaranteed loan portfolios

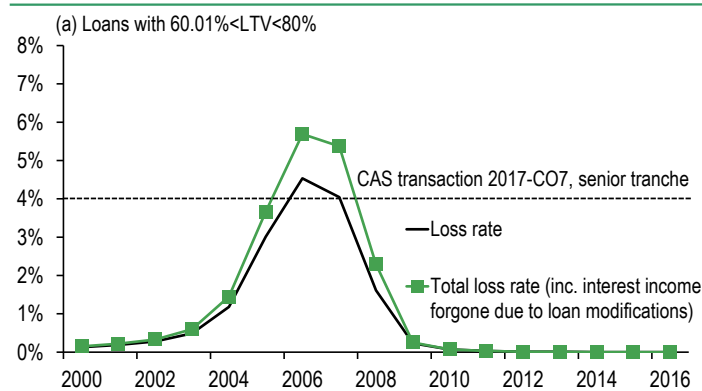
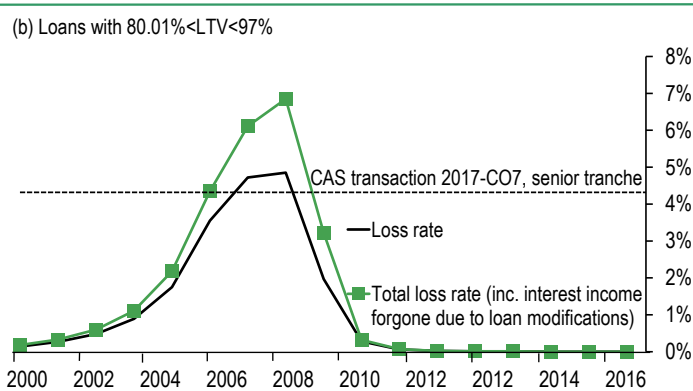


Chart 13



Source : FNMA

Historical loss rates re-weighted

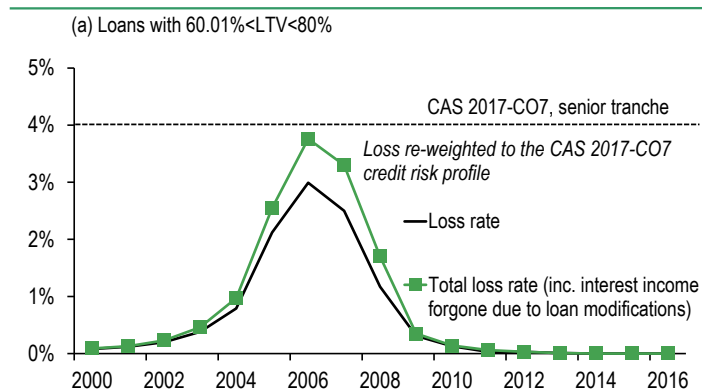
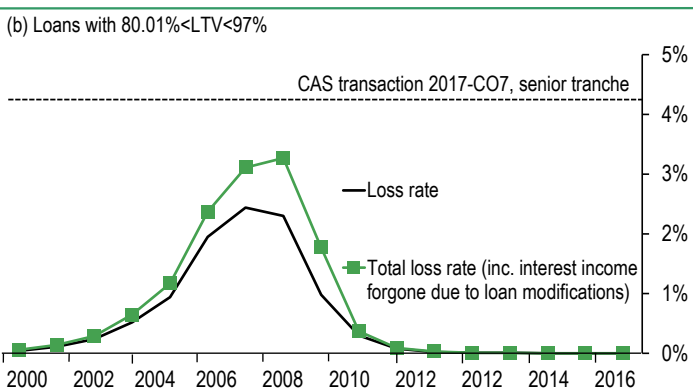


Chart 14



Source : FNMA

We think that questions need to be asked about the system's credibility. First, all the guarantors will be exposed to a systemic risk. In the event of a severe deterioration of economic conditions, where real estate prices suffer a brutal correction, it seems highly unlikely that the inability of a "guarantor" to honour its commitments would be an isolated case. The rebuilding of the guarantee fund's resources would therefore be significantly compromised. Secondly, over time, the requirement for private capital (which would come on top of the capital invested in RMBS) would be colossal, particularly as the current guarantors (Fannie Mae and Freddie Mac) already have sizeable shortfalls in core capital (see below).

The effect of reforms on the cost of credit

The MBA and the Milken Institute estimate that their reform proposals are likely to cause only a small increase in the cost of borrowing (between 15bp and 30bp). Under current conditions, for a typical borrower, the rate on a fixed-rate 30-year loan corresponds to the yield on Treasuries increased by 200 basis points: 90 basis points

corresponding to the difference in yield between GSE MBS and Treasuries, 50bp to costs relating to loan origination and recovery, and 60bp to guarantee fees charged by the GSEs.

Lower yields on MBS

According to the FHFA, current fees already include the remuneration to investors in credit risk (remuneration of CRT securities). However they do not include the fee that the "guarantors" will have to pay in return for the explicit federal government guarantee (for risk exceeding the losses covered by CRT securities)³⁵. Any increase in the capital requirements for the "guarantors" (new minimum capital requirements and contributions to the guarantee fund) could also increase the cost of borrowing. These additional costs will be partially if not entirely (according to the Urban Institute, Parrott et al. 2016b) offset by a reduction in the yields demanded on MBS: thanks to the full federal government guarantee, these yields will be closer to those on MBS

³⁵ Before the crisis, the GSEs captured part of the benefits of the implicit federal guarantee by charging borrowers for a guarantee (theirs in name, but implicitly provided by the government) for which they did not themselves pay (Hermalin and Jaffe, 1996).



guaranteed by Ginnie Mae, which are generally 15bp to 20bp lower. The “slimming cure” launched by the Federal Reserve could also drive down yields on guaranteed MBS by increasing their attractiveness to banks. The ending of reinvestment on maturity by the Fed will come alongside a destruction of reserves at the central bank and, all other things being equal, will force banks, as part of the liquidity coverage ratio (LCR), to substitute other high-quality liquid assets such as Treasuries and guaranteed MBS³⁶.

The effect on CRT security yields is less clear

The risk of “guarantor” default

These estimates assume that the change of status of the “guarantors” will have little effect on the future yields sought by investors in CRT securities³⁷. Admittedly, the reduction in investment portfolios, the increase in the maturity of the debt securities issued³⁸ and the tightening of capital requirements (see below) will help reduce the risk of transformation of maturities and leverage, and hence the risks of a run to which the “guarantors” will be exposed (compared to the risks to which the two GSEs were exposed, see Pozsar et al., 2010³⁹). However, at present holders of CAS and STACR securities have no counterparty risk: the two GSEs (the sole issuers of these securities for the time being) are under the protection of the Treasury, with the result that their credit quality is closely linked to that of US sovereign debt. Under the proposed reforms, the explicit guarantee would only cover MBS and not debt securities issued by the “guarantors”. Holders of CRT securities would no longer be protected against the risk of “guarantor” default.

Traditionally, issues of moral hazard and adverse selection that arise in all principal-agent relationships (DeMarzo, 2005; Gorton and Pennacchi, 1995; Riddiough, 1997) can be attenuated through contracts or incentives (retention of risk by the originator of a loan and/or the issuer of a security, functional integration of the principal and the agent, reputation, representation and warranties). In this type of relationship, the reputation of the principal depends on its financial capital (Boot, Greenbaum and Thakor, 1993). Thus, once the “guarantors” are placed outside the protection of the Treasury, the system for sharing CRT risks will no longer be credible (in particular for operations where the “guarantors” alone retain initial losses) unless the “guarantors” are adequately capitalised.

³⁶ Particularly because with the explicit government guarantee, MBS from the “guarantors” would be considered as level 1 liquid assets, as is the case for Ginnie Mae MBS at present.

³⁷ We are leaving to one side the question of the impact of the current increase in interest rates and risk premiums, as any reforms will take at least a decade to complete.

³⁸ Before the crisis the two GSEs issued short-term debt securities to finance their portfolio investments. In July 2008, concerns over the quality of the loans and private MBS held by the two GSEs, and then in the autumn of that year the increased tension following the Lehman Brothers collapse, made it more difficult for them to refinance their borrowing (Hancock and Passmore, 2010).

³⁹ Pozsar, Adrian, Ashcraft and Boesky (2010) have shown how non-bank financial intermediaries, such as securitisation vehicles and the GSEs prior to the crisis, were subject to the risk of a run on their liabilities on a scale that threatened the stability of the financial system as, unlike banking intermediaries, they did not benefit from an explicit public backstop (deposit guarantee or refinancing window).

The risk of investor flight

The instability of capital invested in CRT securities creates one of the biggest risks that the “guarantors” will face. Current investors (asset managers, hedge funds, other market agents) refinance themselves with short maturity securities (notably repos). In the event of difficulties in refinancing this debt, they might be obliged to sell off their investments, dragging down prices for CRT securities (Goodman et al., 2016). Moreover, in a period of worsening economic conditions (increasing default rates), they could withdraw from the market or require significantly higher returns, with the same consequences for CRT security prices.

A new status for the “guarantors”

The three institutes (MBA, Urban Institute and Milken Institute) recommend ending the conservatorship of Fannie Mae and Freddie Mac and removing their government-sponsored enterprise status. Their new status, or that of their successors, and the opening up of the market to competition is, however, the subject of disagreement⁴⁰.

Various official reports or research articles have highlighted the fact that the private ownership of Fannie Mae and Freddie Mac came into conflict with the implicit federal guarantee they enjoyed before the crisis and with their public service missions (see reports from the Congressional Budget Office and the Financial Crisis Inquiry Commission; Acharya, Richardson, van Nieuwerburgh and White, 2011). Most notably, the moral hazard that resulted from this implicit guarantee could have contributed to shortfalls in good management practice (underestimating risks). Neither the regulator nor the market encouraged them to maintain strict discipline on the level of risk to which they were exposed, with the result that their provisions for credit risk and their capital were revealed to be highly inadequate when the bubble burst. At the same time, the specific status of these two agencies and their market power would have allowed them to impose some form of discipline on credit originators and/or aggregators (Frame, 2017)⁴¹.

The MBA suggests replacing the GSEs with new “guarantors”, created as privately-owned utilities with a regulated rate of return. To encourage lenders to maintain the quality of their loans, the Milken Institute recommends converting the GSEs into entities mutually owned by the lender-servicers. Under both proposals, they would operate in competition with new entrants. The difficulties encountered by the GSEs

⁴⁰ Parrott et al. (2016c) for a discussion of the advantages and disadvantages of the various statuses proposed.

⁴¹ At least in part, as some were able to mislead them on the quality of the loans sold. It nevertheless remains the case that, on average, the GSEs securitised higher quality loans than private issuers: first, in the prime, or correctly documented loan segment, originators sold their “best” loans in terms of credit score, LTV ratios and documentation (Krainer and Laderman, 2014); secondly, in the higher risk subprime and poorly documented loan segment, GSEs had lower levels of loss on their portfolios (Adelino, Frame and Gerardi, 2014).



may, however, discourage originators and/or investors from putting capital into these new “guarantors”, thus preventing the success of this “reprivatisation” stage. Fearing that competition between “guarantors” will result in excessive risk taking and that, ultimately, the system will continue to be dominated by private institutions that are “too big to fail”, the Urban Institute recommends giving the current GSEs state-owned enterprise status.

The stock of guaranteed loans: a central, but often overlooked, topic

The question of the USD 5,000 billion of RMBS issued by the two GSEs before the reform, which benefit from a “simple” effective guarantee from the government, has received little attention. And yet, the market for MBS from the new “guarantors” (with an explicit guarantee and lower yields) could not develop in parallel with the market for GSE MBS. The Urban Institute (Parrott et al., 2016b) suggests allowing holders of the latter to pay a commission to receive an explicit government guarantee, whilst the MBS suggests managing these securities to extinction through the creation of a bridge bank. The proposals from the MBA and the Milken Institute to recapitalise the two GSEs with private capital ask to consider this topic in more detail. The current financial position of the two big mortgage finance agencies is particularly fragile. At the end of 2017, they had a shortfall of core capital of around USD 235 billion, the legacy of the financial crisis and the terms of the agreement with the Treasury.

A widening shortfall in core capital at the GSEs

Between 2008 and 2011, the two big GSEs suffered heavy losses, totalling more than USD 250 billion. They were saved from bankruptcy by the Treasury. Granted, the GSEs have returned to profit since 2012, but they have transferred the bulk of their net profit to the Treasury in the form of dividends⁴² (Chart 15). These payments had reached USD 278.7 billion by the end of 2017 (Chart 16). In the fourth quarter of 2017, the reduction in corporate tax rates in the US, hit the accounts of the GSEs, by reducing the value of their deferred tax assets by

USD 15.3 billion. As a result, they reported a net loss of nearly USD 9.5 billion. Despite the changes to the terms of the arrangement agreed last December, intended to protect against a further call on public funds, Fannie Mae and Freddie Mac reported negative net worth for the final quarter of 2017 and requested support from the Treasury of USD 3.7 billion and USD 312 million respectively⁴³.

The GSEs returned to profit in 2012

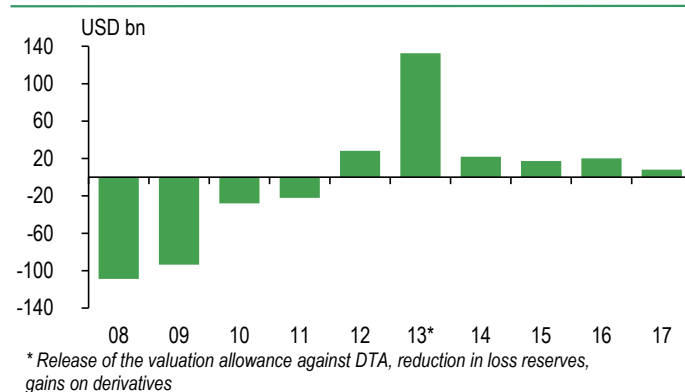


Chart 15

Sources: FNMA, FHLMC

The GSEs have paid cash dividends of USD 280 bn to the Treasury

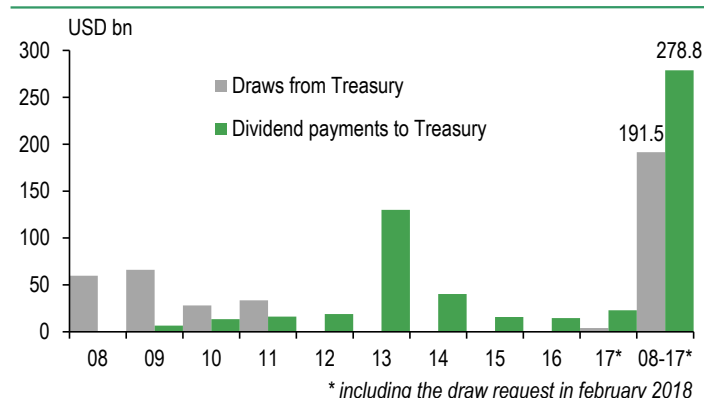


Chart 16

Sources: FNMA, FHLMC

⁴² The terms of the arrangement between the GSEs and the Treasury have been modified on a number of occasions. The agreement of September 28 required GSEs to pay the Treasury the equivalent of 10% of the face value of the stock of preferred senior securities subscribed by the Treasury. The agreement of August 2012 required them, from 2013, to pay at the end of each quarter the net worth recognised in the previous quarter, less a predefined amount (USD 3 billion in 2013, USD 2.4 billion in 2014, USD 1.8 billion in 2015, USD 1.2 billion in 2016 and USD 0.6 billion in 2017). From 2018, the 2012 arrangement called for a transfer in full of the net worth of the GSEs. Against this background, any new loss would require the subscription for further preferred stock by the Treasury. Thus, given the prospect of a devaluation of deferred tax assets (DTA) resulting from the cut in corporate tax rates approved last December, the Treasury and the FHFA modified the terms of the arrangement on 21 December. In the fourth quarter of 2017, the GSEs were allowed to retain USD 3 billion of net worth generated, rather than the USD 0.6 billion allowed under the 2012 arrangement. In 2018, the dividends to be paid each quarter will correspond to the net worth generated over the previous quarter, less USD 3 billion. In return, the face value of the preferred stock subscribed by the Treasury in each GSE increased by USD 3 billion in December 2017.

Given their inability to rebuild their capital through retained earnings or raising capital from private investors, the two agencies have accumulated a core capital shortfall of more than USD 194 billion⁴⁴ (Charts 17 and 18).

⁴³ The Treasury undertook to recapitalise the GSEs in the event that their net worth became negative. Given the support given to the two GSEs (including the USD 4 billion in aid received in the first quarter of 2018), the residual amount of support is USD 254.1 billion.

⁴⁴ In 2013, changes to conditions for the remuneration of senior preferred stock served to increase this deficit. All other things being equal, a continuation of the former dividend payment policy would have limited payments to USD 150 billion and the increase in the capital shortfall to USD 65 billion.



After taking account of their minimum capital requirements⁴⁵ (USD 41.4 billion), their deficit in terms of regulatory capital is now more than USD 235 billion.

The scale of this deficit is not mentioned in the reform proposals. However, it would make all the more difficult any “reprivatisation” of the two GSEs (as recommended by the MBA and the Milken Institute) let alone the introduction of tougher capital requirements.

Dividend payments have increased the cumulative deficit

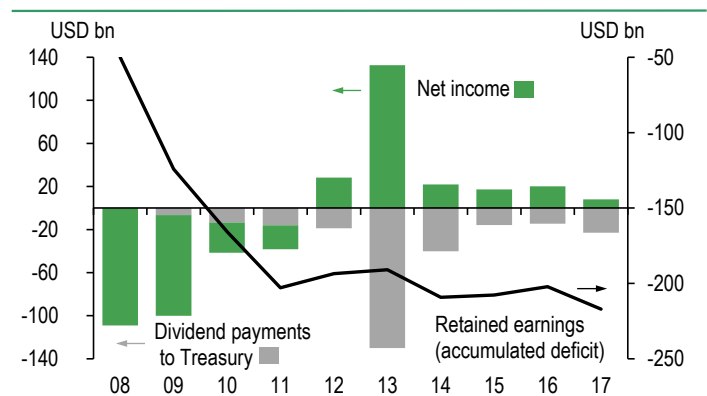


Chart 17 Sources: FNMA, FHLMC

A significant shortfall in core capital

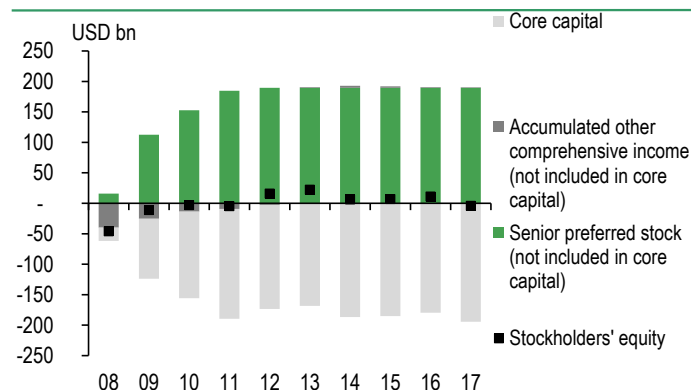


Chart 18 Sources: FNMA, FHLMC

Capital requirements are virtually non-existent

The MBA and the Milken Institute suggest that mortgage loans should carry the same risk weighting (standardised) whether they are held on the balance sheet of a bank or that of a “guarantor”.

Prior to being placed under conservatorship, the two GSEs were subject to leverage constraints. Capital had to cover at least 0.45% of outstanding mortgage loans backing GSE MBS held by third parties,

⁴⁵ The GSEs are required to communicate their minimum capital requirements, even though, since being placed under conservatorship, these requirements no longer represent a constraint.

0.45% of off-balance sheet commitments and 2.5% of other on-balance sheet assets. Assuming a standardised total risk-weighted capital requirement comparable to those of banks (excluding capital buffers and surcharges), or 8%, the risk-weighting of mortgage loans carried on the balance sheets of the two GSEs was around 5.6% prior to the crisis, or nearly nine times less than the standard applied by banks. On the scale of the financial system as a whole, and based on first current regulatory constraints⁴⁶ and secondly stocks of residential mortgages on the balance sheets of banks (29%), the GSEs (45%) and other financial institutions not governed by regulatory capital requirements (mainly Ginnie Mae and private ABS issuers, 26%), the average “theoretical” risk weighting⁴⁷ for mortgage loans would, on our estimates, be close to 20% for the USA.

A massive recapitalisation effort

The recapitalisation effort for the GSEs (or the capitalisation of new guarantors inheriting their portfolios of guaranteed loans) could be spread over time, by applying enhanced capital requirements only to new acquisitions of loans and not to the existing stock. This said, the current orders of magnitude give some idea of the volume of capital that would be required under normal circumstances, once the reform is complete. Assuming a stabilisation of guaranteed loans at the current level, bringing capital requirements for the GSEs into line with those of banks (excluding buffers and surcharges), namely a risk-weighted capital ratio of 8% and a risk weighting of 50% for loans, would create, all other things being equal, capital requirements for the “guarantors” of more than USD 192 billion ($4,815 \times 8\% \times 50\% = 192$). Imposing a leverage standard of 2% to 2.5% would take these to USD 95 billion to USD 120 billion ($4,815 \times 2\% = 96$ and $4,815 \times 2.5\% = 120$).⁴⁸

In the final analysis, and assuming that outstanding guaranteed loans stabilise at their current level, a buffer of USD 380 billion to USD 410 billion will have to be created by the private sector to cover the loans guaranteed by the two GSEs ($4,815 \times 8\%$ to $4,815 \times 8.5\%$). Up to USD 600 billion of private capital could be required to make up the capital shortfall at the current guarantors.

In the absence of legislation, the FHFA has itself sketched out the foundations of a housing finance reform in the US. The Credit Risk Transfer (CRT) program has created a new market where “unexpected” but not “extreme” credit risk on mortgages recently acquired by Fannie Mae and Freddie Mac can be priced and traded. In this market, the two GSEs transfer a share of the risk to which they are exposed, mainly through the issue of structured debt instruments.

⁴⁶ And using a number of simplified assumptions: in particular we assume that the whole of the US banking sector applies an average weighting factor of 60% for mortgage loans on their balance sheets, as is the case at the four biggest US commercial banks.

⁴⁷ We treat it as “theoretical” because the GSEs do not meet this constraint.

⁴⁸ With this increase in the leverage requirement, fifteen or sixteen years of net profits of USD 20 billion (and the suspension of dividend payments to the Treasury) would be required to make up the shortfall in core capital at the two GSEs and recapitalise them.



The major advantage of this structure is that it does not disrupt the liquidity of the secondary market in loans and therefore the supply of long-term, fixed-rate loans. Maintaining government guarantees for securitised loans preserves the Originate to Distribute model, by offering banks an alternative to keeping the loans they originate on their own balance sheets. Far from calling into question the model for financing the US economy – and in the absence of a recovery in the private MBS market – this system instead serves to redirect private capital towards mortgage credit risk. The CRT program will not, however, be truly tested except in the event of an economic deterioration bringing with it an increase in payment defaults. With this in mind, the investor base needs to be broadened, to avoid any sudden drying up of liquidity in the CRT securities market.

The fact remains that the fate of Fannie Mae and Freddie Mac is not yet sealed. The removal of uncertainty over their future will be a prerequisite for any increase in the role played by risk redistribution programs. Appropriate changes in their status and the necessary strengthening of their capital requirements would also provide guarantees of stability to the market. Lastly, whatever approach is adopted, it will be necessary to ensure the correct application of quality criteria for the loans originated, as the CRT program will never provide taxpayers with total protection from mortgage credit risk.

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