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Credit market imperfections and persistent unemployment☆

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Received ▮▮

Abstract

This paper develops the thesis that credit market frictions may be an important contributor to high unemployment in Europe. When a change in the technological regime necessitates the creation of new firms, this can happen relatively rapidly in the U.S. where credit markets function efficiently. In contrast, in Europe, job creation is constrained by credit market imperfections, so unemployment rises and remains high for an extended period. The data show that there has not been slower growth in the most credit dependent industries in Europe relative to the U.S., but the share of employment in these industries is lower than in the U.S. This suggests that although credit market imperfections are unlikely to have been the major cause of the increase in European unemployment, they may have played some role in limiting European employment growth. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

The problems facing European labor markets are now well known, and a large literature tries to explain how unemployment could be so high for such a long time in a number of European economies (see, for example, Layard et. al.,

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1991; Bean, 1994 or Nickell, 1997 for reviews). Most economists believe that the rigid labor market institutions of European economies are responsible for the high rates of European unemployment. In a recent review Siebert put this in a stark form: '*Labor Market Rigidities*: *At the Root of Unemployment in Europe*'.

Although the idea that labor market rigidities cause unemployment is plausible, there have been only a few major changes in the institutions of European economies over the 1970s to lead to the high rates of unemployment of the 1980s and 1990s (see, for example, Nickell, 1997). This assessment of the state of literature on unemployment suggests that we need new ways of looking at the unemployment problem.

This paper makes a preliminary attempt at developing an alternative hypothesis.[1] I develop the thesis that differences in the credit markets may have played an important role in the increase in European unemployment. In addition to illustrating the importance of credit market problems in causing unemployment differences, the model presented here is a simple starting point for analyzing the joint behavior of access to credit and labor market prices.

Credit markets differ in many dimensions between the U.S. and Europe. In the U.S., stock market activity, venture capital finance, and funding of small businesses appear more important than in Europe. In contrast, in Europe, lending by large banks appear to play a more prominent role. Most measures in fact show that credit markets are more developed in the U.S. than in Europe (e.g. Rajan and Zingales, 1998). I will abstract from the many complexities and presume that the U.S. credit market is more flexible in providing loans to new firms. The main argument in the paper is that this difference in the way in which credit markets respond to new opportunities is an important contributor to the different employment performances in these economies.

Even though, as I show below, coordination failures can lead to a high unemployment equilibrium in an economy with imperfect credit markets, differences in credit markets will often not have large effects on steady state unemployment rates, because entrepreneurs who need credit will get it eventually. However, in the medium run, the failure to channel money to the correct entrepreneurs can have a large effect on unemployment. To capture these issues, I think of the U.S. and Europe during the 1950s and 1960s as characterized by the steady state of two economies, one with better credit markets than the other. Unemployment in both economies will be low to start with. I will then consider

[1] Previously, Krueger and Pischke (1997) argued that differences in product market competition could be important in understanding European unemployment. A recent paper by Wasmer and Weil (2000) provides a simple model combining labor and credit market imperfections, and shows that credit market imperfections tend to increase unemployment. Another recent paper by Blanchard and Giavazzi (2000) emphasizes the interaction between product markets and labor markets, while Bertrand and Kramartz (2000) investigate the impact of the zoning restrictions in France on employment creation.

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the response of these two economies to a common shock: the arrival of a new set of technologies. The main result is that the economy with better credit markets will respond to the arrival of new technologies without an increase in unemployment. In contrast, in the economy with worse credit markets (the model equivalent of Europe), the change in technologies can have a persistent adverse effect on unemployment because, in the absence of efficient credit markets, the agents who need to have the cash to start up new businesses cannot borrow the necessary funds. They have to accumulate this cash through their own savings (or rely on more expensive alternative sources of finance, such as borrowing from their family), so the economy goes through an extended period of depressed job creation. Accumulation by potential entrepreneurs may be made even more difficult by the fact that in a depressed labor market, unemployment will be high and wages low, so earnings for many individuals will be low. So a set of self-reinforcing factors slow down the transition of the economy to low unemployment for an extended period.

The idea that there has been a change in technology (or the pattern of comparative advantage), and that the U.S. has adapted to this change faster than Europe is plausible. Many commentators think that the engines of growth of the U.S. economy today is not companies like Ford or GM, but new firms like Microsoft and Intel, which require different skills, and perhaps different types of financial arrangements. Nevertheless, more empirical evidence is necessary to assess the importance of these factors in explaining European unemployment. As a preliminary attempt I look at the evolution of sectoral employment across OECD countries. I classify manufacturing industries into high, medium and low credit-dependent categories following Rajan and Zingales (1998), and look at whether the most credit-dependent industries, such as electronics and office and computer equipment, grew slower in Europe since 1970. I find no evidence for a major differential growth across these sectors. This result is not encouraging for the credit market story. Nevertheless, I find that the fraction of employment in the most credit-dependent industries is higher in the U.S., suggesting that differences in credit markets may be playing some role in constraining employment creation in Europe. Furthermore, it might be argued that what is more relevant is not growth of specific industries, but job creation by new firms within all industries. The data I have do not enable an investigation of whether there has been less employment creation by new firms in Europe than the U.S. over the past 25 years. This is an interesting research area for future work.

2. The model

Consider an economy that consists of a mass 1 of agents who live for one period, and are replaced by an offspring. Each agent can become an entrepreneur, a worker, or remain unemployed. Production takes place in

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worker–entrepreneur pairs. Agents differ in their skills. Let $\alpha_{i,t}$ be the type of agent i of generation t. Then, if agent i becomes an entrepreneur and hires worker j with type $\alpha_{j,t}$, they produce

$$3\alpha_{i,t} + \alpha_{j,t}. \tag{1}$$

This production function implies that skills of both the entrepreneur and the worker matter for productivity, but that of the entrepreneur is more important.[2] I assume that the distribution of α in the population is given by $G_t(\alpha)$ with lower support $\alpha_{\min}$ and upper support $\alpha^{\max}$.

All agents have preferences given by

$$(1-s)^{1-s}s^s C_{i,t}^{1-s} B_{i,t}^s - e_{i,t},$$

where C is consumption, B is bequest left to their offspring, and e is cost of effort. This utility function is convenient as it implies a constant saving rate, s. It also implies that the indirect utility function is linear, in particular $U(y) = y - e$, where y is income, so that all agents are risk neutral.

I also assume that the cost of effort is given as follows:

$$e = \begin{cases} \gamma_{\mathrm{W}} & \text{if worker and exert effort,} \\ 0 & \text{if worker and exert no effort,} \\ \gamma_{\mathrm{E}} & \text{if entrepreneur,} \end{cases}$$

where $\gamma_{\mathrm{W}} < \gamma_{\mathrm{E}}$. For future use, I define $\bar{\Delta}\gamma \equiv (\gamma_{\mathrm{E}} - \gamma_{\mathrm{W}})/2$. The effort choice of an individual is his private information. In contrast, the skill level of a worker is common knowledge.

For the results, it is important that the ability to perform entrepreneurial tasks are correlated across generations. I adopt a particularly simple form of this here, and assume that the type of agents do not change across generations, i.e., $\alpha_{i,t} = \alpha_{i,t-1}$ for all i.

The fact that workers need to exert costly effort that is not observed by others introduces a moral hazard problem. Workers need to be induced to exert effort through monetary incentives. I assume that if the worker does not exert effort, output will be high with probability q, and 0 with probability $1-q$. In contrast, if he exerts effort, output will be high with probability 1. The wage contract of a worker of type α has to encourage him to exert effort as in the standard efficiency wage model. I assume that negative wages are not possible, so $w(\alpha) \geq 0$. Since all agents are risk neutral, a worker who produces no output will get a zero wage. Therefore, the utility to shirking (not exerting effort) is $qw(\alpha)$ whereas the utility to exerting effort is $w(\alpha) - e$. This implies that to encourage

[2] The fact that the productivity of the entrepreneur is three times more important than that of the worker is to simplify some of the expressions below.

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effort, the wage, $w(\alpha)$, needs to be greater than

$$v \equiv (1-q)^{-1}\gamma_{\mathrm{W}}.$$

I assume that it is always in the interest of the entrepreneurs to encourage high effort. Hence, there is an incentive compatibility constraint (the equivalent of the no-shirking condition in the Shapiro and Stiglitz, 1984) which requires that wages for all possible types of workers satisfy

$$w(\alpha) \geq v. \tag{IC}$$

Finally, to become an entrepreneur, an individual needs an investment of $2K$.

The exact timing of events is as follows. At the beginning of the period, each agent decides to become an entrepreneur or a worker. If there is a credit market, entrepreneurs borrow the necessary funds, otherwise they have to use their own wealth. Entrepreneurs hire workers, production takes place, and they pay back the loans. Finally, consumption and bequest decisions are made. The labor market is Walrasian except for the presence of the moral hazard constraint (see, e.g., Acemoglu and Newman, 1997).

Since there is no discounting within a period, an entrepreneur who borrows an amount $2K$ at the beginning of the period has to pay back $2K$. So the utility of an entrepreneur of type α employing a worker of type α' as a function of the wage, $w(\alpha)$, is

$$U_{\mathrm{E}}(\alpha,\alpha') = 3\alpha + \alpha' - w(\alpha') - 2K - \gamma_{\mathrm{E}}, \tag{2}$$

where $3\alpha + \alpha'$ is the revenue that this employment relationship generates, $2K$ is the cost of capital, and γ_{E} is the effort cost. Since the labor market is competitive, in equilibrium an entrepreneur has to obtain the same level of profits from hiring two different workers. Therefore, $U_{\mathrm{E}}(\alpha,\alpha') = U_{\mathrm{E}}(\alpha,\alpha'')$, for all α' and α'' that are workers. This implies that the equilibrium wage contract has to take the simple linear form

$$w(\alpha') = w^* + \alpha', \tag{3}$$

where the constant term, w^* will adjust to clear the market. The incentive compatibility constraint, (IC), imposes a wage floor and implies that workers with $w^* + \alpha' \leq v$, i.e., with

$$\alpha' \leq \underline{\alpha} \equiv v - w^*, \tag{4}$$

will be unemployed. Intuitively, their contribution to the revenues of the firm falls short of the wage that they have to be paid to solve the moral hazard problem.

Along the equilibrium path, all employed workers exert effort, so the utility to becoming a worker for an agent with $\alpha' \geq v - w^*$ is

$$U_W(\alpha') = w^* + \alpha' - \gamma_{\mathrm{W}}. \tag{5}$$

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Combining Eqs. (2) and (5), we obtain that all individuals with skill level greater than

$$\alpha^* \equiv w^* + K + \Delta\gamma \tag{6}$$

would like to become entrepreneurs. Whether they can do so or not will depend on the availability of credit.[3]

3. Equilibrium without credit market frictions

The equilibrium with credit market frictions is relatively easy to characterize since all agents who want to become an entrepreneur can obtain finance. Let me define the wage function that is consistent with full employment, $w^m(\alpha) = w^m + \alpha$, in the absence of credit market frictions. Let α^m be the median of the distribution of α (i.e., $G(\alpha^m) = 1/2$). For full employment, half of the agents need to become entrepreneurs. Without credit market frictions, this implies that all agents with α greater than α^m should become entrepreneurs. Hence, the median agent should be indifferent between entrepreneurship and working for the equilibrium wage, $w(\alpha^m) = w^m + \alpha^m$. Therefore, the full employment equilibrium wage function must satisfy

$$w^m = \alpha^m - K - \Delta\gamma.$$

Since my focus is on the interaction between credit market frictions and unemployment, I impose that the lower support of the ability distribution, $\alpha_{\min}$, is less than w^m:

Assumption 1. $\alpha_{\min} < w_m$, which implies that full employment will not be an equilibrium.

Equilibrium is now characterized by a cutoff level of ability $\underline{\alpha}$ satisfying Eq. (4) to become a worker, a cutoff level of ability α^* for entrepreneurship that satisfies Eq. (6), the wage function (3), and a market clearing condition. This market clearing condition requires that the number of entrepreneurs is equal to the number of workers, or

$$1 - G(\alpha^*) = G(\alpha^*) - G(\underline{\alpha}), \tag{7}$$

where $1 - G(\alpha^*)$ is the number of agents with ability greater than the cutoff level, α^*, who become entrepreneurs, and $G(\alpha^*) - G(\underline{\alpha})$ is the number of agents who

[3] It is also possible that workers with ability less than $\underline{\alpha}$, who cannot become workers because of the wage constraint, might want to become entrepreneurs. I assume that $3\underline{\alpha} - w^* - 2K - \gamma_E < 0$, which rules this possibility out. So workers with low ability will be unemployed.

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are not skilled enough to be entrepreneurs, but have a sufficient skill level to be employed. Eq. (7) is a simple supply equals demand condition. The LHS is the demand for labor, and since α^* is increasing in w^*, demand falls as the price of labor increases. The RHS is the supply of labor, which is a strictly increasing function of w^*. Fig. 1 shows the determination of the unique equilibrium wage function, i.e., w^*. Once w^* is determined, the unemployment level is given by $G(v - w^*)$.

Proposition 1. There exists a unique steady state equilibrium characterized by $(\underline{\alpha},\alpha^*, w^*)$ *given by Eqs.* (4), (6), *and* (7). *In this equilibrium, all agents with skill level greater than* α^* *become entrepreneurs, all agents with skill level* $\alpha' \in [\underline{\alpha},\alpha^*]$ *become workers and receive a wage* $w(\alpha') = w^* + \alpha'$ *and all agents with skill level* $\alpha < \underline{\alpha}$ *are unemployed.*

The comparative statics of this equilibrium are straightforward, and can be obtained using Fig. 1. Increases in K or $\Delta\gamma$ make entrepreneurship less attractive, shift both the supply and demand curves down to the broken curves, and lead to a lower equilibrium wage intercept w^{**}. As a result, both α^* and $\underline{\alpha}$ increase, so there are fewer entrepreneurs, and more unemployed workers.

It is useful to characterize the steady state wealth distribution, even though the wealth distribution does not affect the equilibrium allocation in this economy without credit market frictions. Entrepreneur α will leave bequest of $B^e_{t+1}(\alpha) = s(B^e_t(\alpha) + 3\alpha - w^* - 2K)$ since he received a bequest of $B^e_t(\alpha)$ from his parent, invested $2K$, paid a wage of $w^* + \alpha'$ for a worker of ability α', and produced $3\alpha + \alpha'$. He consumes a fraction $1 - s$ of this, and leaves a fraction s as bequest. In steady state, $B^e_t(\alpha) = B^e_{t+1}(\alpha)$, so an entrepreneur of type α will have wealth $B^e(\alpha) = s(3\alpha - w^* - 2K)/(1 - s)$.

The steady state wealth distribution for workers, i.e. those with ability $\alpha \in [\underline{\alpha},\alpha^*]$, is given similarly. In particular, $B^w_{t+1}(\alpha) = s(B^w_t(\alpha) + \alpha + w^*)$. So $B^w(\alpha) = s(\alpha + w^*)/(1 - s)$. Finally, those workers with ability $\alpha < \underline{\alpha}$ will be unemployed, therefore their steady state wealth level will be $B^u = 0$.

4. Equilibrium with credit market frictions

Without credit market frictions, equilibrium prices determine the distribution of wealth and are not influenced by the distribution of wealth (i.e., the system is block-recursive). In contrast, in an economy with credit market frictions, the equilibrium depends on the wealth level of individuals with high skill, who need to undertake the up-front investment $2K$. This feedback raises the possibility of multiple steady state equilibria and richer dynamics.

Here I assume an extreme form of credit market frictions: there is no borrowing (e.g., an individual could runaway with the money he has borrowed without

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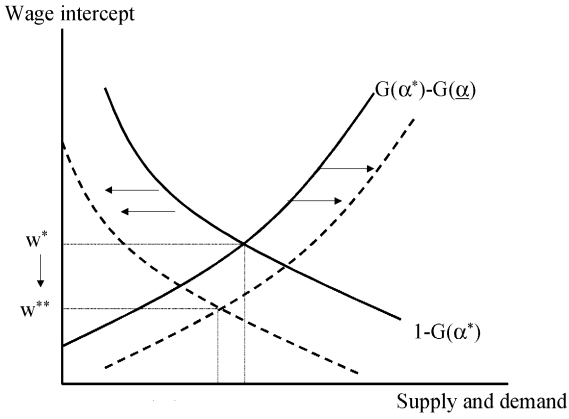

Fig. 1. The determination of equilibrium wage level w^*, and comparative statics in response to an increase in $\Delta\gamma$ of K.

any risk of being caught). In this case, we need to determine the equilibrium allocation jointly with the steady state wealth distribution. Let me denote the steady state wealth distribution by $F(b \mid \alpha)$, i.e. this is the fraction of workers with ability α who have wealth level less than b.

Then, the market clearing condition in this economy with credit market frictions is

$$\int_{K+\Delta\gamma+w^c} \rho(\alpha)\,\mathrm{d}G(\alpha) = \int_{K+\Delta\gamma+w^c} (1-\rho(\alpha))\,\mathrm{d}G(\alpha) + G(K+\Delta\gamma+w^c) - G(v-w^c), \tag{8}$$

where w^c is the constant in the equilibrium wage function $w^c(\alpha') = w^c + \alpha'$, and $\rho(\alpha) = 1 - F(2K \mid \alpha)$ is the fraction of agents with skill level α who can afford to become an entrepreneur, i.e. have wealth greater than $2K$. In expression (8), $\int_{K+\Delta\gamma+w^c} \rho(\alpha)\,\mathrm{d}G(\alpha)$ is the fraction of agents who have skill level greater than $K + \Delta\gamma + w^c$ and have a wealth greater than $2K$. So these agents like and can afford to become entrepreneurs. The remainder become workers except those with skill level less than $v - w^c$, who cannot be employed profitably.

Assumption 2. $s(\alpha^* + w^*)/(1-s) > 2K$.

This assumption ensures that in an allocation corresponding to the equilibrium of the economy with no credit market frictions, a worker with skill level α^* can accumulate enough wealth to eventually become an entrepreneur. So in the neighborhood of the equilibrium of Proposition 1 (i.e. without credit market

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problems), those agents who need money to become entrepreneurs can accumulate this money by saving. This implies

Proposition 2. There exists a steady state equilibrium identical to that described in Proposition 1.

In contrast to the economy without credit market frictions, the steady state equilibrium is no longer unique: there can now exist other steady state equilibria. I will give an example to illustrate this point. Consider the following situation in which only a fraction λ of agents with skill level greater than $K + \Delta\gamma + w^{c}$ have enough wealth to become an entrepreneur. Then, the equilibrium condition can be written as

$$2\lambda \int_{K+\Delta\gamma+w^{b}} \mathrm{d}G(\alpha) + G(v - w^{b}) = 1.$$

where w^{b} is the constant in the wage function. A lower level of λ implies a lower equilibrium wage, and moreover as $\lambda \to 0$, $w^{b} \to v - \alpha^{\max}$. Hence, as long as the upper support of the distribution of skills, $\alpha^{\max}$, is not very high (i.e., $\alpha^{\max} < (1 - s)2K/s$), we can always find a level of λ such that the implied wage level w^{b} satisfies $s(\alpha^{\max} + w^{b})/(1 - s) \leq 2K$. Then no additional agent can accumulate enough wealth to become an entrepreneur, and the economy is stuck with only a small fraction of entrepreneurs (equal to a fraction $\lambda\int_{K+\Delta\gamma+w^{b}} \mathrm{d}G(\alpha)$ of the population). Therefore, with credit market frictions, there can exist other steady state equilibria with higher unemployment and lower wages than the equilibrium characterized in Proposition 2. Intuitively, another steady state equilibrium exists because when only a few of the potential entrepreneurs have enough wealth, there is a limited demand for labor, and this depresses wages. With depressed wages, it is harder for potential entrepreneurs to accumulate enough wealth to finance their investments, and in fact, as the above example demonstrates, they may never be able to do so, leading to another steady state equilibrium with greater unemployment and lower wages.[4] This intuition is very similar to the reasoning for multiplicity of steady states in the Banerjee and Newman (1993) model of occupational choice. There, too, different wealth distributions can be self-sustaining because the equilibrium wage rate depends on the distribution of wealth.

[4] In terms of Fig. 1, this corresponds to the demand for labor being an upward sloping curve because when wages are low, potential entrepreneurs cannot accumulate the necessary funds to hire workers. As a result, there can be multiple intersections of supply and demand.

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5. Change in technology

I now discuss how economies with and without credit market frictions respond to a change in technology. I consider a very simple shift in the distribution of skills, modifying the pattern of comparative advantage in entrepreneurship. In particular, suppose that $G(\cdot)$ takes the following specific form: a fraction $1-2\phi-\kappa$ of agents have a distribution $F(\alpha)$ with upper support α_4, a fraction ϕ have ability α_1, and another fraction ϕ have skill level α_3, and the fraction κ have skill α_2. I assume that

$$\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4 \quad \text{and} \quad \tfrac{1}{2} > \kappa > 2\phi.$$

Two economies, one with and the other without credit market frictions, are in the minimum-unemployment steady state equilibrium (i.e., equivalent to that characterized by Propositions 1 and 2). In particular, I also assume that $\alpha_1 > \alpha_2 > \alpha^* > \alpha_3 > \underline{\alpha}$, so the agents with skill level α_1 and α_2 will become entrepreneurs. This implies that an agent with skill level α_2 has to be indifferent between entrepreneurship and working for a wage. So the equilibrium wage function, $\hat{w}(\alpha) = \hat{w} + \alpha$, is

$$\hat{w} = \alpha_2 - K - \Delta\gamma. \tag{9}$$

Using this, I also obtain that $\underline{\alpha} = v - \hat{w}$, so the unemployment is equal to

$$U = (1-2\phi-\kappa)F(v-\hat{w}). \tag{10}$$

Furthermore, I assume that

Assumption 3. $B^{w}(\alpha_3) = s(\hat{w}+\alpha_3)/(1-s) < 2K < B^{w}(\alpha_1) = s(\hat{w}+\alpha_1)/(1-s)$.

This assumption ensures that the steady state wealth level of a worker with skill level α_3 is not enough to afford the up-front investment for entrepreneurship, while that of a worker with skill level α_1 is sufficient for entrepreneurship.

Now suppose that there is an unanticipated shift in the distribution of skills at time t^*, and all agents with α_1 and α_3 are switched: i.e., those who had skill α_1 now have α_3 and vice versa.[5] The economy without any credit market frictions will immediately adjust to this change, and there will not be any macroeconomic changes – the equilibrium is still given by Proposition 1. In contrast, in the economy with credit market frictions Assumption 3 implies that unemployment increases: at first, agents who previously had productivity α_3, and now have productivity α_1, cannot afford to become entrepreneurs. The

[5] Perhaps this is too simple, since I am assuming that some agents become less productive. It is conceptually straightforward, but is notationally cumbersome to extend the model so that the productivity of all agents increases over time, and the changing technology can be modeled as some productivities growing more than others over a certain time period.

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evolution of unemployment in the economy with credit market frictions now depends on the transitory dynamics of the model. Transitory dynamics are in general quite complicated, since the equilibrium wage rate changes as the wealth distribution of agents evolves. Nevertheless, the specific assumptions that I imposed simplify the analysis. In particular, they ensure that the wage rate is independent of the wealth distribution, and always equal to $\hat{w}$. This is because agents with productivity α_2 continue to be the marginal entrepreneurs, and Eq. (9) still determines the equilibria wage. This implies that immediately after the technology change at t^* unemployment increases to

$$U_{t^*} = (1 - 2\phi - \kappa)F(v - \hat{w}) + \phi > U.$$

After this point, the agents (dynasties) who now have skill level α_1 start accumulating wealth. Their wealth level at time $t^* + \tau$ can be written as[6]

$$B^w_{t^*+\tau}(\alpha_1) = s^{1+\tau}\frac{(\alpha_3 + \hat{w})}{1 - s} + \frac{1 - s^\tau}{1 - s}s(\alpha_1 + \hat{w}).$$

Assumption 3 implies that $\lim_{\tau\to\infty} B^w_{t^*+\tau}(\alpha_1) > 2K$, so there will exist a threshold time τ^* such that at $t^* + \tau^*$, $B^w_{t^*+\tau^*}(\alpha_1)$ exceeds $2K$ for the first time. At this point, the agents with productivity α_1 become entrepreneurs, and unemployment falls from U_{t^*} to U given by (10). Therefore, while unemployment is always constant in the economy with perfect credit markets, it increases upon change of technology in the economy with credit market frictions. It stays high persistently between the date of technology change, t^*, and the date $t^* + \tau^*$.

By changing parameters within this simple example we can make the decline in unemployment arbitrarily late (e.g., if $s(\hat{w} + \alpha_1)/(1 - s) \simeq 2K$), so this model is capable of generating an arbitrarily long period of unemployment, or an arbitrary amount of persistence. It is also useful to note that a potentially important factor contributing to unemployed persistence is missing in this simple example. In general, with a depressed labor demand, the wage rate will also fall during transition, and this will make it harder for potential entrepreneurs to accumulate funds sufficient to finance their own businesses. This is in fact exactly the same force that led to the multiplicity of steady state equilibria in the previous section.

6. Empirical evidence: U.S. vs. Europe

So far I have presented an abstract model of unemployment in the presence of credit market imperfections. Credit market problems do not necessarily lead to

[6] To obtain this expression note that at time t^*, they start with wealth $B^w(\alpha_3) = s(\hat{w} + \alpha_3)/(1 - s)$, and then $B^w_{t^*+1}(\alpha_1) = sB^w(\alpha_3) + s(\hat{w} + \alpha_1)$, etc.

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higher unemployment, though they may introduce additional equilibria with high unemployment levels. The major result is that economies with and without credit market frictions respond to changes in technology quite differently. In response to a shock, that changes which agents have a comparative advantage in entrepreneurship, an economy without a well-functioning credit market may suffer a lengthy period of unemployment, as productive agents lack the necessary funds to create jobs. This situation is reversed only slowly as these agents gradually accumulate enough wealth to finance their investments.

It is possible to tell a story of European unemployment based on this model. Europe and the U.S. had similar unemployment levels during the 1960s because they were both in a 'steady state situation'. A variety of changes during the early 1970s and early 1980s shifted the growth sectors of the economy, requiring different entrepreneurs and firms to assume a more important role. This happened relatively quickly in the U.S. owing to a more fluid credit market, especially with institutions like venture capitalists channeling funds to the rapidly growing high-tech sectors. In contrast, in Europe, lack of funds in the hands of the people with the right skills slowed down job creation.

Is there any evidence supporting this story? I end the paper with a quick look at some sectoral evidence to answer this question. There are two interpretations of the model. The first views the firms that are constrained in Europe to be those using new technologies within each sector. The second maintains that it is firms in some particularly credit-dependent sectors that are most constraint. Although I do not have a way of investigating the validity of the first version of the story, I can look for support for the second version using the OECD sectoral database.

With this purpose, I follow Rajan and Zingales (1998) in classifying sectors according to their credits dependents in the U.S. Using the results in Table 1 of these authors, I classify food, beverages and tobacco, textile, apparel and leather, wood and furniture, paper and paper products, basic metals, and metal products as low credit-dependent industries; chemical, coal, rubber and plastic products, metal products, machinery and equipment, and transport equipment as medium credit-dependent industries, and electrical goods and office and data processing machine industries are high credit-dependent industries. By focusing on manufacturing, this classification avoids other potential differences in the U.S. and European economies in the growth of service sectors, though if service industries are more credit-dependent, it might understate the importance of credit problems.

Fig. 2 plots the share of employment in a number of European countries in the low, medium, and high categories relative to the share of the same categories in the U.S.[7] If European unemployment is mainly due to the failure of the

[7] The data are from the OECD ISDB data set, and refer to the total number of employees in that sector relative to total employment. More formally, let e^1_{ct} be total employment in the low group in country c at time t, and E_{ct} be total employment. I am plotting $(e^1_{ct}/E_{ct})/(e^1_{USt}/E_{USt})$. Data for the high category in Sweden and Finland are missing.

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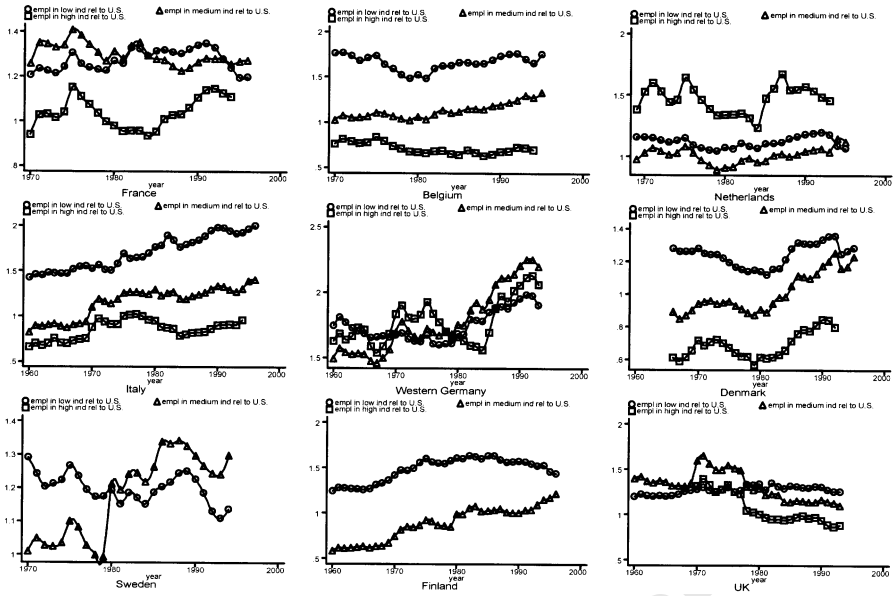

Fig. 2. The evolution of the fraction of total employment in low, medium, and high credit-dependent industries in European countries relative to the U.S. Data from OECD ISDB data set.

European economies to expand into new sectors because of credit constraints, we would expect these economies to fall behind the U.S. in the high credit sectors. In other words, in this case, the curve with the squares (the high category) should fall relative to the other curves, especially relative to the circles, which denote the low industries.[8] For most countries, all three curves move in a more or less parallel fashion. In fact, for France and Germany, employment in high credit-dependent sectors seem to be growing more than other sectors. Therefore, there is no evidence that European economies have been falling behind the U.S. in the credit-dependent industries over the period of rising European unemployment.

Nevertheless, except for the Netherlands and the UK, European economies appear to have substantially less employment in the most credit-dependent industries. For example, in Belgium, Italy and Denmark, relative employment in the least credit-dependent industries is on average about 50 percent more than in the U.S., while the relative employment in the most credit-dependent sectors is about 30 percent less than the U.S. This suggests that credit market problems may

[8] An increase in all three curves, as in the case of West Germany or Denmark, would correspond to an increase in the relative share of manufacturing employment compared to the U.S.

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have played some role in constraining employment in Europe. Interestingly, the U.K. is commonly thought to have the best credit markets among the European economies, so it is suggestive that the most credit-dependent industries have relatively high employment in the U.K. as well as in the U.S. (though their share in the U.K. employment seems to have fallen over the 1980s). These observations give some support for the idea that credit market problems may have been an important factor in the recent European employment experience, and encourage further research in this area.

Uncited References

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