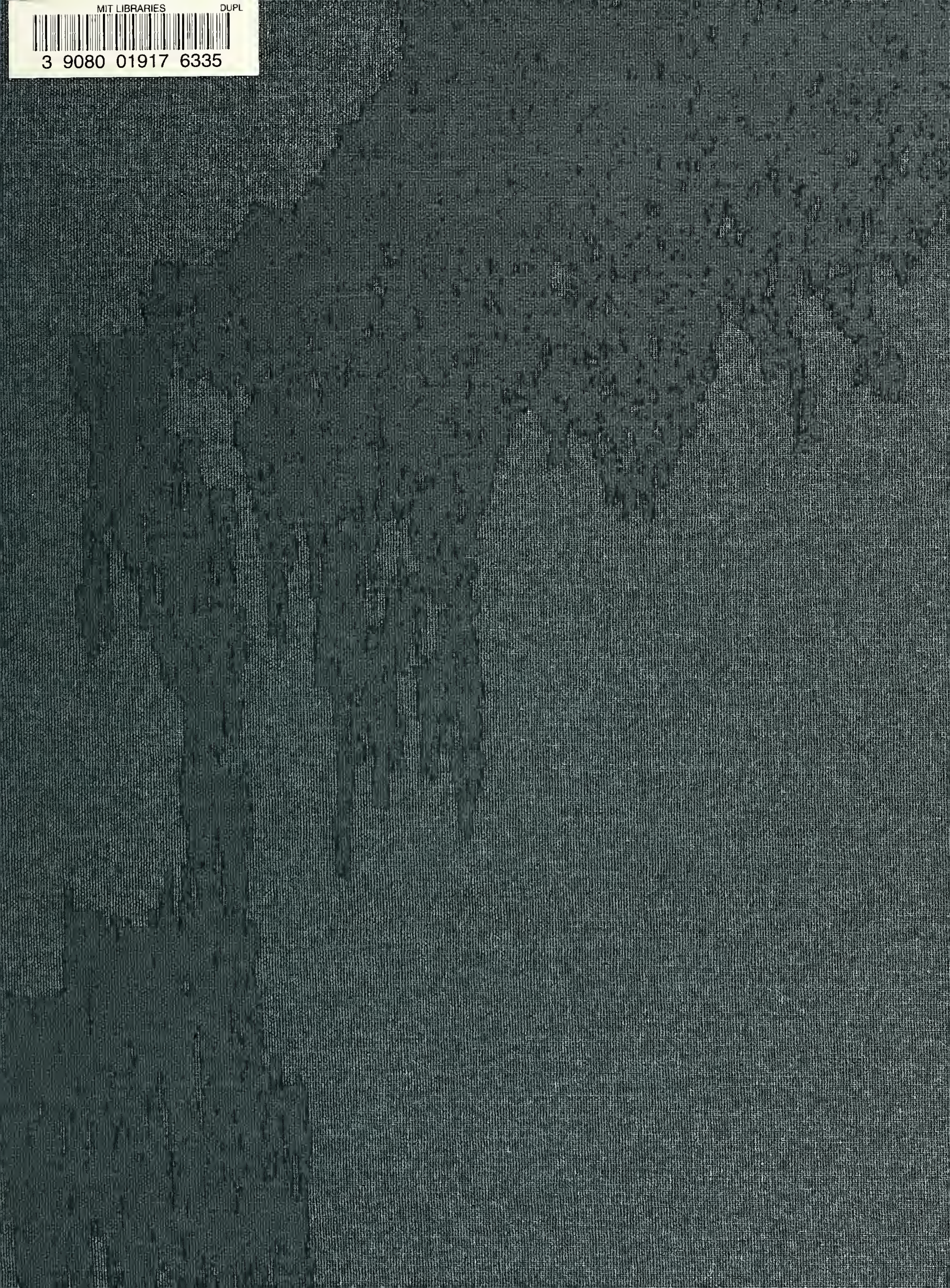

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The Cost of Recessions Revisited: A Reverse-Liquidationist View

Ricardo J. Caballero   Mohamad L. Hammour*

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Abstract

The observation that liquidations are concentrated in recessions has long been the subject of controversy. One view holds that liquidations are beneficial in that they result in increased restructuring. Another view holds that liquidations are privately inefficient and essentially wasteful. This paper proposes an alternative perspective. Based on a combination of theory with empirical evidence on gross job flows and on financial and labor market rents, we find that, cumulatively, recessions result in *reduced* restructuring, and that this is likely to be socially *costly* once we consider inefficiencies on both the creation and destruction margins.

1 Introduction

The concentrated liquidation during recessions of significant segments of the economy's productive structure has been a source of controversy among economists at least since the pre-Keynesian "liquidationist" theses of such eminent economists as Hayek, Schumpeter, and Robbins. Those economists saw in the process of liquidation and reallocation of factors of production the main purpose of recessions. In the words of Schumpeter (1934): "depressions are not simply evils, which we might attempt to suppress, but ... forms of something which has to be done, namely, adjustment to ... change" (p. 16). This led him and others to advocate a passive government attitude at the onset of the Great Depression. (See De Long 1990 for historical survey, and Beaudry and Portier 1998 for a modern formulation of the liquidationist argument).

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Although few economists today would take the extreme position of early liquidationists, many see in increased factor reallocation a silver lining to recessions. Although recessions *per se* are undesirable events, they are seen as a time when the productivity of factors of production is low and, therefore, offers a chance to undertake much needed restructuring at a relatively low opportunity cost. Observed liquidations are considered a prelude for increased restructuring. (See Aghion and Saint-Paul 1993 for a survey of this view of recessions as reorganizations).

At the polar opposite of liquidationism, an alternative perspective holds that concentrated liquidations during recessions — large-scale job losses and financial distress — are associated with significant waste, which we ought to find ways to avoid. Looking more specifically at workers, the recent labor-market literature on the costs of job loss documents the apparently large private losses that result from a significant fraction of separations (see, e.g., Topel 1990; Farber 1993; Jacobson, Lalonde and Sullivan 1993; Anderson and Meyer 1994). As Hall (1995) shows, the product of those private losses with the sharp increase in separations amounts to a substantial cost of recessions.[1]

The debate surrounding the costs or benefits of liquidations during recessions seldom considers two central dimensions of this issue. The first relates to the common *inference* that an aggregate recession increases the overall amount of restructuring in the economy. From the increase in liquidations during recessions — as documented, for example, in the gross job flow series of Davis and Haltiwanger (1992) — it is typically concluded that recessions increase overall factor reallocation. Indeed, this is what one would expect in a representative-firm economy, as the representative firm must replace each job it destroys during a recession by creating a new job during the ensuing recovery. This is illustrated in panel (a) of figure 1.1, which depicts the way the employment recession-recovery episode in panel (d) materializes in this case. However, once we consider a heterogeneous productive structure that experiences ongoing creative destruction, other scenarios are possible. For example, the peak in destruction during the recession may be followed by an equal-sized trough in destruction during the recovery, adding up to a zero cumulative effect. More generally, as illustrated in panels (a)-(c), the cumulative effect of a recession on overall restructuring may be positive, zero, or even negative, depending not only on how the economy contracts, but also on how it *recovers*. Thus, the relation between recessions and economic restructuring requires us to examine the effect of a recession on aggregate separations not only at impact, but *cumulatively* throughout the recession-recovery episode.

Second, the argument that increased restructuring following recessions is wasteful relies on what is ultimately a failure in private contracting on the destruction margin, which results in privately inefficient liquidations. However, the same type of contracting failures are also a well-known source of under-investment, which, in general equilibrium, naturally leads to *insufficient* restructuring (see, e.g., Caballero and Hammour 1998a). This form of "sclerosis" of the productive structure suggests

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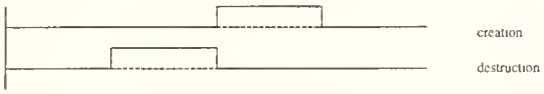
[1] Hall acknowledges that his calculation captures only one aspect of the problem, and that a comprehensive assessment ought to look into general equilibrium and other issues.

that accelerated restructuring may be beneficial. Thus, the same contracting problem points at a possible cost or benefit of increased restructuring, depending on whether it is considered from the destruction or creation margin. It is therefore essential to consider distortions simultaneously on *both* margins to assess the social-welfare effect of increased (or reduced) restructuring.

Figure 1.1

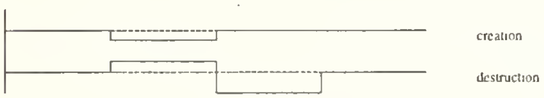
Recessions and Cumulative Restructuring

(a) Restructuring Increases

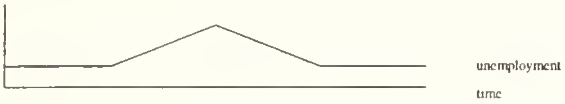


(b) Restructuring is Unchanged

(c) Restructuring Decreases



(d) Unemployment Recession



An adequate model to assess the relation between recessions and restructuring, and its social-welfare implications, must therefore incorporate two main elements. First, it must exhibit a heterogeneous productive structure that undergoes a process of creative destruction able to match observed aggregate gross flows and their dynamics. This makes it possible to capture the cumulative impact of a recessionary shock on those flows. Second, it must include the possibility of rents on both the creation and destruction margins, that can be calibrated to match the private rents documented in the financial and labor market literatures. This is needed to assess, in general equilibrium, the social waste or benefits associated with the impact of recessions on gross flows.

This paper develops such a model. We present a stochastic equilibrium model of creative destruction that incorporates contracting difficulties in both the labor and financial markets. The model is able to capture average and cyclical features of gross flows, as well as documented labor and financial markets rents. We combine our theoretical analysis with empirical evidence on aggregate gross flows and microeconomic rents, and revisit the debate on the cost of recessions and its relation to aggregate restructuring.

A look at the available data on gross flows casts doubt on prevailing views. Our time-series analysis of gross job flows in US manufacturing over the period 1972-93 shows that this sector exhibited a *reduction* in cumulative factor reallocation following a recession. This result contradicts the notion that recessions result in increased restructuring. Essentially, although job destruction peaks sharply at the impact of a recessionary shock, it also falls below normal for an extended period of time during the ensuing recovery. The cumulative effect is a reduction in overall destruction. With a stationary employment response, reduced reallocation can also be seen in job creation, which falls during recessions but does not exhibit as a counterpart an above-normal increase during the recovery phase.

The existing evidence, although limited in several respects, is consistent with the notion that recessions are associated with a "chill" of the restructuring process, rather than increased "turbulence." In the context of the model we develop in this paper, the chill is in fact a natural outcome. We identify two mechanisms which can be responsible for this phenomenon, one financial and the other based on selection across heterogeneous productivities. The financial mechanism results from firms' reduced ability to find financing for creation as they come out of recession. This implies that the recovery cannot take place through a boom in creation but rather through a reduction in destruction, and therefore that the recession-recovery episode results cumulatively in reduced restructuring. The selection mechanism, on the other hand, works through the differential impact across projects of the fall in creation during recessions — which affects mostly low-productivity projects subject to a higher-than-average churn rate and, thus, reduces the economy's average churn.

The welfare implications of the chill depend on which of two factors dominate: how sclerotic the economy is, in the sense that contracting obstacles in creation result in an inefficiently low equilibrium restructuring; and how wasteful destruction is, in the sense that separations are privately inefficient. Which of those two factors dominates over the cycle determines whether the chill is costly or beneficial. We argue that reasonable calibration assumptions lead to the conclusion that the chill is costly, and that it adds about 40 percent to the traditional unemployment cost of recessions.

The perspective we put forth amounts to a distinct alternative to prevalent views of recessions and restructuring. In particular, the traditional assessment based on the costs of job loss holds that recessions are costly because they increase aggregate separations, and that such separations are wasteful. The view that emerges from this paper also points to a cost of recessions, but that cost arises because recessions *decrease* aggregate separations and therefore reduce the beneficial restructuring associated with such separations.

The rest of the paper is organized as follows. Section 2 presents our model economy, and solves for equilibrium. Section 3 anchors the model's parameters based on the microeconomic evidence on private financial and labor market rents and macroeconomic evidence on gross job flows and employment. In particular, this section documents the US manufacturing evidence of chill following recessions. Section 4 discusses the response of the restructuring process to aggregate shocks, and its welfare consequences. Section 5 concludes.

2 A Model of Restructuring and Factor-Market Rents

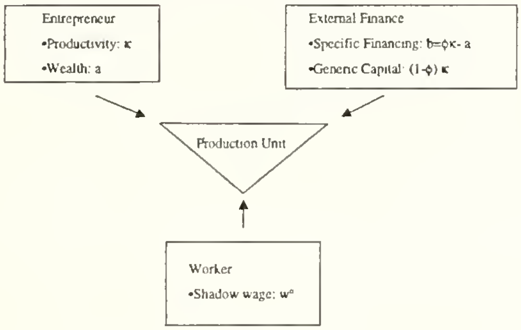
2.1 General Structure

We consider an infinite-horizon economy in continuous time, whose general structure is outlined in figure 2.1.

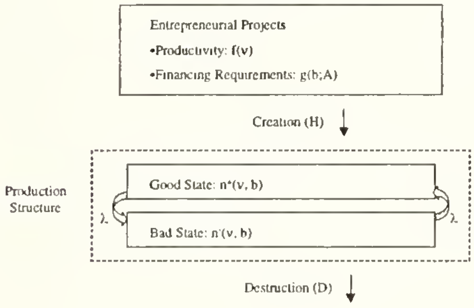
Figure 2.1

The Model Economy

(a) New Production Units



(b) Gross Flows



Production units

There is a single durable good (the numeraire), that can either be consumed or used as capital. Production takes place within infinitesimal *production units* that combine, in fixed proportions, an entrepreneurial project, a unit of labor, and κ units of capital (see panel (a) of figure 2.1). The output flow of production unit i at time t is made up of three components:

$$\tilde{y}_t + \nu_i + \tilde{\epsilon}_{it},$$

where $\widetilde{y}_t$ is a stochastic *aggregate* component; $\nu_i \in [-\overline{\nu}, \overline{\nu}]$ is a *permanent idiosyncratic* component (the unit's "productivity"); and $\widetilde{\epsilon}_{it}$ is a *transitory idiosyncratic* component. $\widetilde{\epsilon}_{it}$ transits between two states at probability rate $\lambda > 0$: $\epsilon > 0$ (the "good" state) and $-\epsilon < 0$ (the "bad" state). Finally, production units fail at exogenous rate $\delta > 0$.

Entrepreneurs, workers, and financiers

Each production unit forms a nexus for a trilateral relationship between an entrepreneur-manager, a worker, and external financiers. The entrepreneur brings the project and uses his internal funds to finance it; the worker contributes his labor; and external financiers fill the unit's financing requirements when the entrepreneur has insufficient funds. We characterize each of those three parties, in reverse order.

External finance is provided by a non-resource consuming competitive sector. It may be called upon either to finance capital investment at the time a production unit is created, or to finance periods of negative cash flow during the lifetime of the unit. The stake of external financiers is measured by the unit's net external liabilities, b ($b > 0$ corresponds to positive external liabilities and $b < 0$ to positive internal funds).

Workers are infinitely-lived agents whose population is represented by a continuum of mass one. Each worker i is endowed with a unit of labor, and maximizes the expected present value of instantaneous utility

$$c_{it} + z(1 - l_{it}), \quad z \geq 0,$$

linear at any time t in consumption c_{it} and labor supply l_{it}, discounted at rate $\rho > 0$.

Entrepreneurs maximize the expected present value of consumption, also discounted at rate ρ. All agents are therefore risk neutral, and the market discount rate will be ρ. Entrepreneurial projects are held by a continuum of non-active entrepreneurs indexed by i. Each has a project for a production unit with known productivity ν_i, and a certain amount of wealth that translates into a financing requirement b_i — equal to the project's investment requirement minus the entrepreneur's wealth.[2] We assume that the distributions of wealth and project productivities are independent in the cross section. At any time t, the marginal density of project productivities is given by $f(\nu)$; and the marginal density of project financing requirements is $g(b; A_t)$, where A_t is an index of the aggregate wealth of non-active entrepreneurs.[3]

Factor-market rents

The employment and financing relationships within production units suffer from contracting obstacles. We assume that a fraction $\phi \in (0, 1]$ of a production unit's capital is *specific*, in the sense that its productive value disappears if either labor or the manager leaves the unit. Specificity with respect to labor and management is intended to

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[2] Note that if $b_i < 0$, the unit starts with positive internal funds.

[3] By fixing the distributions of project productivities and financing requirements, we avoid having to model the detailed population dynamics of potential entrepreneurs. Implicitly, we assume the process by which potential entrepreneurs invent or lose ideas for projects is such that it results in the assumed distributions.

capture the edge that such "insiders" may acquire to appropriate quasi-rents within the nexus of the firm.[4] It creates a classic "holdup" problem. Agents' *ex ante* terms of trade need to be protected through a fully contingent contract. However, such contracts may be unenforceable or excessively complex, and specific quasi-rents will instead be divided according to the parties' *ex post* terms of trade.[5] This constrains certain employment and financing relationships from being formed, and results in rent components of wages and profits that we analyze in sub-section 2.2.

The non-specific component of capital, $(1-\phi)\kappa$, has full collateral value, and gives rise to no contracting difficulties. Its owner can withdraw it at any time from the relationship, and use it elsewhere with no loss of value. Without loss of generality, we consider that it is always leased at a rental cost $r > 0$, which covers the cost of capital adjusted for depreciation.[6] Because the rental cost of generic capital and the marginal utility of leisure are unproblematic, we net them out of production-unit output and define $\widetilde{y}^s \equiv \widetilde{y} - r(1-\phi)\kappa - z$.

Production structure dynamics

At any time t, the distribution of production units is given by the density $n_t^+(b,\nu)$ of units that operate in the good state with external liability b and permanent productivity ν, and the equivalent density $n_t^-(b,\nu)$ of units in the bad state. The total number of units in the good and the bad states are

$$N_t^+ = \int_{-\overline{\nu}}^{\overline{\nu}} \int_{-\infty}^{+\infty} n_t^+(b,\nu)db\,d\nu \quad \text{and} \quad N_t^- = \int_{-\overline{\nu}}^{\overline{\nu}} \int_{-\infty}^{+\infty} n_t^-(b,\nu)db\,d\nu,$$

respectively. Total employment is, therefore, $N_t = N_t^+ + N_t^-$ and unemployment is $U_t = 1 - N_t$. Aggregate output is

$$Y_t \equiv \int_{-\overline{\nu}}^{\overline{\nu}} \int_{-\infty}^{+\infty} \Big[(\widetilde{y}_t + \nu + \epsilon)\, n_t^+(b,\nu) + (\widetilde{y}_t + \nu - \epsilon)\, n_t^-(b,\nu)\Big]\, db\, d\nu.$$

Four factors drive the distributional dynamics of production units (see panel (b) of figure 2.1): *(i)* units are continuously created; *(ii)* units are also continuously destroyed; *(iii)* units decumulate or accumulate b, depending on whether they experience positive or negative cash flows; and *(iv)* units transit between the good and the bad idiosyncratic state at probability rate λ. The effect of distributional dynamics on aggregate employment is captured by the aggregate gross rates of creation and destruction of production units — which we denote by H_t and D_t, respectively.

Creation of new production units requires two conditions that we derive in subsection 2.3: the project must be profitable, and it must find financing. At any point

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[4] Investment specificity may result from firm-specific human and organizational capital, or from the advantage that a party can gain through government regulation. It is clearly only a simplification to assume that it is the same fraction of capital that is specific to both labor and management.

[5] For a discussion of this "holdup" problem that results from specificity, see, e.g., Klein, Crawford and Alchian (1978) and Hart (1995, chapter 4). For a discussion of its macroeconomic implications, see Caballero and Hammour (1998a).

[6] This contractual form is not unique. Non-specific capital could also be financed through a fully collateralized loan. As long as the price of capital remains constant, the two contracts are equivalent (see Kiyotaki and Moore 1997, fn. 8, p. 218).

in time, all projects that satisfy both conditions are started. The entrepreneur hires a worker, makes a specific investment of $\phi\kappa$, and rents $(1-\phi)\kappa$ units of generic capital. If the entrepreneur's wealth is a_i, the initial level of external liabilities is $b_i = \phi\kappa - a_i$. We assume that all new production units start in the good state.

Destruction of production units is of two types. It may either be due to a failure of the production unit (at the above-mentioned rate δ), or due to a separation decision within a functioning production unit. In both events, specific capital loses all value once factors separate. The latter type of destruction takes place during periods of negative cash flows, when the entrepreneur stops making the investment that is necessary to cover negative cash flows and continue operations. We restrict ourselves to a range of model parameters such that operational cash flows are always positive in the good state and negative in the bad state. In the good state, positive cash flows allow a unit to reduce its liabilities over time, then accumulate internal funds; once it transits to the bad state, the unit must decide whether to interrupt operations or fund negative cash flows with the hope of reverting to the good state. Similarly to creation investment, this continuation investment decision requires two conditions that we also derive in sub-section 2.3: the entrepreneur must find it profitable to cover the unit's negative cash flow, and he must find financing for it. Destruction takes place when one of those two conditions fails to be satisfied. Failure of the profitability condition results in privately efficient separation between factors; failure of the financing condition results in privately inefficient separation.[7]

2.2 Contracting Failures in the Labor and Financial Markets

We now turn to the determination of factor rewards when a fraction ϕ of capital is specific with respect to labor and to the entrepreneur-manager. The contracting problem consists in the assumption that labor and the entrepreneur cannot contractually precommit not to withhold their human capital from the relationship. We analyze the effect of specificity with respect to labor on the employment relationship, and of specificity with respect to the entrepreneur on the financing relationship.

The employment relationship

We consider that labor and capital (the entrepreneur and external financiers) transact as two monolithic partners.[8] Because of the contracting problem, specific quasi-rents must be divided *ex post*, after investment is sunk. We assume this division is governed by continuous-time Nash bargaining. Labor obtains, in addition to its

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[7] Because we have assumed no joint-ownership of production units, a literal interpretation of privately inefficient separations is in terms of bankruptcy. This interpretation can be loosely extended to partial liquidations of a firm's activities because of limited funds. If an entrepreneur were allowed to operate several production units at a time, which effectively share in the same pool of liabilities or internal funds, financial constraints may lead him to inefficiently liquidate some units but not others.

[8] One reason why labor may not be able to deal separately with the entrepreneur and external financiers is informational. The entrepreneur may be able to disguise internal funding in the form of external financing. If, however, labor is able to separate between the two, external liabilities can be used as a way to reduce the rents appropriable by labor. See Bronars and Deere (1991) for a discussion and some empirical evidence.

outside opportunity cost, a share $\beta \in (0,1)$ of the present value S of the unit's specific quasi-rents, s_{it}; and capital obtains a share $(1-\beta)S$.

The quasi-rents in production unit i are

$$s_{it} = (\widetilde{y}_t^s + \nu_i + \widetilde{\epsilon}_{it}) - w_t^o,$$

where w_t^o denotes labor's flow opportunity cost of participating in a production unit, above the marginal utility of leisure (which is directly subtracted from $\widetilde{y}^s$). We solve for a wage path for each production unit i,

$$w_{it} = w_t^o + \beta s_{it}, \tag{1}$$

which gives the worker a share βS in present value at any point in time. Profits are therefore equal to

$$\pi_{it} \equiv (\widetilde{y}_t^s + \nu_i + \widetilde{\epsilon}_{it}) - w_{it} = (1-\beta)\, s_{it}. \tag{2}$$

Finally, labor's opportunity cost is given by

$$w_t^o = \frac{H_t}{U_t} \beta E_\nu [S_t]. \tag{3}$$

As is standard in equilibrium bargaining models, it is equal to the rate H_t/U_t at which an unemployed worker expects to find employment, multiplied by the share $\beta E_\nu[S_t]$ he expects to obtain of the surplus from his new job.[9]

Expression (2) allows us to define profit functions $\pi_{it} = \pi^+(\nu_i;\Omega_t)$ in the good idiosyncratic state and $\pi_{it} = \pi^-(\nu_i;\Omega_t)$ in the bad state, where Ω_t is a state vector that constitutes a sufficient statistic for current and future aggregate conditions (including variables $\widetilde{y}_t^s$ and w_t^o). If the unit has net uncollateralized liabilities b_{it}, the expected present discounted value of profit flows is a function $\Pi^+(b_{it},\nu_i;\Omega_t)$ when the unit is in the good state and $\Pi^-(b_{it},\nu_i;\Omega_t)$ when it is in the bad state. Those functions are (weakly) decreasing in b, because, as we argue below, a higher b generally increases the probability of privately inefficient liquidation. Henceforth, we will replace the argument Ω_t by a time subscript to save on notation.

The financing relationship

The financing relationship is restricted to uncollateralizable investments, because the collateralizable share of capital $(1-\phi)\kappa$ is unproblematic and is considered rented. Specificity with respect to the entrepreneur-manager gives rise to contracting problems similar to those that arise in the employment relationship. The entrepreneur-manager can always threaten *ex post* to withhold his human capital from the production unit, and attempt to renegotiate with the financier on that basis. We assume that Nash bargaining would give a share $\alpha \in (0,1)$ of the present value Π of profits to the manager, and a share $(1-\alpha)$ to the financier. Therefore, any external claim for the financier above $(1-\alpha)\Pi$ will be renegotiated down. This puts an upper-bound on the external claims a production unit can support.

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[9] For a detailed derivation of a similar expression, see the appendix in Caballero and Hammour (1998b).

The inability to find financing may prevent an entrepreneur from starting an otherwise profitable project; or may force him to liquidate a highly productive unit that runs into a period of negative cash flows (see sub-section 2.3). As a consequence, an optimal policy for the entrepreneur that minimizes the risk of inefficient liquidation is not to consume dividends until the production unit fails or is liquidated.[10] This implies, in particular, that repayments to the financier are effectively made at the fastest possible rate.

A contract that minimizes the financial constraint must satisfy the following properties: *(i)* the financier expects to get his money back in present value; *(ii)* the above-mentioned re-negotiation constraint is not violated; and *(iii)* the entrepreneur cannot consume from the project's cash flow before the financier's claim has been fully paid. A financial contract with those properties can be thought of as a senior uncollateralized claim b over the unit's cash flow held by a single financier, with a preferred return equal to the risk-adjusted opportunity cost of funds. Our model does not distinguish between different institutional arrangements — debt-like or equity-like — as long as they result in the same investment decisions and net transfers between the two parties.

2.3 Creation and Continuation

We now derive the conditions under which *creation* and *continuation* investments are undertaken. The former investment consists of the specific investment $\phi\kappa$ required to create a production unit. The latter consist of the investments made to cover periods of negative cash flows in order to hoard the unit's specific assets. By its very nature, continuation investment is fully specific and subject to contracting obstacles. Both types of investments are subject to a *financial* and a *profitability* constraint. They will only be undertaken if both constraints are satisfied.

Creation investment

Suppose an entrepreneur with wealth a has a project for a production unit with productivity ν. To create the unit, the entrepreneur needs to incur a net liability $b = \phi\kappa - a$. The two conditions for undertaking the project are as follows. First, the entrepreneur must be able to attract the required financing, which we have seen is limited to the maximum liability

$$b \leq (1-\alpha)\Pi_t^+(b,\nu). \tag{4}$$

Second, the project must be profitable:

$$\phi\kappa \leq \Pi_t^+ (b,\nu) \,. \tag{5}$$

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[10] This statement must be qualified by the observation that, if the aggregate variable $\widetilde{y}$ has finite support, there is a level $b^{safe} < 0$ of internal funds beyond which the production unit is immune from inefficient liquidation. This happens when the interest income ρb^{safe} on internal funds covers any possible negative cash flow π^- in the bad state. Beyond b^{safe}, the entrepreneur is indifferent between consuming dividends or not.

Since Π^{+} is decreasing in b, constraints (4) and (5) can be rewritten as

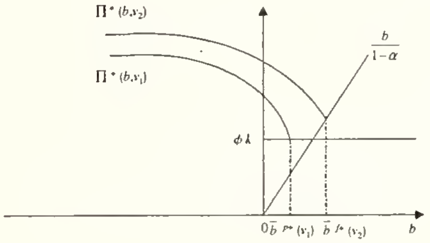
$$\phi\kappa - a \leq \overline{b}_t^{+}(\nu) \equiv \min\{\overline{b}_t^{f+}(\nu), \overline{b}_t^{p+}(\nu)\}, \tag{6}$$

where $\overline{b}_t^{f}$ is defined implicitly by taking the *financial constraint* with equality, and $\overline{b}_t^{p}$ is defined by taking the *profitability constraint* with equality (either variable can take value $+\infty$ when the constraint is not binding). Figure 2.2(a) illustrates the operation of the profitability and financial constraints on the creation of projects with productivities ν_1 and ν_2, $\nu_1 < \nu_2$. For projects with productivity ν_1, it is the profitability constraint $b \leq \overline{b}^{p+}(\nu_1)$ that is binding; while for projects with productivity ν_2, it is the financial constraint $b \leq \overline{b}^{f+}(\nu_2)$.

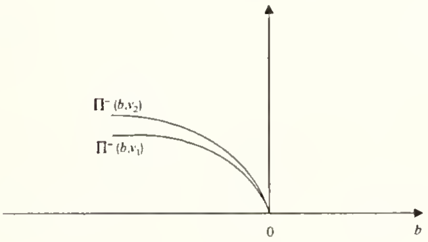
Figure 2.2

Constraints on Creation and Continuation

(a) Creation Investment



(b) Continuation Investment



Continuation investment
Given our restriction to parameters such that cash flows are positive in the good state and negative in the bad state — i.e. $\pi_t^{+}(\nu) > 0$ and $\pi_t^{-}(\nu) < 0$ — continuation investment is always required in the bad state. It faces financial and profitability constraints, $\overline{b}_t^{f-}(\nu)$ and $\overline{b}_t^{p-}(\nu)$, similar to the constraints on creation.

The *financial constraint* may affect a unit in the bad state with no internal funds to cover its negative cash flow ($b \geq 0$). This can be illustrated most easily in a steady-state setting, where aggregate conditions Ω are invariant. In the absence of financing constraints (i.e., taking the limit $b \rightarrow -\infty$), one can show that the value of the option to cover negative cash flows in the bad state is

$$\frac{\pi^{-}(\nu) + \lambda \Pi^{+}(-\infty, \nu)}{\rho + \delta + \lambda}. \tag{7}$$

However, because the manager would renegotiate the debt down to

$$\bar{b}^{f+}(\nu) = (1-\alpha)\,\Pi^{+}\left(\bar{b}^{f+}(\nu), \nu\right)$$

once in the good state, one can show that the value to the financier of the option to finance negative cash flows is no greater than

$$\frac{\pi^{-}(\nu) + \lambda (1-\alpha)\,\Pi^{+}\left(\bar{b}^{f+}(\nu), \nu\right)}{\rho + \delta + \lambda},$$

which is obviously smaller than the private value (7) of continuation. It is therefore possible for *privately inefficient liquidation* to take place, where continuation has positive present value but cannot be financed externally.[11],[12]

Furthermore, one can show that if the entrepreneur is able to attract external finance for continuation, he will be able to do so irrespective of the current level of

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[11] Conceivably, the financier may offer the entrepreneur an "insurance" arrangement through which he commits to finance negative cash flows in the bad state in exchange for an insurance premium paid in the good state. With large enough cash flows in the good state, the financier may be able to break even. However, insurance gives rise to an informational problem if the financier cannot observe the unit's idiosyncratic state. The entrepreneur need only claim to be in the bad state to collect the insurance. As is well knwon, the informational problem is less severe under a simple liability arrangement, where the entrepreneur must liquidate his production unit to discontinue payments to the financier.

[12] When a privately inefficient separation takes place, both the entrepreneur and labor lose their share of the production unit's surplus $S_t^{-}(b, \nu)$. Could labor come to the rescue by taking a wage cut? One can show that the manager-owner is also subject to a financing constraint with respect to the worker, similar to that with respect to an external financier. We constrain the parameter space so that this worker-financing constraint is always binding.

To see this, consider the continuous-time Nash bargaining solution behind wage equation (1), where labor and the entrepreneur get or contribute their share — β and $(1-\beta)$ — of the flow surplus s_t. If the entrepreneur runs out of internal funds in the bad state, and is unable to finance his share of the negative surplus, the Nash bargaining problem becomes constrained and the above solution breaks down. It may make sense for the worker, in that case, to finance the whole of $s_t^{-}(\nu)$ in the bad state in order to retain his share $\beta S_t^{+}(b, \nu)$ in the good state. The steady-state condition for this to happen is

$$s_t^{-}(\nu) + \lambda \beta S_t^{+}(-\infty, \nu) > 0.$$

On the other hand, the condition for continuation to be privately efficient is

$$s_t^{-}(\nu) + \lambda S_t^{+}(-\infty, \nu) > 0.$$

It is therefore clear that as long as $\beta < 1$, financing may not be worth it for labor even when continuation is privately efficient.

$b \geq 0$.[13] In other words, the maximum liability $\overline{b}^{f-}(\nu)$ for continuation financing to be feasible can take only two values: 0 or $+\infty$. The interesting case for us is when continuation in the bad state cannot be financed. We therefore restrict ourselves to parameters under which negative cash flows in the bad state are significant enough, so that the finance constraint on continuation is *always binding*:

$$\overline{b}_t^{f-}(\nu) = 0, \quad \nu \in [-\overline{\nu}, \overline{\nu}],\ t \geq 0.$$

The financial constraint on continuation is illustrated in figure 2.2(b), where both production units are financially constrained in the bad state.

Let us now turn to the *profitability constraint* for a unit that still has internal funds ($b < 0$) to cover negative cash flows. Profitability requires

$$\Pi_t^-(b, \nu) \geq 0.$$

This leads us to define $\overline{b}_t^{p-}(\nu)$ as the lowest value of b for which $\Pi_t^-(b, \nu) = 0$.

One can show that, in steady state, $\overline{b}_t^{p-}$ also takes only two values: $-\infty$ or 0.[14] In other words, if a unit has internal funds and transits to the bad state, it either continues until forced to exit when b reaches $\overline{b}_t^{f-} = 0$; or it exits voluntarily upon transiting into the bad state, irrespective of its level of b. In the former scenario, the unit is financially constrained; in the latter, it is profitability constrained.

2.4 Aggregate Dynamics

We close the model by discussing the distributional dynamics that govern the aggregate production structure. We examine, in turn, the dynamics of a production unit's external liabilities; the aggregate gross creation and destruction rates of production units; and the wealth dynamics that determine new projects' financing requirements.

Dynamics of external liabilities

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[13] Consider two non-negative levels of external liability, $b_{\text{high}} > b_{\text{low}} \geq 0$. If the financier is willing to finance continuation at b_{low}, he has all the more reason to finance it at b_{high}, since his return in that case can only be greater. Conversely, if continuation is financed at b_{high}, the entrepreneur can always find an interest rate path that will attract finance at b_{low}. One such path is to increase the liability instantly to b_{high}, at which level we know that external finance can be induced. This path is preferable for the entrepreneur to inefficient liquidation, although he generally has more favorable alternative paths.

[14] The argument why, generically, $\overline{b}^{p-}(\nu) \in \{-\infty, 0\}$ in steady state is as follows. Let $\overline{\nu}^d$ be the level of productivity at which a unit with infinite funds ($b = -\infty$) is indifferent between continuing or liquidating in the bad state, i.e. $\pi^-(\overline{\nu}^d) + \lambda\Pi^+\left(-\infty, \overline{\nu}^d\right) = 0$. *(i)* When $\nu = \overline{\nu}^d$, the value Π^- of a unit in the bad state is zero, irrespective of its level of b; which implies that its value Π^+ in the good state is also independent of b. Thus, any unit in the bad state will also find that $\pi^-(\overline{\nu}^d) + \lambda\Pi^+\left(b, \overline{\nu}^d\right) = 0$ irrespective of b, and will be indifferent between continuation and liquidation. *(ii)* When $\nu < \overline{\nu}^d$, it is clear that continuation is undesirable for any unit in the bad state, irrespective of the level of b. *(iii)* When $\nu > \overline{\nu}^d$, continuation is strictly desirable irrespective of b for any unit in the bad state, because it must be strictly more desirable than in the case $\nu = \overline{\nu}^d$. From all of the above, one concludes that, generically, $\overline{b}^{p-}(\nu)$ takes either value $-\infty$ (when $\nu < \overline{\nu}^d$) or 0 (when $\nu > \overline{\nu}^d$).

The dynamics of a production unit's external liabilities, b, are determined by the required risk-adjusted return. They are given by[15]

$$\dot{b}_t = \begin{cases} (\rho + \delta + \lambda)\, b_t - \pi_t, & b_t > 0; \\ \rho b_t - \pi_t, & b_t \leq 0. \end{cases}$$

Recall that we have restricted ourselves to the case where negative cash flows cannot be financed externally in the bad state. With positive external liabilities ($b_t > 0$) — which, by assumption, only happens in the good state — the external financier requires a return $\rho + \delta + \lambda$, to cover the opportunity cost ρ of capital as well as the probability $\delta + \lambda$ of failure or bad-state liquidation. With positive internal funds ($b_t < 0$), the entrepreneur earns the interest rate ρ.

Gross Creation

For each productivity ν, we have seen that there is minimum wealth compatible with creation constraints (6) — which translates into an upper-bound $b \leq \bar{b}_t^+(\nu)$ on initial leverage. We define $\underline{\nu}_t^c$ as the productivity at which an entrepreneur with infinite funds would be indifferent between creating or not. Total gross creation is

$$H_t = \int_{\underline{\nu}_t^c}^{\overline{\nu}} \int_{-\infty}^{\bar{b}_t^+(\nu)} g(b; A_t) f(\nu)\, db\, d\nu.$$

With the accounting of the units that are created at any point in time at hand, we can go back and explicit labor's flow opportunity cost (3), by writing an expression for the quasi-rents a worker expects to capture in a future job:

$$E_\nu[S_t] = \frac{1}{1-\beta} \int_{\underline{\nu}_t^c}^{\overline{\nu}} \int_{-\infty}^{\bar{b}_t^+(\nu)} \Pi_t^+(b,\nu) \frac{g(b; A_t) f(\nu)}{H_t}\, db\, d\nu.$$

Gross destruction

The number D_t of production units destroyed at any point in time is made up of three components:

$$D_t = D_t^\delta + D_t^s + D_t^f,$$

where

$$\begin{aligned} D_t^\delta &= \delta(1 - U_t); & (8) \\ D_t^s &= \lambda \int_{-\overline{\nu}}^{\overline{\nu}_t^d} \int_{-\infty}^{\phi\kappa} n_t^+(b,\nu)\, db\, d\nu + \max\{\dot{\overline{\nu}}_t^d, 0\} \int_{-\infty}^{0} n_t^-(b, \nu_t^d)\, db; & (9) \\ D_t^f &= \lambda \int_{\overline{\nu}_t^d}^{\overline{\nu}} \int_0^{\phi\kappa} n_t^+(b,\nu)\, db\, d\nu + \int_{-\overline{\nu}}^{\overline{\nu}} n_t^-(0,\nu)\, \dot{b}_t\Big|_{(b,\widetilde{\epsilon})=(0,-\epsilon)} d\nu. & (10) \end{aligned}$$

The three terms correspond, respectively, to exogenous failures, "privately efficient" (or "Schumpeterian") destruction, and "privately inefficient" (or "spurious") destruction. *(i)* The first term, D_t^δ, captures the flow of units that fail for *exogenous* reasons.

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[15] We follow the convention of denoting the time-derivative of a function $x(t)$ by $\dot{x} \equiv dx/dt$.

(ii) Privately efficient (or Schumpeterian) destruction D^s captures units destroyed because they hit a *profitability* constraint on continuation. Define $\overline{\nu}_t^d$ as the level of profitability at which a unit with infinite internal funds would be indifferent between continuing or not in the bad state. The first term captures units that turn unprofitable because they enter the bad state with productivity $\nu \leq \overline{\nu}_t^d$; the second, units that turn unprofitable because they cross that threshold while in the bad state due to deteriorating aggregate conditions. This type of destruction is a form of Schumpeterian destruction, by which unproductive components of the economy's productive structure are renovated.[16] *(iii)* Privately inefficient (or spurious) destruction, D_t^f, measures destruction due to *financial* constraints. The first term in D_t^f is the flow of units that turn bad and must be liquidated because of insufficient capitalization; the second term captures the flow of units in the bad state that run out of internal funds.[17]

Initial wealth dynamics
Recall that we specified the marginal density $g(b; A_t)$ of new projects' financing requirements as a function of an index A_t of the aggregate wealth of non-active entrepreneurs. In order to allow for an effect of aggregate conditions $\widetilde{y}_t$ on the latter — as emphasized, e.g., by Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) — we assume that A_t follows the following process:

$$\dot{A}_t = \psi(\widetilde{y}_t, A_t), \quad \psi_1 \geq 0, \psi_2 \leq 0. \tag{11}$$

Our model is focused on tracking in detail the internal funds dynamics of production units in operation, but not the population and wealth dynamics of potential entrepreneurs. Although it would be methodologically more sound to track the details of the latter, doing so would add another dimension of complexity to our model. Our specification uses a short-cut designed to capture the essence of the distribution of initial wealth and its cyclical dynamics.

3 Empirical Anchors

In this section, we discuss the empirical evidence on the US economy which we use to "anchor" our model's parameters. Our mission is clearly not to resolve the controversies that characterize the relevant empirical literatures, or to demonstrate that there is only one defensible parametrization. What we argue is that a reasonable reading of the evidence — not necessarily the only reasonable reading — leads to a perspective on the cost of recessions that is surprisingly different from prevailing views.

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[16] This is a rather simplistic view of Schumpeterian destruction. See, e.g., Caballero and Hammour (1994) for a vintage model of creative destruction. In contrasting Schumpeterian with spurious destruction, we do not mean to attribute to Schumpeter the view that separations are privately efficient. What we attribute to him is the idea — central to his "liquidationist" view of recessions — that destruction is highly selective.

[17] All else being equal, the lower a unit's productivity, the more likely it is to be liquidated due to financial constraints. This "selectivity" of spurious destruction makes the difference with Schumpeterian destruction less stark than may appear at first glance.

The evidence that plays a central role in this exercise relates to *(i)* average and cyclical features of aggregate employment and of job flows; and *(ii)* private rents to firms and workers on the creation and destruction margins. We generally rely on existing literatures for evidence. However, there is one central question concerning which, as far as we are aware, there is no empirical literature — namely the *cumulative* impact of aggregate shocks on gross job creation and destruction flows. We start by examining this question in sub-section 3.1, and advance the case of chill following a contractionary aggregate shock. We then turn to calibrating the model's parameters in sub-section 3.2, based on existing evidence as well as the results of sub-section 3.1.

3.1 Semi-structural Evidence: A Case of Chill

Using data from the US manufacturing sector over the period 1972:1-1993:4, we propose two approaches to examine the cumulative impact of "aggregate" business cycle shocks on job flows. The "single-factor" approach assumes that aggregate shocks are the only driving factor behind employment fluctuations; the "two-factor" approach assumes there are two factors, aggregate and reallocation shocks. In both cases, our time-series results indicate that US manufacturing exhibited a chill following recessions. The evidence we find does not support the common presumption that recessions are associated with a cumulative increase in restructuring.[18]

The data

Figure 3.1 presents our data on manufacturing employment and gross flows. The solid line in panel (a) depicts manufacturing employment divided by its mean. For comparison, the dashed line presents the economy-wide unemployment series (rescaled).[19] The two series clearly present a very similar cyclical pattern, a feature we will exploit when we test and do not reject the stationarity of the employment series. Panel (b) reports the path of gross job creation and destruction *flows*, defined as the basic quarterly creation and destruction *rates* reported by Davis, Haltiwanger and Schuh (1994, henceforth "DHS") multiplied by the aggregate employment series from panel (a).[20] All data are seasonally adjusted using the Census X11 procedure.

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[18] Data limitations do not allow us to analyze sectors outside manufacturing. Since a significant portion of layoffs in US manufacturing are temporary, this biases our results against the chill finding because the resulting turbulence does not correspond to true restructuring. On the other hand, some workers who are laid off from manufacturing may find temporary jobs in other sectors. This may mean that the aggregate economy exhibits less chill than manufacturing, but again the appearance of those temporary jobs — which involve negligible investment — does not represent true restructuring.

[19] Source: FRED.

[20] More precisely, DHS calculate their creation and destruction rate series as the ratio of job flows to average employment for plants in their sample. For consistency, we first transform the denominator of the DHS series from average to lagged employment. We then multiply by lagged manufacturing employment, measured in the middle month of the quarter, to obtain our flow series.

Instead of using aggregate manufacturing employment, we could have used employment in the DHS sample. The latter series has a time-trend that is not present in the former, but the two are otherwise broadly consistent. We ran our regressions using the DHS employment series and obtained very similar results.

Figure 3.1a
Manufacturing Employment and (-) Civilian Unemployment

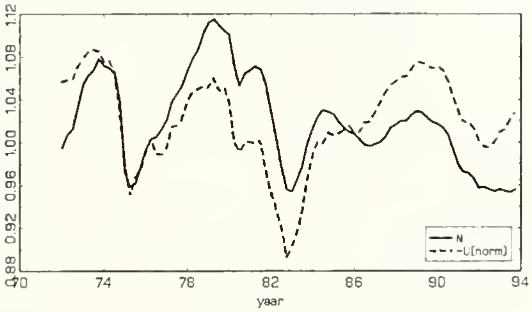
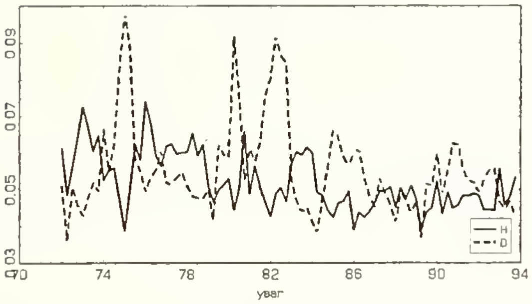


Figure 3.1b
Job Creation and Destruction Flows



We denote the employment, creation, and destruction series in deviation from their mean by $\widehat{N}_t$, $\widehat{H}_t$, and $\widehat{D}_t$, respectively. In principle, those series are related by the identity

$$\Delta \widehat{N}_t = \widehat{H}_t - \widehat{D}_t. \tag{12}$$

In practice, this identity does not hold strictly because of the way we constructed our job flow series — as the product of DHS rates times manufacturing rather than DHS employment.

Single-factor approach
We first assume that employment fluctuations are driven by a single aggregate shock. Since creation and destruction are related by (12), a linear time-series model for the response of job flows to aggregate shocks can generally be written either in terms of creation:

$$\widehat{H}_t = \theta^h(L)(-\widehat{N}_t) + \epsilon_t^h; \tag{13}$$

or in terms of destruction:

$$\widehat{D}_t = \theta^d(L)(-\widehat{N}_t) + \epsilon_t^d; \tag{14}$$

where L is the lag-operator and $\theta^x(L) = \theta_0^x + \theta_1^x L + \theta_2^x L^2 + \ldots$. If identity (12) were exact, those two equations would be equivalent, with $\epsilon_t^h = \epsilon_t^d$. Given the noise introduced into (12), there are grounds for estimating each equation independently. We report results for the following specification:[21]

$$\theta^x(L) = \frac{\eta_0^x + \eta_1^x L + \eta_2^x L^2 + \eta_3^x L^3}{1 - \rho^x L}, \quad x \in \{h, d\}.$$

Panels (a) and (b) of figure 3.2 portray the estimated impulse-response function of (minus) employment and job flows, respectively, to a 2-standard-deviation recessionary shock. As is well documented by DHS, at impact job destruction rises sharply and job creation declines to a lesser extent. Less known is what comes next. Along the recovery path, job destruction declines and falls below average for a significant amount of time, offsetting its initial peak. On the other hand, job creation recovers to its average level but does not exceed it to any significant extent to offset its initial decline.[22] Assuming stationary employment, the qualitative difference in the two series' behavior, if significant, is only consistent with a chill effect. This is shown in panel (c), which reports the cumulative responses of job creation and destruction.

Given (12), the stationarity of employment implies that $\theta^h(1) - \theta^d(1) = 0$. We test this hypothesis and do not reject it at any reasonable significance level.[23] Stationarity of employment, however, does not mean that $\theta^h(1)$ and $\theta^d(1)$ are equal to zero. On the contrary, the constraint $\theta^h(1) = \theta^d(1) = 0$ is clearly rejected in favor of an alternative that sets $\theta^h(1) = \theta^d(1) < 0$.[24] This means that the cumulative effect of a shock on gross flows is significantly negative. On a series-by-series basis, it is destruction that is mostly responsible for this rejection.[25]

Two-factor approach

The chill result does not change much in a richer, more standard time series setting. We now assume that employment fluctuations are driven by two types of shocks, and use a semi-structural VAR approach to identify them. Given the previous test, we maintain the assumption that employment is stationary. By equation (12), the integral of $\widehat{H} - \widehat{D}$ must therefore be stationary.[26] For chill or turbulence effects to be consistent with this fact, the integrals of $\widehat{H}$ and $\widehat{D}$ must be cointegrated with

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[21] Our qualitative, and to a large extent quantitative, results are robust to different lag structures.

[22] Hall (1999) coins the term "concentrated series" to describe series which lump adjustment, in the sense that a burst of activity today predicts a below average level of activity in the near future. This is a necessary but not sufficient condition for a chill, which requires that reduced activity more than offsets the intial burst. He finds that while job destruction is concentrated, job creation is not, which is consistent with our findings.

[23] Estimating jointly equations (13) and (14) without imposing stationarity, $\theta^h(1) - \theta^d(1) = 0$, yields a likelihood of 675.5; while imposing stationarity only lowers the likelihood to 674.8.

[24] If we impose $\theta^h(1) = \theta^d(1) = 0$ on the joint estimation of (13)-(14), the likelihood drops to 671.4.

[25] Estimating equation (13) separately with and without the constraint that $\theta^h(1) = 0$ yields likelihoods of 346.8 and 347.3, respectively. Doing the same for (14) with and without the constraint $\theta^d(1) = 0$ yields likelihoods of 323.5 and 327.0, respectively.

[26] This assumes that the measurement noise introduced into equation (12) is stationary (possibly with a deterministic trend) — a hypothesis we cannot reject.

cointegrating vector $(1, -1)$. Using this low-frequency restriction efficiently suggests running a VAR with the cointegrating vector (equal to $\widehat{N}$) and one of the integrals first-differenced (e.g., $\widehat{D}$).

We write our semi-structural VAR as

$$\begin{bmatrix} \widehat{N}_t \\ \widehat{D}_t \end{bmatrix} = A(L) \begin{bmatrix} \epsilon_t^a \\ \epsilon_t^r \end{bmatrix},$$

where $A(L) = A_0 + A_1 L + A_2 L + \ldots$ and $(\epsilon_t^a, \epsilon_t^r)$ represent i.i.d. innovations that correspond to aggregate and reallocation shocks, respectively. Besides normalizations, achieving identification requires two additional restrictions. For this purpose, we assume that the two innovations are independent of each other, and that, at impact, a recessionary shock raises destruction and lowers creation. Based on Davis and Haltiwanger (1996), we set the relative size of the absolute response of destruction compared to creation to 1.6, which is roughly the value that maximizes the contribution of aggregate shocks to net employment fluctuations with their estimates. We experimented with values of the relative response of destruction to creation in the range $[1, 2]$, without a significant change in our main conclusions.

Figure 3.2a

Impulse response (single factor): (minus) Employment

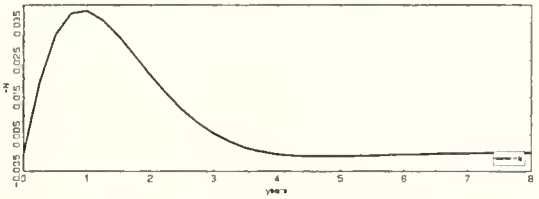


Figure 3.2b

Impulse Response (single factor): Job Creation and Destruction

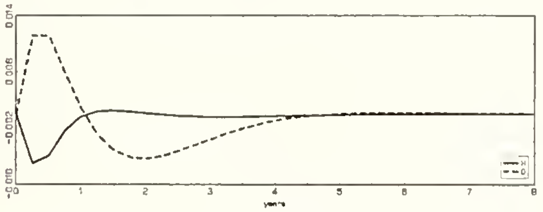
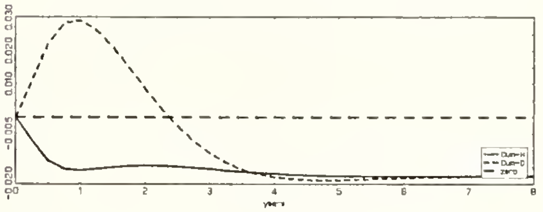


Figure 3.2c

Impulse Response (single factor): Cumulative Job Creation and Destruction



Since we are particularly concerned with medium and low frequency statistics, we used a fairly non-parsimonious representation of the reduced-form VAR and allowed for five lags. The first and second columns of figure 3.3 represent impulse-response functions corresponding to recessionary 2-standard-deviation aggregate and reallocation shocks, respectively, for (minus) employment, gross flows, and cumulative gross flows. The first column exhibits a case of chill following a recessionary aggregate shock, which is qualitatively similar and quantitatively larger than the chill obtained with the single-factor approach.[27] The second column depicts responses to reallocation shocks, which, not surprisingly, generate turbulence.[28]

Figure 3.3a
Aggr. Impulse (minus) Employment

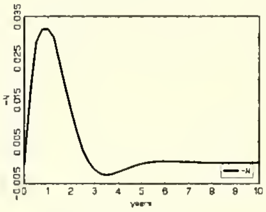


Figure 3.3b
Reall. Impulse: (minus) Employment

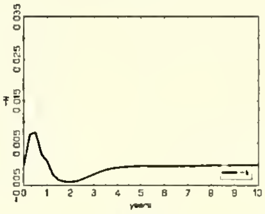


Figure 3.3c
Aggr. Impulse. Job Creation and Destruction

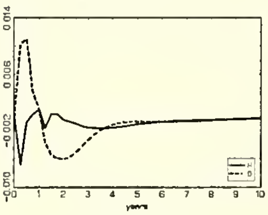


Figure 3.3d
Reall. Impulse: Job Creation and Destruction

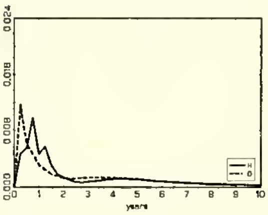


Figure 3.3e
Aggr. Impulse Cum. Job Creation and Destruction

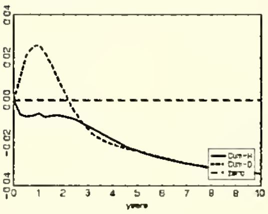
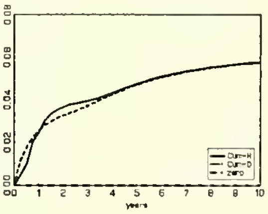


Figure 3.3f
Reall. Impulse Cum. Job Creation and Destruction



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[27] We ran bootstraps to test the no-chill hypothesis, and rejected it. The corresponding histograms are presented in the working-paper version of this study (Caballero and Hammour 1998c).

Our qualitative results are robust to the number of lags used (we tried between 2 and 6 lags), to whether the 1974-75 recession is excluded, or to estimating the VAR for the logarithms of $(N, D/N)$ rather than (N, D).

[28] See Davis and Haltiwanger (1999) for a comprehensive study of the response of job flows to oil shocks, which have a significant reallocation component.

3.2 Parameter Choice

We can now turn to the choice of parameter values in our model. Six parameters characterize technological aspects of production units: κ, ϵ, λ, δ, ϕ, r; two characterize institutional aspects of rent sharing: α and β; and two characterize preferences: ρ and z. We also need to specificity functional forms with their associated parameters. The joint distribution of project productivities ν and financing requirements b is assumed uniform in ν on the interval $[-\overline{\nu}, \overline{\nu}]$ and uniform in b on $[0, b^{\max}]$, with total mass A_t.[29] The dynamic process $\psi(y, A)$ that governs internal funds available for creation is assumed linear. Finally, "business cycle" dynamics for the aggregate component $\widetilde{y}_t$ of firm output is assumed to follow an Ornstein-Uhlenbeck process:

$$d\widetilde{y}_t = -\gamma(\widetilde{y}_t - \overline{y})dt + \sigma dW_t, \quad \gamma, \sigma \geq 0,$$

where W_t is a standard Brownian motion.[30]

Table 1 summarizes the values we chose for the above parameters, based on observed features of the US economy. We first discuss calibration of steady-state features of our model based on evidence concerning *(i)* general features of the economy that are less central to our argument; *(ii)* factor-market rents; and *(iii)* unemployment and gross flows. We then discuss the aspect of calibration that is based on cyclical features of the economy. A number of parameters were calibrated by fitting quantities that arise endogenously within our model. Although this amounts to a simultaneous equations exercise, it will be intuitive to think of it in terms of the assignment of one parameter for each fitted quantity.

General features of the economy

(i) The discount rate was set to $\rho = 0.06$. *(ii)* The gross rental-cost of generic capital was set to $r = 0.135$. Given the discount rate, this means a depreciation rate of 7.5 percent, which falls between the rates of depreciation of structures and equipment (source: BEA). *(iii)* The aggregate component $\overline{y}$ of production-unit output was chosen in such a way as to normalize aggregate output to one. *(iv)* The capital requirement of a production unit was set to $\kappa = 1.94$, which is the value needed to match the observed capital/output ratio (equal to 1.9 for the US business sector in 1995; source: OECD).[31] *(v)* Entrepreneurs' share parameter α determines the return

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[29] By definition, $b^{\max}$ must satisfy the constraint $b^{\max} \leq \phi\kappa$.

[30] Strictly speaking, some realizations of an Ornstein-Uhlenbeck process will violate two assumptions we made in sub-section 2.3 — namely that we restrict ourselves to parameters such that the following properties always hold: *(i)* $\pi_t^+ > 0$ and $\pi_t^- < 0$; and *(ii)* $\overline{b}_t^{f-} = 0$. We therefore need to assume that the process for $\widetilde{y}_t$ is adequately regulated so as to satisfy those two assumptions; and check that they are always satisfied in our simulations.

Another, relatively minor issue is that expression (9) for D_t^s is not compatible with an infinite-variations specification for $\widetilde{y}$, because term $\dot{\overline{\nu}}_t^d$ is ill-defined. We chose to retain this expression for expositional simplicity. This is of no practical relevance to our simulations, which are based on a disretized version of the model.

[31] One must distinguish between the amount of capital actually utilized in production units, and capital as measured using national accounts perpetual inventory procedures. In our case, since the separation rate is higher than the depreciation rate of generic capital, the former stock of capital is less than the latter. Our calibrations are aimed at matching measured capital.

premium on internal funds, and hence the economy's profit rate. We set it to the value $\alpha = 0.7$ that yields a profit rate of 15 percent. *(vi)* For the dispersion of project productivities, we set $\overline{\nu} = 0.106$ near the maximum value compatible with the model's constraint on bad-state financing. This corresponds to ±10 percent of average productivity.

Table 1: Model Parameters

Parameter	Value	Parameter	Value
κ	1.940	z	0.000
ϵ	0.283	$\overline{\nu}$	0.106
λ	0.205	$b^{\max}$	0.394
δ	0.060	ψ_0	-0.009
ϕ	0.329	ψ_1	0.558
r	0.135	ψ_2	-1.940
α	0.700	$\overline{y}$	0.899
β	0.333	γ	0.590
ρ	-0.060	σ	0.180

Factor-market rents

Our model exhibits private rents to labor and firms on the creation and spurious destruction margins. *(i)* Abowd and Lemieux (1993) estimate the equivalent of labor's share β of rents to fall in the range [0.23,0.39].[32] Using a value of $\beta = 1/3$ for labor's bargaining share, we obtain an average rent component of wages equal to 8 percent of the average wage.[33] *(ii)* Alderson and Betker (1995) estimate the liquidation value of a firm to be about 2/3 of firm assets. This leads us to set the capital specificity parameter ϕ to about 1/3, which results in an average flow rent on the firm's side equivalent to 6 percent of the average wage. *(iii)* On the destruction side, privately inefficient separations can cause rent losses to labor and to the firm. The literature includes a wide range of estimates for the cost of job loss, that range from less than 2 weeks of wages to substantially more than a year.[34] Using unemployment insurance data, Anderson and Meyer (1994) estimate an average worker loss of 14 weeks of wages. Although this is an estimated average over all permanent separations — including privately efficient ones — we apply it conservatively to the privately inefficient component of separations D^f.[35] The literature on the firm side is much less developed. Hamermesh (1993, pp. 207-209) surveys various estimates, with

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[32] See Oswald (1996) for a survey of the related literature.

[33] Expressions for private rents on the creation and spurious destruction margins can be found in the working paper version (Caballero and Hammour 1998c).

[34] See, e.g., Ruhm (1987), Topel (1990), Farber (1993), Jacobson, LaLonde and Sullivan (1993), and Whelan (1997).

[35] In fact, the median loss is of only about one week of wages while about 9 percent of workers suffer a loss of more than a year.

again a wide range that goes from 3 weeks to 2.5 years of a worker's wage depending on characteristics of the firm. We use the estimate of 20 weeks of wages from one of the more careful studies (Button 1990). The total loss of 34 weeks for the whole production unit is obtained by choosing a value $\epsilon = 0.283$, that determines the output gap between the good and the bad state.

Unemployment and gross flows
We now anchor the following quantities: U, H, and the different types of destruction. *(i)* We use the variable z to calibrate the unemployment rate to $U = 0.06$. The resulting value is very small, which leads us to set $z = 0$. *(ii)* We calibrate the annual churn rate to $H/(1-U) = 0.11$ by choosing the appropriate width $b^{\max}$ for the distribution of financing requirements.[36] *(iii)* On the destruction side, the churn rate translates into three types of destruction: $H = \delta(1-U) + D^f + D^s$. We set the failure rate of production units to $\delta = 0.06$ to determine the first type, chosen in the lower range of values compatible with the parameter restrictions we impose in section 2. *(iv)* Using the Poisson parameter λ, we set the annual rate of privately inefficient separations D^f to about 2.5 percent of employment, which corresponds to the annualized rate of "displacements" as reported by the Displaced Workers Survey for the period 1991-93.[37]

Cyclical dynamics
We rely on the dynamics of employment and gross flows documented in sub-section 3.1 for parameters that drive cyclical features of our model. *(i)* Parameters γ and σ in the Ornstein-Uhlenbeck process for $\widetilde{y}_t$ were set to values that result in unemployment dynamics similar in volatility and persistence to the dynamics documented in section 3.1. This resulting process implies an annual auto-regressive coefficient for $\widetilde{y}_t$ of about 0.4. *(ii)* In section (4), we examine how the chill following recessions is potentially related to the effect of aggregate income on funds available for creation in dynamic equation (11). We chose parameter values for that equation that can match the empirical case of "chill" we find in sub-section 3.1.[38]

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[36] This gross churn rate is an average value between a sectoral measure of flows in US manufacturing and an economy-wide measure of flows limited to the state of Pennsylvania (see Davis, Haltiwanger and Schuh 1996, p. 21).

[37] See Hall (1995), table 1, p. 232. This survey was conducted in 1994 and asked whether the respondent had lost a job during the 1991-93 period for plant closing, an abolished shift, insufficient work, or similar reasons. Hall points out that a separation is "more likely to be considered a displacement in a retrospective survey if it has larger personal consequences."

[38] The constant term ψ_0 in $\psi(y, A)$ has little relation to the economy's cyclical features. It effectively determines the steady-state mass A of potential entrants, which can be calibrated based on the steady-state churn rate H^* that an "efficient" economy — i.e., one with no contracting impediments — would have. This can be most easily seen if we consider the experiment of adding mass to the $g(b, A)$ distribution at the right of $b^{\max}$, in such a way as to increase the efficient churn rate without affecting the inefficient economy. In the absence of an observable counterpart for H^*, we chose a rather arbitrary value for A in the middle of its admissible range that generated an efficient churn rate $H^* = 0.185$.

4 The Cost of Recessions

We now turn to analyzing our model's implications for the effect of recessions on economic restructuring and its social welfare implications. In order to describe the general economic environment where recessions develop, we start in sub–section 4.1 by characterizing the steady-state implications of factor market rents in an economy that is subject to on-going restructuring. We then analyze in sub-section 4.2 the economy's business cycle dynamics and, in particular, the mechanisms behind the chill following recessions. Finally, we discuss in sub-section 4.3 the social costs of the chill.

4.1 Structural Unemployment, Sclerosis and Scrambling

Suppose the economy is in steady state with a constant $\tilde{y} \equiv \bar{y}$. In order to sort out the effect of labor and financial market rents, we define four different economies: the "efficient" economy, that suffers from no contracting problems; the α-economy, that adds only the financial constraint to the efficient economy ($\alpha > 0$, $\beta = 0$); the β-economy, that adds only the labor market problem ($\alpha = 0$, $\beta > 0$); and the $\alpha\beta$-economy ($\alpha, \beta > 0$), that adds both problems. Our calibration exercise refers to the $\alpha\beta$-economy.

The economy's aggregate performance is summarized by aggregate flow-welfare:

$$\mathcal{W} = Y^s - \phi\kappa H, \tag{15}$$

where $Y^s \equiv Y - r(1-\phi)\kappa N - zN$ measures aggregate output *net* of the return on generic capital and the foregone utility of leisure. Table 2 reports, for each of the economies, welfare $\Delta\mathcal{W} \equiv \mathcal{W} - \mathcal{W}^*$ in deviation from its efficient-economy level, as well as its three basic determinants: unemployment, average labor productivity, and creation. It also reports measures of gross flows and the shadow wage. Note that, because gross aggregate output was normalized to one in the calibration process, measures of aggregate welfare can be interpreted as a percentage of GDP in the $\alpha\beta$-economy.

Table 2: Steady-State Equilibrium

	Efficient Economy	α-economy	β-economy	$\alpha\beta$-economy
$\Delta\mathcal{W}$	-	-0.007	-0.060	-0.077
U	-	-	0.049	0.060
Y^s/N	0.960	0.947	0.886	0.884
H	0.185	0.177	0.094	0.104
D^s	0.125	0.101	0.037	0.024
D^f	-	0.015	-	0.023
w^o	0.745	0.737	0.725	0.697

The net welfare cost of contracting impediments in the $\alpha\beta$-economy corresponds to nearly 8 percent of GDP. This cost is accounted for by several factors. Compared to the efficient economy, the $\alpha\beta$-economy suffers from a 6 percent *structural unemployment* rate.[39] It also suffers from average productivity lower by 8 percent, itself due to two phenomena that we will describe shortly: *sclerosis* of the productive structure, and a *scrambling* of the productivity ranking along which creation and destruction decisions are made. Those costs are partly alleviated by a reduction in job-creation costs, given the economy's substantially lower churn rate.

Structural unemployment
"Structural" unemployment in steady state is intimately tied to a churn process that faces impediments in the labor market. In the absence of either a churn (i.e., if $\delta = \lambda = 0$) or labor-market impediments (if $\beta = 0$), steady-state unemployment would be zero. Financial constraints compound with those two factors to cause even higher unemployment. Unemployment rises to 4.9% due to the labor-market problem, and to 6.0% when we add financial constraints.

Unemployment can be thought of as a response of the economic system that restores equilibrium in the presence of wage rents. Compared to an efficient steady state with full employment, we have seen that contracting impediments in the labor market give rise to wage rents, which break the efficient free-entry condition on the creation margin. Lower creation and higher unemployment are an endogenous response of the economic system. They lead to higher unemployment duration U/H, which reduces labor's outside opportunity cost w^o (see equation 3). This offsets rent appropriation, and helps guarantee the rate of return required by capital markets. Note, however, that although the shadow wage w^o falls, this is not generally true of actual wages inclusive of the rent component.[40]

Table 2 shows that financial constraints compound with labor-market constraints to further increase the structural rate of unemployment. This happens as financial constraints reduce the steady-state demand for labor, both because of the financial restrictions on creation and because the profitability of hiring is reduced by the risk of inefficient liquidation.

Sclerosis and scrambling
In addition to unemployment, the economy suffers from distortions in the restructuring process. The inefficiency of the churn is characterized by a combination of "sclerosis" and "scrambling," i.e. a slower and less effective churn, respectively. Both labor-market and financial-market problems create *sclerosis* — the survival of production units that would not survive in an efficient equilibrium. As illustrated in table 2, sclerosis arises through the low shadow wage w^o associated with lax labor-market

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[39] A number of factors that affect the social cost of observed unemployment are not captured by our model. The cost may be higher because *(i)* unemployment is associated with deterioration in human capital, social stigma, etc.; and *(ii)* transactional impediments cause a reduction in the participation rate that is not captured by unemployment statistics. The cost of unemployment may be lower because *(iii)* unemployment facilitates the matching of employers and workers; and *(iv)* work is associated with a disutility (we calibrated $z = 0$).

[40] See Caballero and Hammour (1998b).

conditions (high unemployment). This lowers the pressure to scrap low-productivity units in the bad state, which reduces the threshold productivity $\underline{\nu}^d$ at which this is done. The result is a substantial reduction in the Schumpeterian churn rate D^s. A pure sclerosis effect is exhibited in the β-economy, where the Schumpeterian churn rate there is about one-third the efficient-economy rate while average labor productivity Y^s/N falls by 8 percent. Sclerosis is costly because it leads to an inefficiently low rate of restructuring.

Adding financial constraints to the β-economy worsens the quality of the churn. The $\alpha\beta$-economy has a higher active churn rate $D^s + D^f$, but slightly lower average productivity Y^s/N. The fact that a higher reinvestment cost is expended to maintain lower average productivity is clearly costly. It is due to a *scrambling* phenomenon on the creation and destruction margins, that reduces the effectiveness of the churn. In the absence of financial constraints, creation and destruction decisions are based on a strict productivity-ranking of production units. When internal funds become a factor in those decisions, some units are financed that have lower productivity than others that are not financed. Given the creation rate H, this tends to lower the productivity of the average unit created. It also tends to increase the productivity of the average unit destroyed, by shifting the composition of destruction from Schumpeterian D^s to spurious D^f.

4.2 Mechanisms behind the Chill

We now turn to the economy's cyclical properties. We highlight the model's ability to generate impulse-response functions of employment and gross flows consistent with those documented in sub-section 3.1. We focus, in particular, on the effect of recessions on cumulative restructuring and the mechanisms that can generate a chill. To do so, we analyze our economy in two steps. We first remove financial constraints and look at the cyclical properties of the β-economy. Although this economy does not exhibit the financial constraints on creation or the privately inefficient separations discussed in our calibration exercise, analyzing it helps isolate a specific mechanism for the chill based on *productivity selection*. We then bring back financial constraints and look at the $\alpha\beta$-economy. The productivity-based mechanism is weakened and replaced by a much costlier chill based on a *financial* mechanism.

Figures 4.1 and 4.2 depict the impulse-response functions for a recessionary shock in the β-economy and the $\alpha\beta$-economy, respectively. For comparability, we chose the size of the shock to be such that it yields the same cumulative unemployment in the $\alpha\beta$-economy as a 2-standard-deviation shock in the VAR estimated in subsection 3.1. Panels (a) and (b) depict the response of unemployment and job flows. Panel (c) depicts the cumulative response of creation and destruction, $\int_0^t \widehat{H}_s ds$ and $\int_0^t \widehat{D}_s\, ds$. Panel (d) depicts the privately efficient and privately inefficient components of destruction.

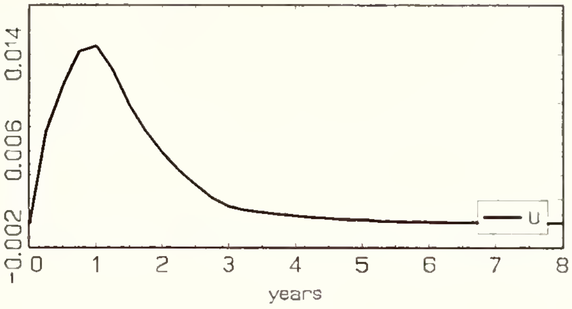


Figure 4.1a (β-economy)
Unemployment

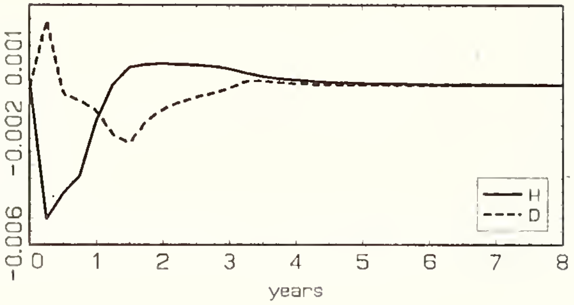


Figure 4.1b (β-economy)
Job Creation and Destruction

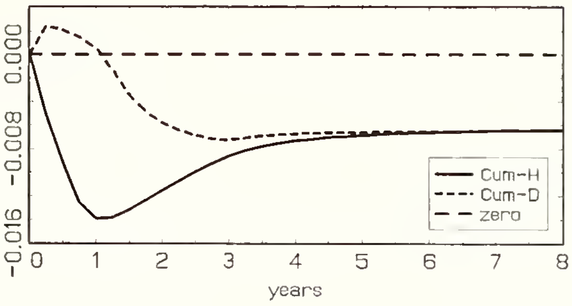


Figure 4.1c (β-economy)
Cumulative Job Creation and Destruction

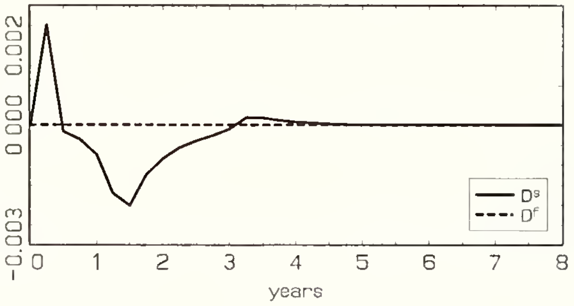


Figure 4.1d (β-economy)
Schumpeterian and Spurious Destruction

Figure 4.2a ($\alpha\beta$-economy)
Unemployment

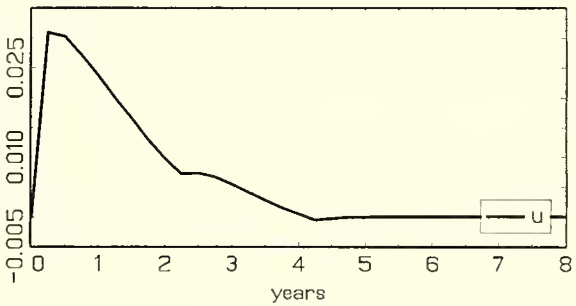


Figure 4.2b ($\alpha\beta$-economy)
Job Creation and Destruction

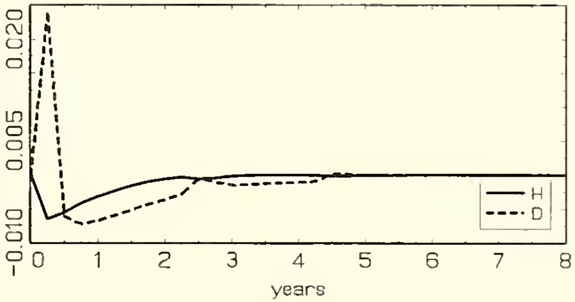


Figure 4.2c($\alpha\beta$-economy)
Cumulative Job Creation and Destruction

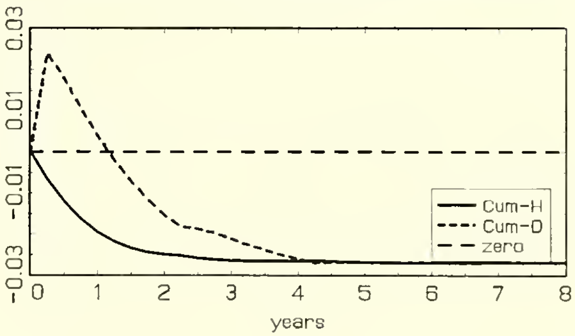
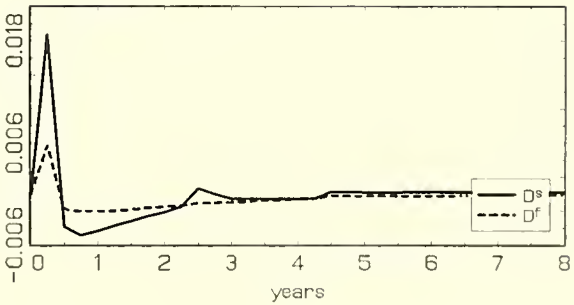


Figure 4.2d ($\alpha\beta$-economy)
Schumpeterian and Spurious Destruction



The β-economy: productivity-based chill

The β-economy in figure 4.1 exhibits a positive unemployment response to the recessionary shock, that returns to steady state over time. The unemployment response is due to the wage "rigidity" brought about by workers' rent-seeking behavior ($\beta > 0$). In the absence of rents ($\beta = 0$), and off-corners, one can show that the shadow wage w^o will absorb all fluctuations in $\widetilde{y}$ with no resulting quantity response. When $\beta > 0$, a central determinant of the shadow wage is the job-finding probability H/U (see equation 3). In that case, a quantity response in the form of increased unemployment or reduced hiring is required to induce a fall in the shadow wage in response to a contraction in $\widetilde{y}$.

In terms of gross flows, the recession materializes through both an increase in destruction and a decrease in creation. What determines which of those two margins responds to the shock? As we argue in Caballero and Hammour (1994, 1996), the key to this question lies in the "insulation" mechanism by which a fall in creation reduces w^o and insulates destruction from aggregate shocks. If an exclusive response on the creation margin is not costly, the economy will respond on the creation margin only and will fully insulate destruction. In fact, one can show that this is what would happen, off-corners, if all projects in our economy had the same productivity ν. Heterogeneous productivities in the pool of potential entrants is what makes an exclusive response on the creation margin costly. In that case, the average productivity of the entrant pool rises when the rate of creation falls, which makes further reductions in creation increasingly costly and shifts part of the response to destruction.

The recession's effect on cumulative flows depends not only on the response of gross flows at impact, but on the manner in which the economy recovers. As can be seen in panel (c), the economy initially experiences turbulence in the form of increased destruction at impact, but ultimately ends up with a decrease in cumulative destruction. The reason for this is that the recovery takes place essentially through lower-than-normal destruction, while creation simply converges back to its normal level without much overshooting. In addition to the fact that cumulative destruction is lower because employment is lower along the path, a quantitatively more important mechanism that underlies the chill is due to the selectivity of creation across project productivities. Those units that are not created during the recession are precisely units that have relatively low productivity, and therefore a high churn rate. Their absence reduces destruction in the ensuing recovery.

The $\alpha\beta$-economy: finance-based chill

Compared to the β-economy, the $\alpha\beta$-economy in figure 4.2 experiences more volatile unemployment, responds much more on the destruction rather than on the creation margin, and exhibits a more significant chill. Overall, the $\alpha\beta$-economy exhibits a good fit for the empirical impulse-response functions of employment, gross flows, and the cumulative churn in figures 3.2 and 3.3.

The introduction of financial constraints induces a significant shift in the economy's cyclical responsiveness from the creation to the destruction margin. The fact that entry for many projects is now determined by the ability of entrepreneurs to finance them introduces financial rents on the creation margin. Those rents allow many projects to absorb negative profitability shocks, which renders the insulation mechanism even costlier for the remaining projects and shifts more of the response to the destruction margin. This dampening effect of financial rents on creation investment goes against the common conclusion that financial constraints increase the volatility of investment.[41] The latter conclusion relies on internal fund dynamics (Bernanke and Gertler, 1989) or cyclical fluctuations in the value of collateral assets (Kiyotaki and Moore, 1997), which we capture through the dynamics of funds available for creation (equation 11). Fluctuations on the creation margin are therefore partly driven by a cyclical financial constraint rather than a profitability constraint.

The fact that financial constraints dampen creation investment does not mean that it dampens the *net* employment response. On the contrary, employment becomes more volatile as the economy's cyclical response shifts to the destruction margin, which is more sensitive to current conditions because of a shorter expected survival horizon. The greater volatility of destruction in this economy is, thus, causally related to the amplitude of economic fluctuations.

The chill following the recession is of a very different nature than the productivity-based chill in the β-economy. In fact, the quantitative significance of the selection mechanism behind the latter is now greatly reduced, as creation becomes much less responsive and the productivity ranking for entry decisions is scrambled. At the core of this phenomenon are now the dynamics of financial resources for creation. The nature of fund dynamics is such that it leads to a natural shift in the margin which responds during the recession and recovery phases. While the reduction in financial resources can accentuate the fall in creation during the recession, it will constrain the recovery from taking place along that margin until resources recover. The result is a shift from the creation to the destruction margin in the recovery phase, which results in significantly negative cumulative reallocation. As we show in the next sub-section, a finance-based chill is socially much costlier than a productivity-based chill.

Nonlinear response

Before leaving behind the description of the positive implications of the model, it is worth highlighting that the $\alpha\beta$-economy exhibits interesting non-linearities. Although destruction is nearly four times more responsive to a large negative shock than creation, the ratio of the overall standard deviations of destruction to creation is only 1.5 — roughly the same as in the US manufacturing sector. This is essentially due to a substantial difference in the economy's response to negative versus positive shocks. Relative to creation, destruction responds much more to a negative than to a positive shock. This feature has been documented for US manufacturing gross flows (e.g., Caballero and Hammour 1994, Davis and Haltiwanger 1996). As a result, unemployment responds more to a negative than a positive shock. This asymmetry in net employment fluctuations is reminiscent of features documented for the US economy as a whole (see, e.g., Sichel 1989), and arises out of a fully symmetric shock process.

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[41] An exception is Carlstrom and Fuerst (1997).

4.3 Social Costs of the Chill

In this sub-section, we develop a social-welfare decomposition that allows us to analyze the social costs of recessions. In addition to the direct cost associated with unemployment, recessions in our model also result in reduced cumulative restructuring. In an economy that suffers from sclerosis, there are positive gains from increased restructuring. The presumption is therefore that the chill is costly, but much depends on how cumulative restructuring is reduced in the recession-recovery episode. With productivity-based chill, the foregone gains from restructuring are relatively small because the fall in creation affects selectively projects with low productivity. With finance-based chill, the foregone gains from restructuring are larger because the financially-driven fall in creation is not very discriminate across productivities. The latter is therefore socially much costlier that the former.

Assume the economy starts in stochastic steady state, and experiences a negative aggregate shock to $\widetilde{y}$ at time $t = 0$. If this shock affects "real" productivity, an obvious *direct* social loss — which also affects the efficient economy — results from lower productivity in all units. In order to separate the costs of inefficient churn from this direct cost, we assume that the shock to $\widetilde{y}$ is due to an "aggregate distortion" — e.g., due to a distortionary tax on gross output that is redistributed lump-sum. To compare the recession path of any variable X_t with its stochastic steady-state value $\overline{X}$ in the absence of the new shock, we define $\widehat{X}_t \equiv X_t - \overline{X}$ and the resulting present-value operator

$$\mathcal{L}_X \equiv \int_0^\infty \widehat{X}_t e^{-\rho t}\, dt.$$

We also define, for any two variables X_t and Y_t, the interaction operator

$$\mathcal{X}_{X,Y} \equiv \int_0^\infty \widehat{X}_t \widehat{Y}_t e^{-\rho t}\, dt.$$

We measure the social-welfare effect of a recession as the present value $\mathcal{L}_{\mathcal{W}}$ of the shock's effect on flow welfare $\mathcal{W}$, defined in (15). The welfare effect can be decomposed into a component in $\mathcal{L}_U$ that captures an unemployment effect, and a component that captures the productivity effects related to the churn:

$$\begin{aligned}
\mathcal{L}_{\mathcal{W}} \;=\; & -(\rho+\delta)\left(\overline{V}^h - \phi\kappa\right)\mathcal{L}_U \\
& + \left(\overline{V}^h - \overline{V}^{ds} - \phi\kappa\right)\mathcal{L}_{D^s+D^f} \\
& - \left(\overline{V}^{df} - \overline{V}^{ds}\right)\mathcal{L}_{D^f} \\
& + \left(\overline{H}\mathcal{L}_{V^h} - \overline{D}^s\mathcal{L}_{V^{ds}} - \overline{D}^f\mathcal{L}_{V^{df}}\right) \\
& + \mathcal{X}. \qquad (16)
\end{aligned}$$

The term V_t^h measures the average social value of creating a production unit; V_t^{ds} and V_t^{df} measure the average social loss from privately efficient and privately inefficient destruction; and $\mathcal{X}$ is an interaction term.[42]

The "unemployment" effect, which corresponds to the first line in (16), captures the direct social cost of unemployment, adjusted for the passive response of δ-destruction. Formally, it is equal to the cumulative employment effect of the recession, $-\mathcal{L}_U$, multiplied by the flow social value $(\rho + \delta)(\overline{V}^h - \phi\kappa)$ of a production unit.

The "productivity" effect, captured in the next four lines, reflects a potential cost of maladjustment in addition to the unemployment cost. It is essentially a function of the present value $\mathcal{L}_{D^s+D^f}$ of the response of active destruction to the recessionary shock, as well as of the response of the composition of gross flows over time. The terms on lines two to four, respectively, answer the following questions: *(i)* What is the welfare effect of changes in the amount of restructuring, assuming that it affects all productivities in equal proportions and that all destruction is privately efficient (the "churn" effect); *(ii)* By how much should that welfare effect be adjusted to account for the fact that some destruction is privately inefficient? (the "spurious destruction" effect); *(iii)* By how much should that effect be adjusted to account for the fact that some productivities are affected more than others by changes in the churn (the "selection" effect). The last line captures an interaction term. Note that to answer the first question, we value a unit-increase in cumulative reallocation is $(\overline{V}^h - \overline{V}^{ds}) - \phi\kappa$. It is equal to the *private* value increase from updating a production unit, minus the reinvestment cost. Because of private rents on the creation margin, this social value is positive. To answer the second question, one must subtract from this the private loss $\overline{V}^{df} - \overline{V}^{ds}$ that applies to privately inefficient separations.

Tables 4 and 5 report the cumulative responses and the social-welfare decompositions that correspond to the impulse-response functions in figures 4.1 and 4.2 for the β-economy and the $\alpha\beta$-economy. As explained in sub-section 4.1, social costs can again be interpreted as a percentage of steady-state annual GDP in the $\alpha\beta$-economy.

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[42] Formally, we define

$$\begin{aligned} V_t^h &\equiv \frac{\overline{y}^s + \nu_t^h}{\rho + \delta} + \frac{\epsilon}{\rho + \delta + 2\lambda}; \\ V_t^{ds} &\equiv \frac{\overline{y}^s + \nu_t^{ds}}{\rho + \delta} - \frac{\epsilon}{\rho + \delta + 2\lambda}; \\ V_t^{df} &\equiv \frac{\overline{y}^s + \nu_t^{df}}{\rho + \delta} - \frac{\epsilon}{\rho + \delta + 2\lambda}; \end{aligned}$$

where

$$\nu^x \equiv \int_{-\overline{\nu}}^{\overline{\nu}} \frac{x(\nu)}{X} \nu d\nu, \quad X \in \{H, D^s, D^f\};$$

and

$$\mathcal{X} \equiv \mathcal{X}_{H,V^h} - \mathcal{X}_{D^s,V^{ds}} - \mathcal{X}_{D^f,V^{df}}.$$

Table 4: Response to a Recessionary Shock

	β-economy	$\alpha\beta$-economy
$\mathcal{L}_U$	0.022	0.046
$\mathcal{L}_H$	-0.008	-0.024
$\mathcal{L}_{D^s}$	-0.006	-0.003
$\mathcal{L}_{D^f}$	-	-0.015

Table 5: Welfare Effect of a Recession

	β-economy	$\alpha\beta$-economy
Unemployment	-0.017	-0.035
Churn	-0.003	-0.015
Spurious Destruction	-	0.007
Selection	0.002	-0.002
Interaction	-0.001	-0.001
Productivity	-0.002	-0.011
Total	-0.019	-0.046

The social cost of a two-standard deviations recession in the β-economy is 1.9 percent of a year's GDP. It is essentially due to an unemployment cost of 1.7 percent. Productivity only adds another 0.2 percent. Although a lower cumulative churn is harmful in an economy that suffers from sclerosis, it is less so once we consider that units created in a recession have high productivity and present relatively low gains from restructuring. This is why the selection term reduces by nearly a half the social cost of reduced churn.

The $\alpha\beta$-economy exhibits larger and more costly employment and chill responses. The unemployment cost rises to 3.5 percent, and the chill adds another 1.1 percent. The recessionary fall in creation is mostly financially driven, hence less selective across productivities than in the β-economy. As a result, the finance-based chill is much costlier.

5 Conclusion

The main question in this paper concerns the effect of aggregate shocks in an economy that is subject to on-going restructuring. There is a common presumption among macroeconomists that a recession increases restructuring activity, but controversy about whether this is socially costly or beneficial. A tradition that goes back to the pre-Keynesian "liquidationist" school, views increased liquidations as healthy; another view holds that liquidations are often privately inefficient and wasteful.

First, we showed that the existing evidence contradicts the common presumption, and seems to indicate that recessions *reduce* rather than increase the cumulative amount of restructuring in the economy. Second, we argued that a systematic treatment of contracting problems — of which privately inefficient liquidations are only one manifestation — is required to make a welfare assessment. In equilibrium, contracting difficulties on the creation margin generally lead to insufficient restructuring, which points to a cost of reduced restructuring. The model we developed provides a useful framework to analyze how recessions affect restructuring activity, and what the social welfare implications may be.

We made an effort to quantify our conclusions by drawing on existing empirical evidence. Our mission was clearly not to resolve the controversies that characterize the relevant empirical literatures, or to demonstrate that there is only one defensible parametrization. What we argued is that a reasonable reading of the evidence — not necessarily the only reasonable reading — leads to a perspective on the cost of recessions that is quite different from prevailing views.

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