

**CREDIT MARKETS AND UNEMPLOYMENT IN THE SHORT RUN
AND IN THE LONG RUN***

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This paper examines the short run and long run responses of unemployment to credit and labor market shocks in a world in which both credit and labor market frictions keep the economy away from full employment. We examine the respective contributions to equilibrium unemployment of stochastic credit market frictions and of credit conditions. We examine the contrasting effects of financial liberalization in the short run and in the long run. [E44]

1. INTRODUCTION

Credit markets have come back to haunt macroeconomics. After many years of research, both theoretical and empirical, devoted to explaining unemployment by labor market imperfections, the focus has shifted to credit markets.¹ In an earlier paper (Wasmer-Weil 1999), we have introduced a simple double search model with stochastic frictions on labor and credit markets, and argued that it might serve as a useful tool to understand the impact of credit market imperfections on employment.²

A major limitation of our previous model was that it only characterized equilibrium on credit and labor markets in the long run, i.e., after enough time has elapsed to guarantee that the economic profits of starting a new firm or creating a new bank have been driven to zero by the entry of new entrepreneurs or of financiers. As a result, we could only tell one part of the story: equilibrium unemployment is higher in the long run with credit frictions than it is without

*This paper was prepared for the Second International Economic Journal Economics Annual, held in Seoul, Korea, on October 27, 2000. We are grateful to our discussants, No-snu Kwark and Wooheon Rhee, for their useful comments and suggestions.

¹While the theoretical literature has made significant progress, empirical results have failed to prove persuasively that unemployment is mainly a labor market phenomenon.

²See also the subsequent paper of Acemoglu (2000).

them — simply because the workings of the labor market are further slowed down by stochastic frictions on credit markets. More unemployment results, in the long run, from stochastic rationing and costly search in the credit market. This story is however incomplete because it leaves aside a potentially important channel of transmission from credit to labor market: in the short run, there might simply not be enough financiers in the economy.

To understand the distinction we are making between this latter effect and the former, it is useful to think of venture capitalists and budding entrepreneurs trying to meet in Silicon Valley. Knowing who is who is difficult, and getting together involves for both parties costly efforts that succeed stochastically. The effect on unemployment in Silicon Valley of these costs and of these stochastic frictions, given free entry in the venture capitalist market, is what we have described in Wasmer-Weil (1999); it should be viewed as a long run outcome. But there is a separate effect (think of it as a short run phenomenon) deriving from the fact that the number of brunches that can be organized on any given Sunday morning to bring venture capitalists and entrepreneurs together is limited in the short run by hotel infrastructure.

Finding out how short run constraints on the availability of credit lines (or, loosely speaking, “credit conditions”) impact unemployment in the short run, and how these effects compare with the long run influence of credit frictions on unemployment, constitutes the first objective of this paper. The second objective of the paper is to contrast the effects of “financial liberalization” in the short run and in the long run. We will show that while financial liberalization does lower unemployment in the long run, it is always contractionary in the short run! This rationalizes the often made claim that financial liberalization destabilizes the economy (see, for instance, Easterly, Islam and Stiglitz 1999).

Section 2 lays out the model, while section 3 compares its short-run and long-run properties. Section 4 evaluates quantitatively the respective contributions of short-run credit conditions and long-run stochastic credit rationing to equilibrium unemployment. Section 5 exhibits the destabilizing effects of financial liberalization. The conclusion outlines directions for future research.

2. THE MODEL

To analyze the short run and long run effects of credit market imperfections on unemployment, we use the symmetric search framework introduced in Wasmer-Weil (1999). In our earlier paper, we had shown that describing labor *and* credit market imperfections by means of matching functions yields a parsimonious, yet rich, macroeconomic model of unemployment.³ We briefly present that model,

³At the heart of this parsimony lie the simplifying assumptions that i) all financiers, all firms and all workers, are of equal quality; ii) it is costly for agents to search for each other; and iii) matches are “produced” randomly by matching functions.

which serves as our starting point here, and refer the reader to our earlier work for further details.

There are three types of agents: entrepreneurs, workers and financiers. Entrepreneurs have ideas, but need workers to transform them into output. However, labor market frictions make it difficult and costly for entrepreneurs and workers to meet. Following Pissarides (1990), we summarize these difficulty by a constant returns to scale matching function $h(\mathcal{U}, \mathcal{V})$ that “produces” a flow of matches between firms and workers with two “inputs:” job vacancies \mathcal{V} posted by firms, and available (i.e., unemployed) workers \mathcal{U} .⁴ Measuring *labor market tightness* (from the point of view of firms) by the ratio $\mathbf{q} = \mathcal{V} / \mathcal{U}$, the instantaneous probability that an entrepreneur finds a worker,

$$\frac{h(\mathcal{U}, \mathcal{V})}{\mathcal{V}} = h(\mathbf{q}^{-1}, 1) \equiv q(\mathbf{q}),$$

is, quite naturally, decreasing the tighter the labor market, i.e., the higher \mathbf{q} . The converse probability of a worker finding an entrepreneur, $\mathbf{q}q(\mathbf{q})$, is increasing in \mathbf{q} .

We assume that entrepreneurs do not have *any* financial resources of their own,⁵ so that they must find, before they start searching for a worker, a financier willing to pay for the cost of posting a job vacancy. Credit (or, if one prefers, financial) market frictions prevent the match between available financiers, or “credit lines,” and entrepreneurs from being instantaneous. As shown in Wasmer-Weil (1999), it is fruitful to model these financial frictions in a way that parallels the formalization of labor market frictions. We therefore postulate the existence of a *credit market matching function* $m(\mathcal{B}, \mathcal{F})$ that produces matches between available bankers \mathcal{B} and available firms \mathcal{F} .⁶ Measuring *credit market tightness* (again from the point of view of entrepreneurs) by $\mathbf{f} = \mathcal{F}/\mathcal{B}$, the probability that an entrepreneur finds a financier is

$$\frac{m(\mathcal{B}, \mathcal{F})}{\mathcal{F}} = m(\mathbf{f}^{-1}, 1) \equiv p(\mathbf{f}),$$

which is decreasing in credit market tightness \mathbf{f} . The converse probability that a financier finds a worker, $\mathbf{f}p(\mathbf{f})$, is of course increasing in \mathbf{f} .

⁴Marginal products in matching are positive but decreasing: $h_1 > 0$, $h_2 > 0$, $h_{11} < 0$, $h_{22} < 0$.

⁵This is an obvious simplification.

⁶We impose $m_1 > 0$, $m_2 > 0$, $m_{11} < 0$, $m_{22} < 0$.

A. The life of a firm

A firm goes through four successive phases of stochastic length:

Fund raising. In stage 0, prospective entrepreneurs are looking (at a flow sweat cost⁷ c) for a bank willing, in exchange for a future repayment, to finance the posting of a job vacancy, while financiers are searching for clients at a flow search cost k .

Recruitment. In stage 1, entrepreneurs have found a financier and are looking (at a flow search cost g borrowed from their financier) for the worker that will enable them to start operating their firm. Financier and entrepreneur bargain over the future flow repayment r to be made by the firm to the financier as long as the productive unit operates.

Creation. In stage 2, the firm has found a worker and is generating exogenous flow output y . As long as the productive unit operates, the firm pays its workers an exogenous wage w and repays r to its financier.⁸

Destruction. In the final stage 3, the match between firm and worker is destroyed. We assume that destruction is exogenous — i.e., that the transition from stage 2 to 3 occurs with an exogenous probability s .

Throughout, we assume that there are no commitment problems for financiers, firms or workers. All agents are risk neutral.

B. Optimality Conditions

Call B_i , ($i = 0, 1, 2, 3$), the value of a bank in the fund raising, staffing, creation and destruction phases, and r the (given) riskless rate. The Bellman equations describing the evolution of the value of the bank over these four stages are therefore:

$$rB_0 = -k + fp(\mathbf{f})(B_1 - B_0) + \dot{B}_0, \quad (1)$$

$$rB_1 = -g + q(\mathbf{q})(B_2 - B_1) + \dot{B}_1, \quad (2)$$

⁷We have assumed that entrepreneurs have no financial resources. For consistency, we therefore hypothesize that the cost c of searching for a financier is a time, or sweat, cost.

⁸We have solved the more complex case of endogenous wages in Wasmer-Weil (1999).

$$rB_2 = \mathbf{r} + s(B_3 - B_2) + \dot{B}_2. \quad (3)$$

We assume that value of a bank destroyed after the financier has met the entrepreneur is $B_3 = B_0$ — i.e., that *the termination of the relationship leads to the loss of the specificity of the entrepreneur-banker relationship*.

Furthermore, let F_i ($i = 0, 1, 2, 3$) denote the value of an entrepreneurial unit in the fund raising, staffing, creation and destruction phases. It evolves over the four stages of the life of the firm according to:

$$rF_0 = -c + p(\mathbf{f})(F_1 - F_0) + \dot{F}_0, \quad (4)$$

$$rF_1 = q(\mathbf{q})(F_2 - F_1) + \dot{F}_1, \quad (5)$$

$$rF_2 = y - \mathbf{w} - \mathbf{r} + s(F_3 - F_2) + \dot{F}_2. \quad (6)$$

The value of a firm destroyed after the entrepreneur has met the financier is assumed to be $F_3 = F_0$, reflecting again our assumption that the termination of the relation leads to loss of specificity.

C. Bargaining Between Financier and Entrepreneur

The contract between a financier and an entrepreneur is written after they meet. The terms of the contract are i) that the bank will finance the recruitment cost of the entrepreneurs (\mathbf{g} per unit of time) for as long as it takes to find a worker, and that, in exchange, ii) the entrepreneur will repay the financier a constant amount \mathbf{r} per unit of time for as long as the firm operates. Financier and entrepreneur share the surplus of their relationship according to a generalized Nash bargaining rule

$$\mathbf{r} = \arg \max (B_1 - B_0)^b (F_1 - F_0)^{1-b},$$

where $\mathbf{b} \in (0,1)$ measures the bargaining power of financiers in the credit relationship. It follows that the stipulated loan repayment \mathbf{r} must satisfy

$$\mathbf{b}(F_1 - F_0) = (1 - \mathbf{b})(B_1 - B_0). \quad (7)$$

We postpone to subsection 3.2 below the computation of \mathbf{r} and the analysis of equilibrium implications of equation 7.

3. EQUILIBRIUM

We now describe the *short run* equilibrium of this economy, which we define as the outcome of free entry into the entrepreneurial market (as in Pissarides 1990) combined with *no entry* in the financial market. This short run can be viewed as the extreme instance of a more general class of equilibria in which the number of financiers adjusts more slowly than all other processes in the economy. We will contrast below this short run equilibrium with the *long run* outcome of an economy in which there is free entry of firms *and* banks (which we have described in Wasmer-Weil 1999).

Normalize the number of workers to 1, so that $u = \mathcal{U}/1$ denotes the unemployment rate. The dynamic evolution of the stock of unemployed workers, firms and banks follows:

$$\dot{u} = s(1 - u) - q(\mathbf{q})u,$$

$$\dot{\mathcal{B}} = s(1 - u) - \mathbf{f}p(\mathbf{f})\mathcal{B},$$

$$\dot{\mathcal{V}} = \mathbf{f}p(\mathbf{f})\mathcal{B} - q(\mathbf{q})\mathcal{V}.$$

Unemployment rises when the number of workers losing their job because of exogenous separations, $s(1 - u)$, exceeds the number of workers who find jobs at any instant, $q(\mathbf{q})u$. The number of banks in the first stage of their life (i.e., of financiers searching for entrepreneurs) rises when the flow of banks losing their client because of exogenous separations, $s(1 - u)$, is larger than the flow of searching banks finding a partner firm, $\mathbf{f}p(\mathbf{f})\mathcal{B}$. Finally, the stock of job vacancies increases when the flow of new vacancies created by successful bank/firm matches, $\mathbf{f}p(\mathbf{f})\mathcal{B}$, exceeds the number of vacancies that get filled in at every instant, $q(\mathbf{q})\mathcal{V}$.

Free entry of firms brings to zero the value of an entering firm, so that

$$F_0 = 0 \tag{8}$$

in equilibrium. Moreover, if we abstract from very short run (and uninteresting) dynamics of u , \mathcal{B} and \mathcal{V} , we must also have $\dot{u} = \dot{\mathcal{B}} = \dot{\mathcal{V}} = 0$.⁹ Accordingly, we impose the flow equilibrium conditions

$$s(1 - u) = \mathbf{q}q(\mathbf{q})u = \mathbf{f}p(\mathbf{f})\mathcal{B}.^{10} \quad (10)$$

A. Credit Conditions

Call N the total number of banks — i.e., the sum of the number of financiers searching for a firm, of financiers matched with entrepreneurs who have not yet found a worker, and of financiers matched with firms who have found a worker. We will sometimes refer to N as *credit conditions*: it measures the availability, as opposed to the cost, of credit lines.¹¹ By definition, N is fixed in the short run, and it must equal the sum of the number of banks in stages 0, 1 and 2:

$$\mathcal{B} + \mathcal{V} + (1 - u) = N. \quad (10)$$

In equilibrium, the value of a “credit line” searching for a firm must be nonnegative:

$$B_0 \geq 0 \quad (11)$$

Otherwise, banks would find it profitable to exit the market.¹² This short run equilibrium condition should be contrasted with that of our previous long run model (Wasmer-Weil 1999), where we had $B_0 = 0$. Because of restricted entry, credit lines in search of firms now have positive value as long as the number total number of banks in the economy falls short of the number of banks that would operate under free entry. Our task is indeed to describe how B_0 depends, in equilibrium, on the total number of financiers N .

⁹We correspondingly also neglect the very short run dynamics of F_i and B_i , $i = 0, \dots, 3$.

¹⁰By definition of \mathbf{q} and using our normalization $u = \mathcal{U}$, $\mathcal{V} = \mathbf{q}\mathcal{U} = u$.

¹¹Alternative definitions of “credit conditions” are of course possible. Our definition is designed to highlight the importance of the *number*, rather than the *cost*, of available credit lines. We discuss in section 5 below the impact of the *cost* of credit lines under the label of “financial liberalization.”

¹²Although entry of banks is impossible, exit can occur instantaneously.

Combining equations (9) and (10), we obtain

PROPOSITION 1. *Credit and labor market tightness \mathbf{q} and \mathbf{f} satisfy the following condition:*

$$\frac{\mathbf{q}q(\mathbf{q})}{s + \mathbf{q}q(\mathbf{q})} \left(1 + \frac{s}{\mathbf{f}p(\mathbf{f})} \right) + \mathbf{q}s = N. \quad (12)$$

Given the fixed number of banks N , equation (12) expresses mathematically the short run constraint on the number of credit lines that must be satisfied in equilibrium. One can show that equation (12) defines an upward sloping locus of points in (\mathbf{q}, \mathbf{f}) space, which we call NN.¹³ When the labor market is tight (\mathbf{q} high), there are many firms, and consequently many banks, operating in stages 1 and 2. Since the number of banks cannot exceed N , there must accordingly be few banks in stage 0 (\mathbf{f} low) — whence the negative slope of the NN locus. As N rises, NN shifts down and to the right (*cf.* Figure 1): for given \mathbf{q} , the credit market need not be as tight, nor \mathbf{f} as high, if there are more financiers in the economy.

B. Financial Contracting

From the free entry condition for firms (8), which implies $\dot{F}_0 = 0$, and from the fund-raising stage value functions (1) and (4), it immediately follows that

$$B_1 - B_0 = \frac{k + rB_0}{\mathbf{f}p(\mathbf{f})}, \quad (13)$$

while

$$F_1 = \frac{c}{p(\mathbf{f})}. \quad (14)$$

¹³One can also show that curve NN goes through the origin and has a vertical asymptote at $\mathbf{q} = \mathbf{q}^a$, where \mathbf{q}^a is the solution of the equation $\mathbf{q}(s + q(\mathbf{q})) = N$. Thus, \mathbf{q}^a increases with N .

For a given B_0 , the equilibrium value of a (matched) financier is lower, while the value of a (matched) firm is higher in a less liquid credit market (higher \mathbf{f}), as financiers have to search less and firms more when there are more firms relative to banks.

Since the total surplus $(B_1 - B_0) + (F_1 - F_0)$ of the banking relationship is shared between financier and entrepreneur according to (7), we immediately conclude that

PROPOSITION 2. *Credit market tightness satisfies*

$$\mathbf{f} = \frac{1 - \mathbf{b}}{\mathbf{b}} \frac{k + rB_0}{c}. \quad (15)$$

PROOF: *Substitute (13) and (14) into (7).*

For given B_0 , the lower the flow cost k for financiers of looking for a suitable lender and the higher the flow cost c for entrepreneurs of searching for a banker, the lower \mathbf{f} (i.e., the higher the number of available financiers relative to the number of entrepreneurs raising funds). Moreover, the less profitable the sharing of the surplus of the credit relationship is to the bank (i.e., the lower \mathbf{b}), the tighter the credit market (the higher \mathbf{f}).

Proposition 2 was obtained by reading the banks' and the firms' Bellman equations backward in time starting from stage 1. By reading them instead forward from stage 1, we can characterize the equilibrium financial contract struck, according to the bargaining rule (7), between financiers and firms once they have met. The stronger the bargaining power of the bank relative to the entrepreneur, the larger the share of the firm's profits that it will claim. Indeed, we have:

PROPOSITION 3. *In equilibrium, the repayment flow from entrepreneur to financier is*

$$r/(r + s) = \mathbf{b}\Pi + (1 - \mathbf{b}) \left[\frac{\mathbf{g}}{q(\mathbf{q})} + \frac{r + q(\mathbf{q})}{q(\mathbf{q})} \Delta(\mathbf{q})B_0 \right]$$

where $\Delta(\mathbf{q}) = 1 - \{s/(r + s)\}\{q(\mathbf{q})/[r + q(\mathbf{q})]\} \geq 0$ and $\Pi = (y - \mathbf{w})/(r + s)$ represents the expected discounted value of profits before repayment of the debt.

PROOF: The proof is by forward substitution of the Bellman equations. From

equations (13), (14) and proposition 2, observe that free entry of banks and firms imposes the constancy of the value of the bank and of the firm in the fund-raising stage. Therefore, $\dot{B}_1 = \dot{F}_1 = 0$ in equilibrium. But then the Bellman equations in the recruitment stage, (2) and (5), imply that, in equilibrium,

$$B_1 - B_0 = \frac{-\mathbf{g} + q(\mathbf{q})B_2}{r + q(\mathbf{q})} - B_0 \quad (16)$$

and

$$F_1 - F_0 = \frac{q(\mathbf{q})F_2}{r + q(\mathbf{q})}. \quad (17)$$

Similarly, the “exit” equations $B_3 = B_0$ and $F_3 = F_0 = 0$ imply that $\dot{B}_2 = \dot{F}_2 = 0$, so that we conclude from equations (3) and (6) that

$$B_2 = \frac{\mathbf{r}}{r + s} + \frac{s}{r + s} B_0, \quad (18)$$

and from equations (5) and (6) that

$$F_2 = \frac{y - \mathbf{w} - \mathbf{r}}{r + s}. \quad (19)$$

By forward substitution of (18) into (16), and of (19) into (17), we find, using the (equilibrium) Nash bargaining condition $\mathbf{b}F_1 = (1 - \mathbf{b})B_1$, that the value of \mathbf{r} must be the one given in the proposition.

To interpret this proposition, rewrite \mathbf{r} as

$$\frac{\mathbf{r}}{r + s} \frac{q(\mathbf{q})}{r + q(\mathbf{q})} = \mathbf{b} \Pi \frac{q(\mathbf{q})}{r + q(\mathbf{q})} + (1 - \mathbf{b}) \left[\frac{\mathbf{g}}{r + q(\mathbf{q})} + \Delta(\mathbf{q})B_0 \right], \quad (20)$$

where we have dropped the argument of q for brevity.

The term on the left is the expected present discounted value, evaluated at the instant financier and entrepreneur meet, of the flow repayment from the entrepreneur to the financier between the random dates the firm will start and stop producing. The first term on the right is the expected present discounted value of profits, net of wages, generated by the firm while in operation — computed, again, from the perspective of the instant financier and entrepreneur meet. Finally, the second term on the right-hand side of (20) represents the expected present discounted value of the flow of funds loaned by the financier to the entrepreneur from the time they meet until the random time the firm finds a worker and starts producing, augmented by a term in $\Delta(\mathbf{q}) B_0 = B_0 - \{s/(r+s)\}\{q(\mathbf{q})/[r+q(\mathbf{q})]\} B_0 \geq 0$. This latter term is the sum of two effects, a positive one and a negative one. The positive effect, B_0 , reflects the fact that a higher B_0 reinforces the bargaining position of the banks by providing them a higher outside option. The negative term, discounted by the factors $\{s/(r+s)\}\{q(\mathbf{q})/[r+q(\mathbf{q})]\}$, is a pure size-of-the-cake effect: when the outside option of the banks raises, the total surplus to be shared goes down, which reduces the share going to bankers — but of course by an amount inferior to the first effect.

The characterizations of credit market tightness and of financial contracts provided by propositions 2 and 3 are of course incomplete, since we have not yet determined the equilibrium value of B_0 as a function of credit conditions N . This is the task we now take on.

C. Equilibrium in Credit and Labor Markets

To complete the computation of equilibrium, it suffices to remember that, because of the free entry of firms, the expected search costs that entrepreneurs incur by entering the credit market must equal in equilibrium the expected benefits that they derive from eventually striking out a financial relationship (i.e., $F_0 = 0$). Therefore:

PROPOSITION 4. Credit market tightness \mathbf{f} and labor market tightness \mathbf{q} satisfy

$$\frac{c}{p(\mathbf{f})} = (1 - \mathbf{b}) \frac{q(\mathbf{q})}{r + q(\mathbf{q})} \left\{ \Pi - \frac{\mathbf{g}}{q(\mathbf{q})} \right\} - (1 - \mathbf{b}) \Delta(\mathbf{q}) B_0. \quad (21)$$

PROOF: A straightforward extension of Wasmer and Weil (1999).

Given B_0 , equation (21) defines a downward sloping iso-value ($F_0 = 0$) locus in (\mathbf{q}, \mathbf{f}) space, depicting the trade-off for the entering firm between a tighter credit

market (which raises the expected cost of searching for a bank) and a looser labor market (which lowers the expected cost of finding a worker).

We can now put the pieces of the model together and show how equilibrium labor market tightness \mathbf{q} , credit market tightness \mathbf{f} , and the value of a credit line B_0 depend, in our short run equilibrium, on the number of financiers N .

Credit Constraints and Equilibrium

Remember that equation (12) describes, in (\mathbf{q}, \mathbf{f}) space, an upward sloping short run credit constraint curve NN whose position in the plane depends on N . Now, equations (15) and (20) can be combined to provide us, by eliminating B_0 from equations (15) and (20), with a second relation between \mathbf{q} and \mathbf{f} that subsumes the effects of both financial bargaining and free entry of firms. This latter curve, which we call AA, is downward sloping in (\mathbf{q}, \mathbf{f}) space with a vertical asymptote at $\mathbf{q} = 0$. Each point on the AA curve corresponds to a different value of B_0 . To the value $B_0 = 0$ that would prevail were there free entry of banks corresponds the long run equilibrium $E_{LR} = (\mathbf{q}_{LR}, \mathbf{f}_{LR}) = \{\mathbf{q}_{LR}, [(1 - \mathbf{b})/\mathbf{b}](k/c)\}$ described in Wasmer-Weil (1999). In the short run, however, with the total number of banks limited at N , equilibrium occurs at the intersection $E_{SR} = (\mathbf{q}_{SR}, \mathbf{f}_{SR})$ of the NN and AA curve, as described in Figure 1.

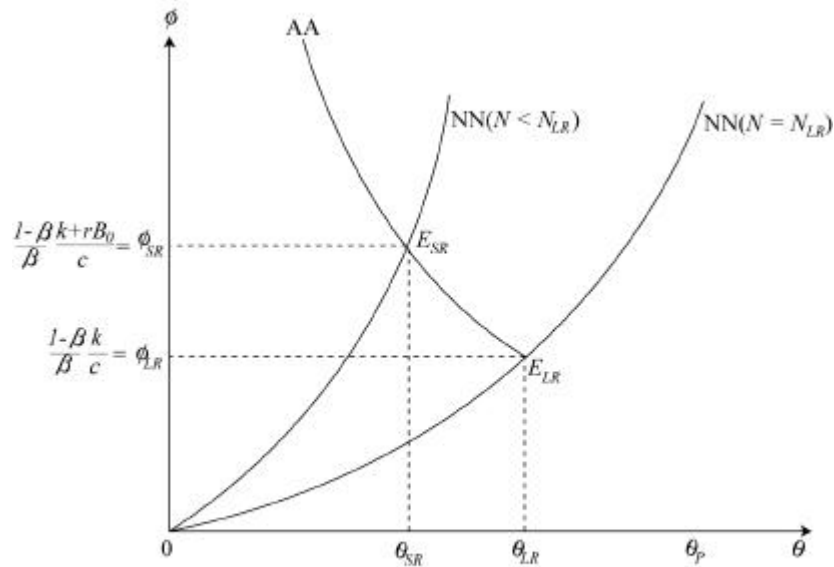


Figure 1. Equilibrium

Call N_{LR} the number of banks in the long run (i.e., the number of banks such that the NN curve intersects the AA curve at E_{LR}). If $N < N_{LR}$, the lack of financiers in the short run amplifies the effect of credit matching frictions by raising equilibrium credit tightness and slackening the labor market — thus leading to increased unemployment in the short run relative to the long run.¹⁴

Since (as shown in Wasmer-Weil 1999), there is less unemployment in the Pissarides equilibrium with no credit matching frictions (which we index by a subscript P) than in our long run equilibrium with credit matching frictions, we have $q_{SR} < q_{LR} < q_P$.

Credit Constraints and the Value of a Credit Line

Figure 2 provides an alternative representation of equilibrium. It depicts the negative equilibrium relationship between the value of a credit line B_θ and the number of banks N that results from changing N in Figure 1. Note that this relationship could be used to solve the model in quite a different way. If there were a fixed cost B_θ of setting up a bank, but free entry of both firms and banks, the equilibrium number of banks entering the market under such conditions could be derived by reading figure in reverse, i.e., by finding N as a function of B_θ .

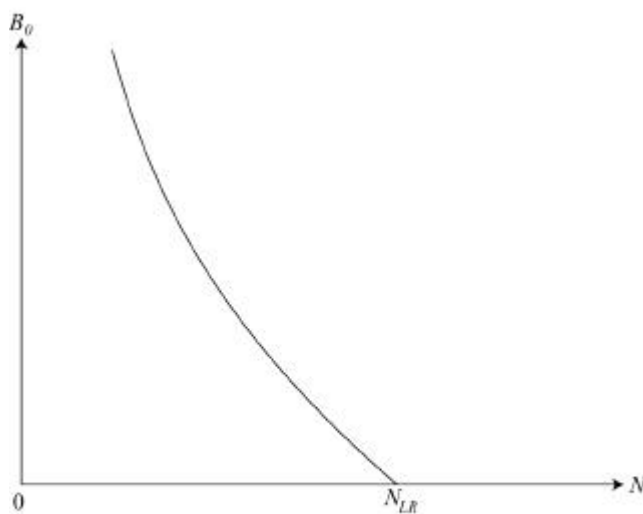


Figure 2. B_θ as a function of N

¹⁴If, on the other hand, the total number of banks is excessive in the short run, i.e., if $N > N_{LR}$, banks instantaneously exit the market to avoid losses ($B_\theta < 0$) until the number of remaining banks reaches N_{LR} and the value of a credit line returns to 0.

Internal Rate of Return

Finally, an indirect (and empirically relevant) measure of equilibrium market tightness is provided by the internal rate of return R on loans to the firms by the financiers. Define it as the interest rate that equalizes the expected discounted value of the loan $\mathbf{g}/[R + q(\mathbf{q}_{SR})]$ and the expected discounted repayment $\{q(\mathbf{q}_{SR})/[R + q(\mathbf{q}_{SR})]\}\{\mathbf{r}/(r + s)\}$. Using proposition 3, we find that the excess return on loans over the riskless rate is

$$R - r = (r + s) \left[\mathbf{b}\mathbf{m}^f + (1 - \mathbf{b})\mathbf{m}^i \right], \quad (22)$$

where

$$\mathbf{m}^i = q(\mathbf{q}_{SR}) / q(\mathbf{q}_P) - 1,$$

$$\mathbf{m}^f = \frac{r + q(\mathbf{q}_{SR})}{\mathbf{g}} \Delta(\mathbf{q}_P) B_0.$$

As in Wasmer-Weil (1999), \mathbf{m}^i is a measure of the distance between the Pissarides equilibrium without frictions in the credit market and our equilibrium: it is thus a measure of the effect of stochastic frictions in the credit market. The extra term \mathbf{m}^f is increasing in B_0 ; it reflects the additional effects on the credit market of credit conditions (restricted entry of financiers). The excess return $R - r$ on business loans is a weighted average, according to the financiers' bargaining power \mathbf{b} , of these two measures. Accordingly, it is increasing in both \mathbf{m}^i (credit market imperfections) and in \mathbf{m}^f (credit rationing due to entry costs). Finally, an increase in the destruction probability s increases R by decreasing the expected length of the repayment period.

4. STOCHASTIC FRICTIONS VS CREDIT CONDITIONS

The qualitative description of the equilibrium we have just provided leads to several (related) quantitative questions. What is the relative contribution to departures away from the Pissarides equilibrium without credit frictions of

stochastic frictions in the credit market and of limited entry of financiers? Are high search costs most damaging, or is limited entry the main problem? How sensitive is the value of a bank to the number of banks?

To answer these questions, and understand the long run and short run determinants of unemployment in an economy with credit frictions, we now parametrize our model.

A. Long Run

We adopt, for this numerical exercise,¹⁵ the following functional forms for the labor and credit matching functions:

$$q(\mathbf{q}) = q_0 \mathbf{q}^h,$$

$$p(\mathbf{f}) = p_0 \mathbf{f}^e,$$

where q_0 and p_0 are (scale) measures of the intensity of the matches in labor and credit markets.

Table 1 (drawn from Wasmer-Weil 1999) reports long run equilibrium unemployment rates in four different cases that correspond to all possible combinations of “high” and “low” credit and labor market frictions for the base parameters $\mathbf{b} = 0.5$, $r = 0.05$, $\mathbf{g} = 1.5$, $c = k = 0.35$, $y = 1$, $\mathbf{w} = 0.66$, $\mathbf{h} = \mathbf{e} = 0.5$, and $s = 0.15$. In all four cases, free entry imposes $B_0 = 0$ so that $N = N_{LR}$.

Table 1. Long Run Unemployment

$u(\%)$	Credit	$p_0 = +\infty$	$p_0 = 1$
Labor			
$q_0 = 1.5$		5.6	9.3
$q_0 = 1.1$		9.9	16.0

Traditional explanations of unemployment (purely based on labor market imperfections) rely on a high degree of mismatch on the labor market, as measured by q_0 , to explain high unemployment: this is the $p_0 = +\infty$ column of our table. Our model suggests an alternative perspective, provided instead by the $q_0 = 1.5$ row of Table 1: high unemployment could well be the result of a combination of labor and credit frictions that are both moderate.

¹⁵Our theoretical analysis only requires constant returns to scale.

The parameters corresponding to the northeastern cell of the table lead to plausible equilibrium magnitudes:

- It takes about one year to find a credit line, and eight months to recruit a worker.
- Total pecuniary credit costs,¹⁶ measured by $k/[\mathbf{f}p(\mathbf{f})]$, represent 7% of total discounted output $y/(r + s)$. Equivalently, flow pecuniary credit costs $\mathcal{B}k$ represent 5.3% of annual GDP.¹⁷
- The internal rate of return R is 22.4% a year, i.e. an excess return of 17.4% over the riskless rate $r = 5\%$.¹⁸
- The equilibrium run number of banks in the long run (i.e., under free entry) is $N_{LR} = 1.13$. This means that for each firm operating stage 2, there are $(\mathcal{B} + \mathcal{V})/(I - u) = [N_{LR} - (I - u)]/(I - u) = .25$ credit lines in activity (i.e., credit lines operating either as “virtual” financiers in the search stage 0 or in the financing stage 1).

B. Short Run

We now study the short run effects of credit conditions, i.e., the quantitative impact of restricting the number of credit lines N below their long run values *for given search costs*. Our objective is to disentangle the long run effect of stochastic frictions (exhibited in Table 1) from the short run impact of limited credit availability.

Table 2 shows us what happens to equilibrium when N is below its long run level (the last column corresponds to the long run equilibrium of the economy depicted in the northeastern cell of 1):

Table 2. The Effect of Credit Conditions N

N	0.9	0.95	1	1.05	1.1	1.13
$u_{SR}(\%)$	22.7	19.20	15.90	13.00	10.60	9.3
\mathbf{f}_{SR}	1.3	1.26	1.20	1.14	1.06	1.0
B_0	2.1	1.83	1.45	0.98	0.41	0.0

Short run unemployment is quite sensitive to credit conditions N . For

¹⁶I.e., excluding the “sweat cost” for the entrepreneur of finding a financier.

¹⁷Using the formula $\mathcal{B}\mathbf{f}p(\mathbf{f}) = (I - u)s$, we get $\mathcal{B}k/[y(I - u)] = [sk/y] \mathbf{f}p(\mathbf{f}) = [.15 \times .35/1] \times 1 = 5.3\%$.

¹⁸We view this as a significant improvement over the standard calibration of the matching model without credit frictions that predicts a zero excess return.

instance unemployment rises from 9.3% to 10.6% if number of banks falls to 1.1 down from its long run value of 1.13. This corresponds to the ratio $(\mathcal{B} + \mathcal{V})/(I - u) = [N - (I - u)]/(I - u)$ of firms in stage 2 to financiers in stage 0 or 1 falling to 23% (as compared to 25% in the long run) — i.e., to a semi-elasticity of the number of banks with respect unemployment of -2 near the long run equilibrium. Credit crunches, or sudden disappearance of credit lines, can thus lead, for plausible search costs, to significant short-run unemployment jumps.

5. FINANCIAL LIBERALIZATION

The large short-run impact of small changes in credit conditions (i.e., in the number of available banks) is a remarkable result of our model. We now exhibit a second noteworthy result about the adjustment path of the economy in response to “financial liberalization” — a term which hereafter refers to a decrease in the search cost k of banks (as opposed to “credit conditions” which referred to the number of credit lines). This “liberalization” should be understood broadly as any reform that makes it cheaper for financiers to find entrepreneurs, either by decreasing pecuniary costs directly, by deregulating the financial sector, or by removing red tape.

There is a sharp contrast between the long-run and short-run effects of financial liberalization. In the long run, as shown in our earlier paper (Wasmer-Weil 1999), a decrease in k always tightens the labor market: lower search costs for banks attract more financiers into the financial markets, who themselves attracts more entrepreneurs, which results in a lower unemployment rate.

Table 3. Financial Liberalization

k	Short run ($N = 1.83$)			Long run ($B_0 = 0$)		
	u	f	B_0	u	f	N
0.35	9.28	1.00	0.00	9.28	1.00	1.13
0.30	9.62	0.90	0.27	8.85	0.89	1.15
0.25	10.00	0.79	0.57	8.42	0.71	1.18
0.15	11.00	0.60	1.23	7.56	0.43	1.25
0.05	12.70	0.42	2.00	6.57	0.14	1.43
0.00	14.00	0.35	2.44	5.55	0	∞

Things are quite different in the short run. The free entry of banks that is at the heart of the expansionary long run effects of a lower k is now blocked. With fixed N , lowering k increases the value of existing banks B_0 instead of attracting

more banks. This strengthens the bargaining power of banks in their negotiation with firms (as entrepreneurs are now facing a given number of banks that have more favorable outside options!). As a result,¹⁹ repayment r from firms to banks rises. This deterioration of the firms' financial condition leads some entrepreneurs to leave the credit market. This in turn results in higher unemployment.²⁰ Were k reduced to zero, unemployment would fall to 5.5% in the long run (the Pissarides-Mortensen equilibrium rate of unemployment without credit market frictions for this parametrization) but would first shoot to 14% in the short run!

We conclude that the unemployment rate overshoots its long run value: a lower k first raises, but then eventually lowers equilibrium unemployment, as depicted numerically in Table 3. This rationalizes the widely held suspicion, advanced for instance by Easterly, Islam and Stiglitz (1999), that financial liberalization might well destabilize the economy.²¹ The mechanism at play is straightforward, and it is quite general: reducing the incumbents' costs when, in the short run, all barriers to entry have not yet been removed, only increases the incumbents' rents! Consequently, financial reform when there are obstacles to entry raises short run unemployment.

6. CONCLUSION

This paper has examined the short run and long run response of unemployment to credit and labor market shocks in a world in which both credit and labor market frictions keep the economy away from full employment. We have shown that unemployment is amplified, relative to the Pissarides (1990) world of perfect credit markets, by two factors. First, stochastic frictions on the credit market hinder job creation, even when there is free entry in banking, and thus raise equilibrium unemployment (this is what we have called the long run equilibrium). Second, tight credit conditions, which we interpret to mean the unavailability of enough credit lines to sustain the long run equilibrium with free entry of banks, further slacken the labor market.

From an empirical point of view, this means that credit markets impact unemployment either directly (how costly and difficult is it for venture capitalists and entrepreneurs to find each other and have brunch together on Sunday morning?) or indirectly (are there enough venture capitalists in the economy?). Our quantitative exercise shows that both factors might matter very much for unemployment. The challenge is of course to assess empirically the respective contributions of each factor to unemployment, both across countries and over the

¹⁹See proposition 3.

²⁰Formally, one can show that the AA curve shifts down and to the left when k falls.

²¹Because of free entry in the entrepreneurial sector, there is no such contrast between long run and short run effects of decreasing the search cost c of entrepreneurs.

business cycles — a task we will take on in further work. Regardless of the outcome of this future investigation, the current paper suggests looking with extreme care at financial markets, broadly defined, to understand unemployment.

Finally, our model suggests that episodes of financial liberalization (by which we mean a reduction in the costs of operating a bank) should result, if they are not accompanied right away by increased competition in the banking sector, in an upward, and then downward swing in unemployment — a prediction that can be tested empirically.

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