15

The Credit Surface and Monetary Policy

John Geanakoplos

I believe that credit plays a central role in the booms and busts of market economies, and even in milder fluctuations. But I do not believe that the credit conditions influencing booms and busts are driven primarily by fluctuations in riskless interest rates, or by the wrong riskless interest rates. When bankers say credit is tight, they do not simply mean that riskless interest rates are so high they are choking off demand for loans. They mean that many businesses and households that would like to borrow at the current riskless interest rates cannot get a loan. They are referring to the supply side of the credit market, not just the demand side.

The reason some borrowers cannot get a loan at the same (riskless) interest rate that others do is that their lenders are afraid they may default. Risky interest rates (or spreads to riskless interest rates on loans that might default) are often more important indicators of economic conditions than riskless interest rates. Nevertheless, central bankers have paid scant attention to default in their macroeconomic models.[1] In my opinion, central banks should pay attention to, and influence, risky interest rates if they want to preserve financial stability.

When lenders are afraid of default, they often ask for collateral to secure their loans. How much collateral they require is a crucial variable in the economy called the collateral rate or leverage. Lenders also worry about the creditworthiness of the borrowers, which in the case of firms is represented by credit ratings and in the case of households is often represented by a FICO credit score.[2] The credit conditions of the economy cannot be summarized accurately by a single riskless interest rate, but rather by an entire surface, where the offered interest rate from lenders can be thought of as a function of the collateral and the FICO score: $r = f(\text{collateral, FICO})$.[3] The higher the collateral, or the higher the

FICO score, the lower will be the interest rate. For sufficiently high collateral and FICO score, the interest rate may stabilize at a constant called the riskless interest rate. If we compare two different economic climates, represented by two different surfaces *f* and *g*, it might well be the case that both of them give precisely the same riskless interest rate, but nevertheless *g* depicts much tighter credit conditions than *f*. For example, in *g* the riskless interest rate might be attained only with much higher levels of collateral and FICO, or the rate in *g* might rise much faster above the riskless level as collateral and FICO fall.

In figure 15.1 I present the average interest rate charged on a large sample of Fannie and Freddie thirty-year fixed rate mortgage loans during 2013. One can see that as FICO falls and as collateral falls (loan-to-value ratio, or LTV, rises), the corresponding interest rate rises.[4]

In my opinion, central banks should be trying to estimate the existing credit surfaces on a quarterly basis. They could get the data to do much of this if they looked at individual transactions to see how the rates change as the terms change. They could do even better if they could collect the offers banks make. Part of the surface would have to be estimated by extrapolation, since it covers conditions at which no trades (or only a few trades) are observed. Estimating these surfaces explicitly would bring much clarity to the general credit climate.[5]

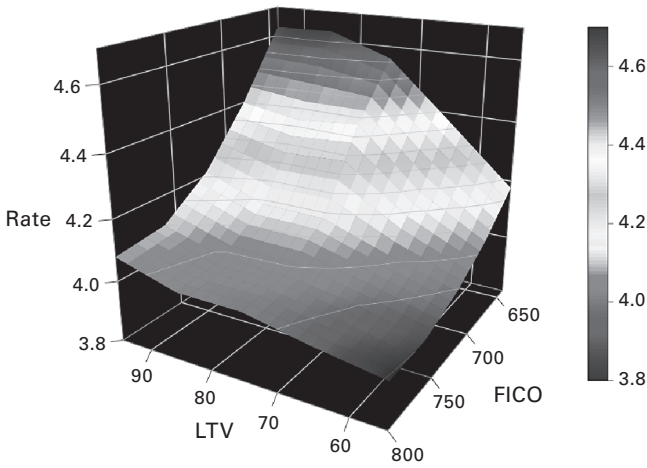

Figure 15.1
Two-Dimensional Credit Surface.

Credit Surface Theory

The riskless interest rate depends on the impatience of the agents in the economy and on the expectations for future growth, among other factors. The rest of the credit surface is driven primarily by the risk tolerance of borrowers and lenders' fears of default, in addition to the conventional determinants like impatience and growth, which apply with or without uncertainty. The probability of default in turn depends on at least two factors: one is the volatility of collateral prices, and the other is the indebtedness of the borrowers.

The higher the volatility of collateral prices (at least in the down tail), the more insecure lenders will feel and the higher the interest rate they will insist on for the same collateral. The higher the indebtedness of the borrowers, the less likely it is that they will be willing or able to repay a new loan. Higher volatility and higher indebtedness make for a tighter credit climate.

The tightness of the credit environment is more related to the steepness of the credit surface than to the level of the riskless interest rate. Borrowers know that if they want to borrow more money with the same collateral, they will pay a higher interest rate, because the LTV of the loan will move up.[6] In traditional macroeconomic theory, any investor can borrow all he wants at the going rate of interest. With an upward-sloping credit surface agents will typically feel constrained, borrowing less than they would like at a constant interest rate.

A stark case of this can be seen from the binomial leverage theorem of Fostel and Geanakoplos (forthcoming). Let's consider the situation in which all loans are entirely no recourse (and there is no reputation to be lost), so borrowers deliver only up to the value of the collateral. The credit surface then depends on LTV but not on the FICO score. In figure 15.2 the interest rate is constant at the riskless rate so long as the LTV is sufficiently low (to make the loan absolutely safe) but rises for higher LTV. Fostel and Geanakoplos (forthcoming) showed that if the collateral gives no direct utility (as would be the case if the collateral were a financial security like an MBS or stock) and has only two possible payoffs, then nobody will ever borrow at higher LTV than at point *A* in the diagram, the maximum LTV at which there will be no default. All the observed loans in the economy will transact at the riskless interest rate, yet many

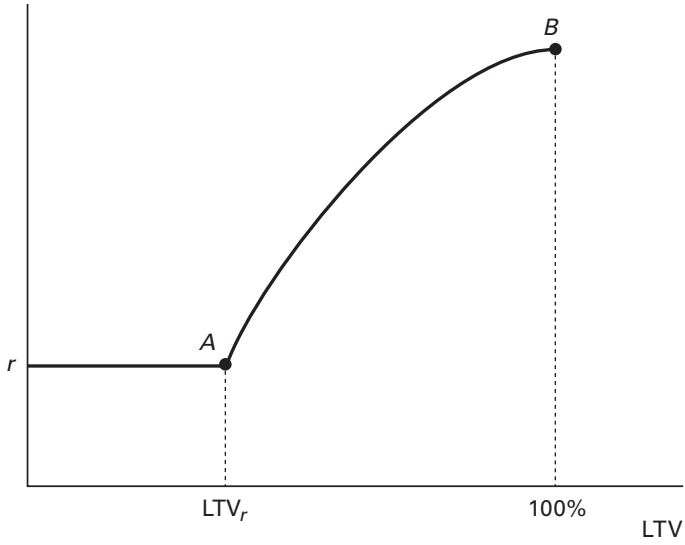

Figure 15.2
One-Dimensional Credit Surface.

borrowers would want to borrow much more if only they could increase their borrowing at the same rate. Credit conditions become looser when point *A* moves to the right. This happens when the volatility of the collateral prices declines, so the maximum LTV at which a loan is still riskless increases.

The Credit Surface and Asset Prices

The theory of asset pricing is one area that would be radically improved by considerations of the credit surface. Economists as far back as Irving Fisher have understood that the riskless interest rate influences the price of an asset by changing the expected present value of its dividends, or its fundamental value. But economists have not sufficiently appreciated that the rest of the credit surface also influences risky asset prices. As I have demonstrated (Geanakoplos 1997, 2003, 2010a), a looser credit surface boosts the demand for the corresponding collateral asset, and thus tends to raise its price.[7]

One can measure the looseness of the credit surface by exploring global measures such as its average slope. Alternatively, one can look at

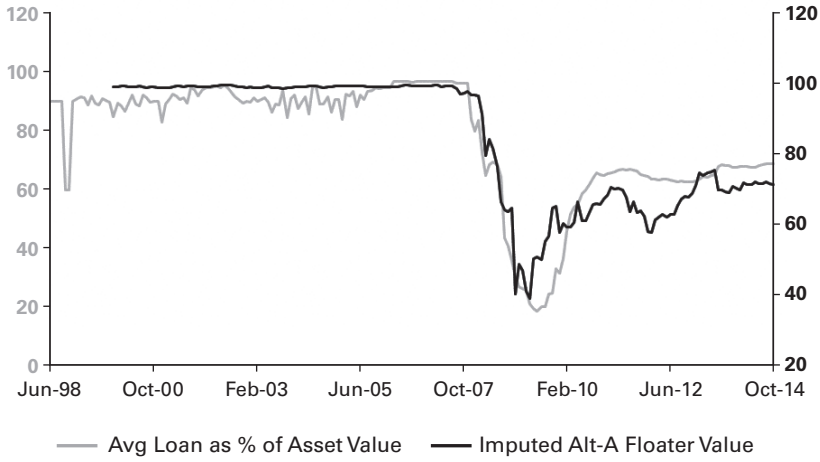

Figure 15.3
Mortgage Bond Leverage Cycle.
Note: The chart represents the average total repo loan as a percentage of asset value available from dealers on a hypothetical portfolio of CMOs originally rated AAA, subject to certain adjustments noted below. The price time series of imputed Alt-A floater prices is based on the Alt-A price drop versus agency collateral time series available from Barclays.

The portfolio evolved over time, and changes in average margin reflect changes in composition as well as changes in margins of particular securities. In the period following August 2008, a substantial part of the increase in margins is due to bonds that could no longer be used as collateral after being downgraded, or for other reasons, and hence count as 100 percent margin.

the distribution (or average or top quartile) of LTVs or FICO scores of loans that have actually been given. These latter numbers reflect demand as well as supply, but, ceteris paribus, the realized LTVs will be higher and the FICO scores lower when the credit surface is looser.

Figure 15.3 illustrates the connection between the price of a portfolio of AAA-rated mortgage securities and how much they could be leveraged over a sixteen-year period before and after the crisis.[8] Before the crisis leverage and prices rose together, during and after the crisis leverage and prices dramatically fell, and then they rose together, in a leverage cycle.

We have seen the same kind of leverage cycle in mortgage loan LTVs and housing prices, in student loan LTVs and school tuition, and in ECB collateral requirements and sovereign bond prices.

The Multidimensional Credit Surface and Volume

As mentioned several times already, the credit surface should really be more than a two-dimensional object, since rates also depend on ratios such as debt servicing to income or debt to wealth, and so on. These numbers are sometimes hard to get. There are often unobserved factors that affect the supply of loans. For example, new regulations may tighten credit supply by requiring increased documentation that some borrowers simply cannot provide. If the credit surface is calibrated against realized loans without taking into account the unobserved factors, it may actually look looser when credit is getting tighter because the restricted group of borrowers in the data is of higher quality, and so would be receiving more favorable interest rate offers for the same collateral. In such a case the drop in volume might reveal the tightening effect of the regulation.

The Credit Surface and Monetary Policy

I argued that monitoring and publishing the credit surface (and volume data) would greatly improve our understanding of evolving credit conditions and provide a framework for discussing monetary policy. It might even encourage policymakers to predict what effect their interventions would have on the whole surface, not just on the riskless interest rate. How clearly did the US Federal Reserve Board of Governors understand that its recent policy of quantitative easing (achieved partly by buying agency mortgages) would dramatically loosen the credit surface for high-yield bonds, but provide very little loosening of the credit surface for mortgage borrowers with average credit scores? In my opinion, policymaking would be enormously sharpened if it were disciplined by the question of the whole credit surface.

If a very tight credit climate is unhealthy for the economic environment, then we are led by considerations of the credit surface to two radical-sounding conclusions. First, central banks could intervene not only by influencing the riskless interest rate (fully cognizant of the indirect effects on the rest of the credit surface, as I mentioned earlier) but also by directly influencing risky debt. In one direction, central banks could tighten overly hot credit markets by, for example, prohibiting loans at LTV exceeding

some threshold, as the Bank of Israel did in 2010 by banning mortgage loans at LTV ratios above 60 percent. In the other direction, a central bank could extend credit to borrowers at terms that no private investor would provide, as the Fed did in 2009, lending 95 cents against a dollar's worth of credit card collateral, and student loan collateral, and car loan collateral.[9] The ECB has done the same with sovereign debt.

Second, in extreme environments, such as the United States faced in 2007–2009 and Europe faces now, debt forgiveness could also figure into the policy mix of central banks. Once it is admitted that there may be defaults against the central bank, one can consider the idea of partial forgiveness as a policy tool. Properly implemented, forgiveness can actually recover more money for the lender, without creating any moral hazard for present or future borrowers. The stigma against default is so strong that it has stymied rational discussion about forgiveness.[10]

The Current Environment

Several commentators have remarked that in the United States, and especially in Europe, we have seen several years of low growth and extraordinarily low interest rates. Some have concluded that we must be entering a period of secular stagnation in which there are very few projects with high expected returns. An alternative view, one that can only be understood in terms of the credit surface, is that even though the riskless rate may have declined, the full credit surface may have become steeper, and thus for many or most potential borrowers the credit environment might be tighter than before.

In the United States the credit surface for corporate loans is quite different from the credit surface for consumer (or small business) loans. We are witnessing a tale of two different leverage cycles. Corporate borrowers with mediocre credit ratings and high debt-to-equity ratios are able to issue bonds at extraordinarily low interest rates. But homeowners with average credit scores cannot easily get loans. One reason is that banks holding AAA-rated mortgage securities now incur capital charges they did not bear before. This lowers the price of the AAA-rated piece and lowers the profitability of nonagency securitizations. Without a vehicle into which to sell their loans, banks offer far fewer loans. Second, the banks are terrified of putbacks, which oblige them to buy back loans at

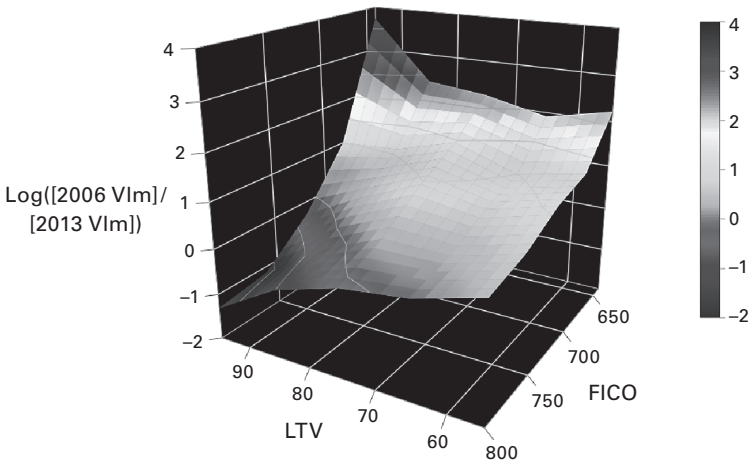

Figure 15.4
Change in Origination Volumes, 2006 versus 2013.

par that were not properly vetted. To temper that fear, regulators created a safe harbor of qualified mortgages that could not be put back, but this has only served to convince banks that non-QM loans are in graver danger of putbacks. Figure 15.4 shows that there were vastly more loans made to borrowers with below 725 FICO scores securitized by Fannie Mae and Freddie Mac in 2006 than in 2013. The only category of loans that was more prevalent in 2013 consisted of very high FICO score loans.

Default and Forgiveness

The American crisis began over eight years ago in February 2007 when the BBB subprime mortgage index collapsed. The economy has finally picked up, but I believe our biggest mistake after the crisis began was not taking effective measures to ameliorate the massive foreclosure problem, or to confront the problems of debt overhang for homeowners, small businesses, and government. We did save our banks. What we should have done is partially forgive subprime debt.

Between four and seven million homes were foreclosed on as a result of the American mortgage crisis, involving more defaulters in the households

than the number of people in Greece. In a *New York Times* op-ed with Susan Koniak in October 2008, I warned of the impending foreclosure disaster and predicted that government efforts to help homeowners by temporarily reducing their interest payments would fail. We argued that subprime borrowers, without a good credit rating to protect, who were far underwater and who took a hit in their earnings would default. For subprime loans with an LTV of 140 percent to 160 percent, the rate of new defaults at the time was 7.4 percent *per month*!

In another *New York Times* op-ed in March 2009, Susan Koniak and I advocated reducing principal as the only way to help homeowners and lenders and the country at the same time. Losses from foreclosures of subprime loans have been horrible. The average recovery is under 25 percent. This is understandable once one realizes that in many states, it takes eighteen month to three years to throw somebody out of his house. In that time the mortgage isn't paid, the taxes aren't paid, the house is not repaired, the house is often vandalized, and the realtor must be paid. Consider a $160,000 subprime loan on a house that is now worth only $100,000. If the borrower loses his job or finds his earnings prospects are reduced, he will default.

The lender who forecloses will then end up with about $40,000. But if the loan is forgiven down to $90,000 (perhaps with the added proviso that if the house rises in value and is then sold, half the sale price beyond $100,000 will also be returned to the lender), both the lender and the borrower can be made better off. The borrower might choose to stay in his house and continue to pay the mortgage, or he might decide to sell the house as expeditiously as possible, returning $90,000 to the lender and pocketing the $10,000 himself. Either way the lender makes out much better than with $40,000. And this does not count the boost to the economy and to home prices if a large number of potential foreclosed homes are taken off the market.

Partially forgiving underwater debt before the homeowner defaults eliminates moral hazard. But it runs the risk that some homeowners who would have paid everything are asked to pay less. Only a careful analysis of what happened loan by loan, couched in a model that takes into account the effect of forgiveness on home prices, can reveal what would have been the effect on losses. I am working on that analysis now.

Notes

1. Of course, central bankers pay a great deal of attention to the solvency of individual banks, but when it comes to their macroeconomic forecasts of demand and growth, it is my impression that default does not figure in.

2. FICO is a private company that provides credit scores to financial institutions to help them in their decision making. The FICO score is not the perfect representation of creditworthiness. Ideally one would like a measure that represented the willingness of the borrower to repay even if there was no collateral, which would depend on the ratio between the internal penalty (in lost reputation and embarrassment, etc.) and the marginal utility of consumption or wealth.

3. There should be a different credit surface for each maturity and each type of collateral. One could also imagine adding more variables beyond LTV and creditworthiness, such as debt-to-income or debt-to-wealth ratios.

4. The full credit surface for mortgages should include nonagency loans. This would give a much greater variation in interest rates. The difficulty is that these loans are often of a different type (say, variable rate), so that it is not so easy to assign a comparable rate to them. But this difficulty could probably be overcome by using a so-called option-adjusted spread.

5. The credit surface or credit menu was introduced in an equilibrium model in Geanakoplos (1997), and the recommendation that central banks should monitor it appears in Geanakoplos (2014).

6. If we added more axes to the credit surface to reflect ratios such as credit servicing to income, or credit to income, or credit to wealth, then it would be still more obvious that bigger loans would involve higher interest rates.

7. Retailers who find ingenious ways to extend credit to their customers have understood this principle for decades (if not centuries). Consider the binomial case illustrated in figure 15.2. A looser credit surface pushes point *A* to the right. Any borrower who felt credit constrained would naturally borrow more on his existing collateral. But where would he spend the extra cash? All his other choices have unchanged marginal utility. But the next unit of collateral brings higher marginal utility than before, because now its purchase can be accompanied by a bigger loan.

8. Think of the leverage as the LTV corresponding to point *A* in figure 15.2. The price on the portfolio is measured by Barclays by looking at the price difference from a similar mortgage that is guaranteed against default, and then subtracting this difference from 100. A floater (which pays a current coupon equal to the going interest rate) that was guaranteed not to default would always be priced at 100, so the vertical axis is the implied price of a floater that defaults like the AAA tranche of Alt-A bonds in the portfolio.

9. This might lead to a whole new kind of policy, tailored to specific kinds of borrowers.

10. If central banks are not allowed to consider the possibility that there may be defaults on their loans, then they cannot be allowed to calculate that losses might

be reduced by partial forgiveness. In my view it is impossible to fully separate the central bank from a fiscal authority such as the Treasury. There needs to be a well-defined mechanism for the central banks to lose money as well as make money. When private lenders are pooled, as was the case with bondholders of subprime securitizations, there may be no coordination mechanism for them to partially forgive debt. In my view, in extreme situations policymakers should consider imposing debt forgiveness on private lenders, as well as extending debt forgiveness themselves. See Geanakoplos (2010b).

References

Fostel, Ana, and John Geanakoplos. Forthcoming. "Leverage and Default in Binomial Economies: A Complete Characterization." *Econometrica*.

Geanakoplos, John. 1997. "Promises, Promises." In *The Economy as an Evolving Complex System II*, ed. W. Brian Arthur, Steven Durlauf, and David Lane, 285–320. Reading, MA: Addison-Wesley.

Geanakoplos, John. 2003. "Liquidity, Default, and Crashes: Endogenous Contracts in General Equilibrium." In *Advances in Economics and Econometrics: Theory and Applications, Eighth World Conference, Vol. 2*, 170–205. Econometric Society Monographs. Cambridge: Cambridge University Press.

Geanakoplos, John. 2010 a. "The Leverage Cycle." *NBER Macro-Annual* 2009:1–64.

Geanakoplos, John, 2010 b. "Solving the Present Crisis and Managing the Leverage Cycle." *FRBNY Economic Policy Review,* August, 101–131.

Geanakoplos, John, 2014. "Leverage Default, and Forgiveness: Lessons from the American and European Crises." *Journal of Macroeconomics* 39, Pt. B (March): 313–333.

Geanakoplos, John, and Susan Koniak. 2008. "Mortgage Justice Is Blind." Op-ed. *New York Times*, October 30.

Geanakoplos, John, and Susan Koniak. 2009. "Principal Matters." Op-ed. *New York Times*, March 5.