

CREDIT RATIONING

Credit rationing – a situation in which lenders are unwilling to advance additional funds to borrowers at the prevailing market interest rate – is now widely recognized as a problem arising because of information and control limitations in financial markets. This article reviews various motivations behind research on credit rationing, traces the history of theoretical efforts to explain how this phenomenon can persist in equilibrium, and reviews recent empirical research on its prevalence and effects. In the process, credit rationing is shown to be simply an extreme case of the more general problem of capital market misallocation.

Broadly speaking, ‘credit rationing’ refers to any situation in which lenders are unwilling to advance additional funds to a borrower even at a higher interest rate. In the words of Jaffee and Modigliani (1969, pp. 850–1), ‘credit rationing [is] a situation in which the demand for commercial loans exceeds the supply of these loans at the commercial loan rate quoted by the banks’. Key to this definition is that changes in the interest rate cannot be used to clear excess demand for loans in the market. In essence, this definition treats credit rationing as a supply-side phenomenon, with the lender’s supply function becoming perfectly price inelastic at some point.

If the projects that are being funded by the loan are not scalable, however, then a distinction must be made between a situation in which a lender eventually restricts the size of loan it will provide to any individual borrower and one in which ‘rationed’ borrowers are denied credit altogether. This phenomenon arises in circumstances in which lending is not scalable. Stiglitz and Weiss (1981, pp. 394–5) therefore define credit rationing as follows:

We reserve the term credit rationing for circumstances in which either (a) among loan applicants who appear to be identical some receive a loan and others do not, and the rejected applicants would not receive a loan even if they offered to pay a higher interest rate; or (b) there are identifiable groups of individuals in the population who,

with a given supply of credit, are unable to obtain loans at any interest rate, even though with a larger supply of credit, they would.

According to this definition, lenders fully fund some borrowers but deny loans to others despite the fact that the latter are identical in the lender's eyes to those who receive loans.

Thus, there are two working definitions of credit rationing in the literature. The first focuses on situations in which increases in the interest rate cannot clear excess demand in the loan market, whether this excess demand reflects a single borrower (who would like a larger loan amount) or many. Under this definition, rationing would exist if every potential borrower received a loan but a smaller one than that desired at the equilibrium interest rate. The second definition – the Stiglitz–Weiss definition – restricts its attention to situations in which some borrowers are completely rationed out of the market, even though they would be willing to pay an interest rate higher than that prevailing in the market.

Both of these definitions focus on the supply side of the market. One could argue, however, that it is useful to think of non-price rationing as any phenomenon that limits the amount of funding used by firms such that firms are not able to use the price mechanism to successfully bid for additional funds, whether this is caused by supply-side constraints (as under the narrow definitions of credit rationing described above) or by other distortions in credit markets (related, for example, to regulation). This would allow a broader definition of 'credit rationing' in which regulatory constraints, rather than just informational problems, lead to non-price allocations of credit.

Why care about credit rationing?

Early interest in credit rationing was driven in part by questions about the role that credit rationing might play in transmitting the macroeconomic effects of monetary policy, which was related to research on the so-called 'availability doctrine' in the 1950s and 60s (Scott, 1957). To the extent that monetary policy operates through a 'credit channel' (in which contractionary policy affects the economy through a decline in the supply of funds available for banks to lend), and to the extent that changes in the terms of lending include not only changes in loan pricing but also changes in the quantities of credit available to

borrowers, credit rationing may play an important role in the transmission of monetary policy's effects on the economy (Blinder and Stiglitz, 1983).

In addition to the cyclical effects of rationing in credit markets related to monetary policy, development economists, especially Ronald McKinnon (1973), argued that a different credit rationing problem is more relevant for the long-term growth prospects of developing countries. High inflation, high zero-interest reserve requirements, government-mandated loan allocations to favoured borrowers, and interest rate ceilings on loans or deposits in developing economies (a combination which McKinnon termed 'financial repression') subjected many developing countries' banking systems to an extreme form of regulation-induced credit rationing. High reserves, high inflation, and interest ceilings on deposits meant that banks were rationed in the deposit market, and thus had few funds to lend, while lending mandates and loan interest-rate ceilings meant that what funds were available to lend were often rationed by restrictions on who could bid for those funds.

Additionally, George Akerlof (1970), in his path-breaking article on the role of adverse selection in preventing market development, drew attention at an early date to the possible effects of information problems in retarding the development of lending markets, particularly in developing countries. In an ideal world, in the absence of any government policies limiting beneficial lending, all borrowers with positive net present value projects would be able to obtain outside funding (whether through debt or equity instruments, or bank or non-bank sources of funds). But Akerlof showed that, if markets were unable to distinguish good risks from bad ones, lending might not be feasible. The failure to develop institutions capable of producing credible information about borrowers and using that information to screen applicants could, according to Akerlof, play an important role in financial underdevelopment.

Many development economists have come to recognize that the failure to properly allocate funds in the loan market – a broad phenomenon, within which credit rationing is a special and extreme case – can be an especially important potential impediment to growth in developing countries because of the relative absence of institutions in those countries that allow effective screening of borrowers (to mitigate adverse selection) or ongoing monitoring of borrowers' actions (to mitigate moral hazard).

An additional motivation for an interest in credit rationing comes from the literature on bank fragility. Credit rationing can also apply to the market in which financial intermediaries raise their funds. Financial institutions go to great pains to attract and maintain deposits through (a) the structure of their contracts (which typically afford withdrawal options to depositors), (b) their long-term relationships with market monitors who track their progress, and (c) their established reputations for good management. But sometimes the market suddenly decides to ration credit to a particular bank or to the whole banking system; and when this happens the affected banks find it hard to attract and maintain deposits at any price. Thus, the literature on ‘bank runs’ as an historical phenomenon can be thought of as a literature on credit rationing in the markets in which financial institutions raise their funds. Depositors that decide to participate in a bank run ration credit to their bank in the sense that the decision to withdraw is a quantity, not a price, decision. They are simply unwilling to leave their money in the bank.

Finally, much of the current research on discrimination in credit markets is driven by evidence that black and Hispanic minority loan applicants are denied more frequently than comparable whites (for example, Munnell et al., 1996; Cavalluzzo and Cavalluzzo, 1998; Cavalluzzo and Wolken, 2005). Of course, this begs the question of why borrowers are denied loans in the first place, rather than simply priced according to their risk. In other words, understanding why there are differences in denial rates across groups necessarily entails exploring why rationing (loan denial) occurs.

The development of credit rationing theory

Early views on credit rationing

The earliest discussions of credit rationing viewed it as a non-equilibrium phenomenon, arising either because of exogenous interest rate rigidities (for example, interest rate ceilings or usury laws) or because of a lack of competition in the loan market (Scott, 1957). Soon authors made a distinction between temporary credit rationing, in which market interest rates are slow to adjust to exogenous shocks such as changes in the lender’s cost of funds or borrower demand, and ‘equilibrium’ credit rationing, which persists after the market has fully adjusted to these shocks. Clearly the more interesting and difficult to explain phenomenon is equilibrium credit rationing.

Hodgman (1960) was the first to try and explain how credit rationing can persist in a rational, equilibrium framework. In this model, lenders evaluate potential borrowers on the basis of the loan's expected return-expected loss ratio. In addition, it is assumed that there is a maximum repayment that the borrower can credibly promise, which effectively limits how much the lender will offer the borrower regardless of the interest rate: eventually the expected losses become too great relative to the expected return. This model was much debated in the ensuing years. In particular, Miller (1962) argued that Hodgman's analysis could be made consistent with rational expectations between the borrower and lender by incorporating bankruptcy costs that would be incurred by the lender upon the borrower's default. The real significance of the Hodgman article, however, was that it established as an important theoretical goal the objective of explaining how credit rationing could persist as an equilibrium phenomenon.

Freimer and Gordon (1965) resolved many of the issues regarding the structure of the Hodgman and Miller models by showing that credit rationing can occur with a risk-neutral lender if the borrower has a fixed-sized funding need. But this was done assuming an exogenous interest rate. Jaffee and Modigliani (1969) completed the picture by endogenizing the equilibrium interest rate by modelling both the supply and demand sides of the market. Credit rationing in their model, however, is the direct result of an exogenous assumption that borrowers within a given group must be charged the same interest rate, even though the lender can distinguish differences among them.

This early work was important in that it firmly established the idea that credit rationing could be a persistent equilibrium phenomenon. Ultimately, however, the solutions proposed relied on very restrictive assumptions about agent preferences or the contracts they could employ. More satisfactory explanations of credit rationing had to wait for the information economics revolution of the 1970s.

Modern credit rationing theory

Akerlof's (1970) pioneering article on adverse selection was motivated in part by the desire to explain extreme cases of credit rationing (the absence of a credit market), but Jaffee and Russell (1976) provide the first explicit asymmetric information rationale for credit rationing in the general sense. In their model, lenders cannot distinguish *ex ante*

between high- and low-quality borrowers (that is, those who will repay their loans and those who will default). Contracts are written to determine the size of the loan offered and the interest rate. As in the Rothschild–Stiglitz (1976) insurance framework, low-quality borrowers must accept the contract that is preferred by the high-quality borrowers, lest they be identified as the deadbeats they are. Although a market-clearing interest rate/loan amount combination does exist, high-quality borrowers prefer a contract that entails a slightly lower interest rate with a reduced loan amount. As a result, the pooling outcome entails credit rationing. The primary problem with this model is that the ‘equilibrium’ is not stable, in that unsustainable separating contracts dominate the pooling outcome.

In 1981, Joseph Stiglitz and Andrew Weiss published what has become the canonical model of credit rationing, because it was the first model that fully endogenized contract choices with a stable, rationing equilibrium. In the Stiglitz–Weiss framework, credit rationing occurs because the lender’s expected return is not monotonically increasing in the interest rate. Instead, adverse selection or moral hazard problems eventually cause the lender’s expected return to decline as the interest rate rises.

In the adverse selection version of the model, borrowers and lenders are both risk neutral. Borrowers are characterized by their projects, which are assumed to have the same expected returns but differ from one another in their risk. Specifically, borrower projects differ on the basis of mean-preserving spreads (Rothschild and Stiglitz, 1970). These projects are also assumed to require a fixed investment (that is, they are indivisible) and borrowers have a fixed amount of internal equity that they can invest in the project. Limited liability upon default means that the lender’s payoff is a concave function of the project’s return, while the borrower’s profit function is convex.

These assumptions imply that, at any given interest rate, a subset of the least risky borrowers will drop out of the market, choosing instead to forgo their projects. In essence, the borrower’s limited liability means that he reaps all of the project’s gain (beyond the cost of debt service) when its return is high, but loses his collateral (his paid-in capital invested in the project, if any) only when the project’s return is low. For low-risk projects, however, the potential upside gains are small. If those low-risk borrowers are pooled with high-risk borrowers, they will face higher than warranted interest rates.

Low-risk borrowers will increasingly withdraw from the market as interest rates rise; as rates rise, borrowers with low-risk projects are better off withdrawing from the market and simply consuming their endowments rather than agreeing to invest and pay a high interest rate. As a result, increases in the interest rate cause more and more good borrowers to drop out of the market, lowering the average creditworthiness of the lender's remaining applicant pool. The size of the adverse selection premium faced by low-risk borrowers (the amount of interest low-risk borrowers have to pay in excess of what their project risks warrant) becomes larger with each interest rate rise because the interest rate must compensate for the default risk of an ever-worsening pool of borrowers.

Thus, increases in the interest rate affect lender returns in two ways. The first is the direct effect that a higher interest rate raises the lender's return (for a given pool of borrowers). Rising interest rates, however, also have the indirect effect of lowering the average quality of the lender's applicant pool, thereby lowering the lender's expected return from any given loan. Eventually, this secondary, adverse selection effect may outweigh the first interest rate effect, causing lender profits to decline as the interest rate rises.

Once the non-monotonicity of the lender's return in the interest rate is established, the possibility of credit rationing follows immediately. Profit-maximizing lenders will never voluntarily choose to raise the interest rate beyond where the adverse selection effect dominates. If excess demand exists in the market at this rate, credit rationing will be the equilibrium.

Paradoxically, in this model the very best credit risks do not seek funding because they do not find it worthwhile. This may seem odd, but it is important to remember that these borrowers are not rationed. Instead, they voluntarily drop out of the market because the cost of being pooled with higher-risk borrowers is too great. The rationed borrowers are the higher-risk borrowers who stay in the market and request funding.

Alternatively, Stiglitz and Weiss show how changes in the interest rate may also affect the borrower's choice of project, so that moral hazard in project choice (sometimes referred to as 'asset substitution' in the finance literature) can be another reason that the lender's expected return is non-monotonic in the interest rate. Suppose that the borrower is able to choose among projects with different risk profiles. If, at a given interest rate,

the borrower is indifferent between two projects, Stiglitz and Weiss show that an increase in the interest rate will cause the borrower to prefer the project that has the higher probability of default. Of course, the lender prefers the safer project. Thus (with slightly more restrictive distributional assumptions than in the adverse selection case), increases in the interest rate once again can eventually lower the lender's expected return, leading to credit rationing.

Models of credit rationing need not posit rationing for all borrowers. Realistically, some borrowers (certain firms for which information control problems are particularly acute) may be subject to rationing while other borrowers are not. Borrowers not subject to rationing may be able to avoid rationing because their prospects are more observable, or because their behavior is more controllable.

Bank runs as credit rationing

The theoretical literature on credit rationing in the deposit market (bank runs) has some features that distinguish it from the literature on credit rationing in the loan market. The ultimate causes of deposit market rationing can be similar to, or very different from, the causes of loan market rationing. As discussed above, loan market rationing can reflect either information and incentive problems in the loan market or exogenous regulations. In the case of the deposit market, rationing can result either from incentive and information problems relating to the depositor-bank relationship or from exogenous liquidity needs of depositors.

With respect to the former, under some circumstances a bank run may reflect a loss of confidence in the market value of the bank's asset portfolio and changes in bank behaviour that attend such a loss. If the value of the portfolio falls sufficiently, and if the information and incentive problems are sufficiently severe, the perceived risk of losses in the bank can prompt depositors to ask for their money back because depositors have reason to be risk-intolerant (that is, to be unwilling to leave their money in a bank that has too high a level of risk). An example of such a model is Calomiris and Kahn (1991). Here the depositor withdraws funds in bad states of the world because doing so is necessary to prevent the banker from abusing his control over the bank's portfolio.

An alternative cause of credit rationing in the deposit market is a shock to the liquidity needs of depositors, which forces depositors to demand their funds from their banks irrespective of the portfolio performance of the banks. Diamond and Dybvig (1983) is an example of a model of this phenomenon.

Bank depositor runs are but one specific example of how financial intermediaries may be credit rationed due to creditor risk intolerance and/or liquidity shocks. During the 1998 Russian financial crisis, for example, it was widely reported that many emerging market hedge funds dumped their holdings of risky securities of all kinds in a scramble to reduce their risks and thus re-establish the high-quality credit ratings needed to retain their debtors. Intermediaries were also scrambling to accumulate liquidity, as many of their claimants needed to withdraw funds to meet other obligations related to the financial market upheaval.

The limits of credit rationing

Credit rationing as a problem of information and control (as it was modelled by Jaffee and Russell, 1976, and Stiglitz and Weiss, 1981) is properly seen as an extreme case of the more general phenomenon of capital market misallocation, which includes cases where capital is misallocated (due to adverse selection and moral hazard) without any rationing occurring. It is important to recognize that, from the standpoint of either cyclical concerns about the transmission of monetary policy or developmental concerns about the efficiency of the allocation of capital, the important phenomenon is not rationing per se but rather the extent to which the market fails to allocate resources efficiently. Even a market that never suffers from credit rationing can be highly inefficient in its allocation of capital. In that sense, credit rationing may be somewhat beside the point. Indeed, the corporate finance literature is full of examples of models of market imperfections involving moral hazard and adverse selection in which credit is misallocated, and in which positive net present-value projects are not funded or negative net present-value projects *are* funded.

In some cases, firms may even be priced out of the market for funds entirely, so that they avoid funding profitable investments. For example, Jensen and Meckling (1976) show that the potential for asset substitution at the expense of creditors can make it much

more costly for firms to access debt markets. Indeed, asset substitution can make it prohibitively expensive to issue debt. Note that this is not a case of credit rationing as defined by Stiglitz and Weiss, since suppliers are not refusing credit. Rather, the high asset substitution premium that firms would be charged if they sought credit can result in a decision by the firm not to fund a positive net present-value investment. Similarly, Myers and Majluf (1984) show that because of adverse selection problems – which are particularly acute in the public equity market – some firms may decide to avoid issuing equity to fund a positive net present-value investment. Here, again, a firm is not being rationed by suppliers, but is unwilling to seek financing because of its prohibitive pricing.

As the literature on capital market misallocations and credit rationing developed in the late 1970s and early 1980s, critics pointed out some limiting circumstances in which capital markets did not have a tendency to underfund positive net present-value projects. For example, both adverse selection and moral hazard problems can be overcome by sufficient collateral. By placing collateral at risk a firm could signal its high quality, or commit itself not to abuse creditors by undertaking excessive risk (see Bester, 1985). Of course, collateral is not always available, nor is it costless to place collateral at risk. In the case of a limited liability enterprise, the firm's net worth limits its available collateral. Firms that can finance themselves from internal funds and limited amounts of low-risk debt can avoid the adverse selection and moral hazard costs associated with external finance, but young, growing firms tend to be in need of substantial amounts of external finance, far in excess of their accumulated net worth. If borrowers use all of their available 'collateral', then, on the margin, collateral cannot mitigate adverse selection or moral hazard problems.

In the consumer context, it is also important to recognize that the moral hazard and adverse selection problems that arise in corporate lending may differ in importance across the various areas of consumer lending. For example, moral hazard may be limited in the context of mortgage lending where actions destructive to the lender's interest are likely to harm the homeowner as well (consider inadequate protection against the risk of fire, for example). Furthermore, the modern use of credit scores and loan-to-value ratios may make mortgage lenders more knowledgeable about an applicant's true credit risk than the applicant himself, particularly if that applicant has significant equity invested in the

house and lacks experience in the credit market (Calomiris, Kahn and Longhofer, 1994). Under such circumstances, the implications of adverse selection models (which depend on the superiority of the information of the borrower about his type) may be irrelevant, or even reversed. On the other hand, in the context of uncollateralized credit card borrowing based only on past credit records, unobservably high-risk borrowers (those who know that they are about to have major medical costs, lose their job, or become divorced) may have strong incentives to borrow, implying the possibility for severe adverse selection.

How is credit rationing measured empirically?

Although credit rationing is a widely discussed phenomenon, there is a surprising paucity of evidence confirming its existence. The key problem is that, while the concept of a credit-rationed borrower is easy to understand in theory, under each of the various models of credit rationing discussed above it is extremely difficult to measure ‘excess demand’ of individual borrowers or the similitude of borrowers’ creditworthiness.

Indirect methods

Jaffee and Modigliani (1969) attempt to infer the presence of credit rationing by measuring the proportion of new commercial loans originated at the prevailing prime rate and/or with very large loan sizes. The intuition they use is that prime and/or large borrowers have the lowest risk and are therefore the least likely to be rationed. As a result, a larger proportion of loans will go to these low-risk borrowers when credit rationing is severe. Jaffee and Modigliani use this proxy to see how market factors affect the prevalence of credit rationing. Of particular interest is their result that increases in the average commercial loan rate are associated with higher levels of rationing, which seems to confirm the appropriateness of their proxy for credit rationing.

Other authors have attempted to measure whether commercial loan rates are ‘sticky’ in response to changes in open-market interest rates. The idea here is that in most credit rationing models there is an implicit cap above which lenders will ration credit. As open-market rates rise, this cap is more likely to become binding, meaning that commercial loan rates will not fully respond to changes in open-market rates. Following this

approach, a number of authors, including Goldfeld (1966) and Jaffee (1971), have found that commercial loan rates are, in fact, slow to adjust to changes in open-market rates, and offer this as evidence in support of credit rationing.

Berger and Udell (1992), however, provide convincing evidence that, although commercial-loan rate stickiness does occur, it does so in a fashion that is inconsistent with information-based credit rationing models. In particular, they find that nearly half of the observed loan rate stickiness occurs for loans made to borrowers who are exploiting a previously contracted bank loan commitment. Such borrowers are precluded from rationing by contract. Furthermore, they show that the fraction of loans made under commitment actually decreases during times of credit market tightness, exactly the opposite of what one would expect should credit rationing be an important phenomenon.

Direct methods

Other authors have attempted to directly measure credit rationing using survey data to identify ‘rationed’ borrowers. For example, Cox and Jappelli (1990) and Chakravarty and Scott (1999) use data from the Survey of Consumer Finances (SCF) in which households are directly asked whether they recently have been denied credit or been unable to obtain as much credit as they requested. Although these articles purport to measure how some outside factor affects the likelihood of being rationed, it is not clear that borrowers who self-report being denied credit have, in fact, been ‘rationed’ in the Stiglitz–Weiss meaning of the term. After all, their denial of credit could simply reflect a failure to properly select into the right risk class in order to be approved, or the fact that the borrower was simply uncreditworthy at any interest rate.

With regard to business lending, Cressy (1996) uses a sample of new businesses that opened accounts with a major British bank to ascertain whether credit rationing affects the likelihood of business survival. He concludes that firms self-select for finance based on the entrepreneur’s human capital, implying that no credit rationing is occurring.

One strand of the empirical literature on credit rationing, broadly defined, focuses on whether differential mortgage loan denial rates between white and minority borrowers constitutes evidence of discrimination (a much cited reference is Munnell et al., 1996; Ross and Yinger, 2002, provide an excellent review of this literature). Although the

discrimination literature does not specifically focus on the question of whether borrowers are credit rationed, any conclusion that one group is denied loans at a greater rate than others after creditworthiness is controlled for would imply that a form of credit rationing is occurring. This ‘rationing’, however, is distinct from that in Stiglitz–Weiss because the borrowers are not observably identical, and the underlying cause of ‘rationing’ is either lender preferences (Becker, 1971) or some form of statistical discrimination (Calomiris, Kahn and Longhofer, 1994; Longhofer and Peters, 2005).

Evidence on ‘intermediary rationing’

In contrast to the limited evidence of traditional borrower credit rationing, there is a significant body of evidence supporting the idea that financial institutions are rationed by their depositors. In recent years, a large literature has developed examining the determinants of deposit withdrawal from individual banks, and a parallel literature has developed on systemic banking panics. These articles find that in circumstances where the condition of banks is perceived to have deteriorated, depositors withdraw funds rather than simply demand a higher interest rate on deposits (Calomiris and Mason, 2003; Calomiris and Wilson, 2004). The links between bank characteristics and deposit withdrawals observed in these and other similar studies suggest that deposit rationing is related to information and incentive problems, rather than just liquidity shocks to depositors, although such shocks may still play a role.

Final thoughts

It is worth noting that improvements in underwriting processes may have dramatically altered the practical impact of credit rationing in recent years. The use of risk-based pricing in consumer lending, including credit card loans and mortgages, has become widespread, reflecting the increased ability of lenders to distinguish between borrowers with different risk profiles (see, for example, Edelberg, 2003; Chomsisengphet and Pennington-Cross, 2006). The same is true for commercial credit markets, in which instruments such as junk bonds, senior-subordinated securitization issues, and the like serve to provide financial market access to broader classes of instruments, borrowers and risks. As a result, ‘sorting’ among borrowers overall has increased, and today there is

likely much less diversity in pools of ‘observably identical’ borrowers than there was when Stiglitz and Weiss first developed their model. While this suggests that in some markets credit rationing is a very different and perhaps less important phenomenon today than it once was, an important potential role remains for credit rationing, particularly as it pertains to financial allocations in emerging markets, the pricing of particularly opaque segments of the lending markets of developed economies, and the ways in which financial institutions may be rationed in response to shocks to their portfolios.

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See also Akerlof, George A.; banking crises; capital flight; credit markets in developing countries; Stiglitz, Joseph

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Index terms

adverse selection
 asset substitution
 asymmetric information
 availability doctrine

banking crises
bankruptcy
capital market misallocation
credit market discrimination
credit markets in developing countries
credit rationing
efficient allocation
financial intermediaries
financial repression
information economics
interest rate controls
limited liability
liquidity shocks
monetary policy transmission
moral hazard
rational expectations
separating contracts
usury