"GROSS WORKER AND JOB FLOWS IN EUROPE"

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Abstract

Despite the impression of Eurosclerosis, labor markets in Europe are in fact quite active. Flows into and out of unemployment are large, countercyclical, and highly coherent in four European countries examined. Worker exits from unemployment to employment exhibit a countercyclical pattern similar to that in the United States and Japan. The matching function paradigm is capable of explaining these facts only if the unemployment stock rises sufficiently fast in downturns. We propose an equilibrium model which can deliver a wide range of job and worker flow dynamics. For sufficiently large adverse shocks, the model can generate endogenous layoffs and job destruction which match the stylized facts.

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Introduction

The conventional wisdom holds that high and persistent unemployment in Europe reflects either insufficient economic activity or stagnant labor markets, or both. Despite the impression of Eurosclerosis, labor markets are in fact quite active. Table 1 shows that in 1987, an average year in the last business cycle, France's employment office reported 4.1 million new cases of unemployment or about 340,000 *per month,* while unemployment itself averaged only 2.7 million. Every month, the equivalent of roughly 1.7% of the French labor force passed through the state of unemployment. The picture is similar for Germany, Spain and the United Kingdom. Even when compared with the United States and Japan, labor markets in Europe are far from stagnant. They are characterized by large flows between employment, unemployment and nonparticipation.

[Table 1 about here]

The stylized facts which emerge from the study of gross labor flows challenge conventional macroeconomics. A large class of theories of business cycles assume that flows from unemployment to employment grow during an upturn while flows from employment to unemployment are the driving force behind increases in total unemployment during downturns. The data from all countries we examine, however, indicate that recessions are associated with increases in gross outflows from unemployment. Even more striking is that most of these new exits from unemployment represent *job findings* rather than exits from the labor force.[1] The data are presented in Section 1, which proposes a set of stylized facts about worker flows. Section 2 proposes explaining the facts in terms of a matching function relating exits from unemployment to stocks of unemployment and vacancies, and presents estimates of the matching function for four European countries. The matching function is capable of

[1]This observation, and its implication for some theories of unemployment, has previously been made by Darby et. al. (1986). See also Blanchard and Diamond (1990) and Murphy (1990).

explaining the pattern of outflows if the stocks of unemployment rise sufficiently fast in downturns to offset the decline in the exit rate.

While relatively new to Europe, the study of labor flows has been pursued actively in the United States for several years (see for example, Marston (1976), Clark and Summers (1979), Abowd and Zellner (1985), Darby et al. (1985, 1986), Blanchard and Diamond (1989, 1990)). More recently, however, attention has shifted to job flows. The work of Davis and Haltiwanger (1990, 1992, 1993) lend support to the view that job creation and destruction are the driving force behind worker flows over the cycle. As a result, several models have been developed to account for worker flows solely as a by-product of job flows (Davis and Haltiwanger (1990), Caballero and Hammour (1992), and Mortensen and Pissarides (1993)). Section 3 notes the tension between the empirical behavior of the two sets of flows. An equilibrium model of worker and job flows, which rests on the foundation of a matching function, is proposed in Section 4. This model, which draws a sharp distinction between worker and jobs, can reproduce the key stylized facts on labor market flows. Section 5 concludes.

1. Stylized Facts about Gross Worker Flows in Europe and Elsewhere

1.1. Unemployment Flows

To understand unemployment, we focus on flows into and out of unemployment, irrespective of where people go to or from. Yet it is important to put these flows into perspective. Figure 1 provides a useful map of gross workers flows among the three states of employment, unemployment and out of the labor force for Germany and France in 1987. For France, we present two estimates which bound the range of movements between unemployment and the two other states.[2] Both absolutely and relative to the size of the stocks, flows in and out of unemployment are

[2] The ANPE category "radiations" (workers who fail to report to the local employment office during the designated time and subsequently purged from the registry) have either found a job and fail to report it, or have left the labor force. The upper panel of Figure 2 assigns this flow entirely to employment, while the lower assigns it to out-of-the-labor force.

large compared with other flows in labor markets.

[Figure 1 about here]

The behavior of gross flows unemployment flows over time is surprisingly counterintuitive. Figure 2 displays time series of annual unemployment flows normalized by the labor force for France, Germany, Spain and the United Kingdom.[3] In all four countries, inflows and outflows from unemployment move strikingly closely together, both over the cycle and over the longer term. For example, in Germany the correlation between inflows and outflows is 0.92. This feature is not shared by flows in and out of employment or in and out of the labor force. In one sense this is necessarily true since the flows are so large relative to the stocks; small deviations between such large flows imply sharp movements in unemployment. This coherence holds despite an upward trend in both inflows and outflows by more than 50% in all economies since the 1960s.

[Figure 2 about here]

Inflows into unemployment are known to be countercyclical. The high correlation of inflows and outflows implies however that outflows are also countercyclical. This can be confirmed by inspection of Figure 2, which also plots an index of capacity utilization in manufacturing as a cyclical indicator. Statistical support for this visual impression can be found in Table 2, which reports elasticities of unemployment flows with respect to the OECD capacity utilization rate while controlling for the lagged flow, a time trend, and seasonal dummies. While stronger in Germany, France and Spain and weaker in Japan, the US, and the UK, both unemployment inflows and outflows are uniformly countercyclical. Similar results (not reported) were obtained when first differences of log GNP or a measure of bankruptcies was substituted for capacity utilization.[4]

[3]For France, Germany and Spain these are new registrations at unemployment offices. For the UK, they are based on the Labor Force Survey.

[4]The figure also gives the impression that inflows lead outflows in the

[Table 2 about here]

1.2. Unemployment Flows: Where to and From

It is not conventional wisdom that gross outflows out of unemployment increase in a downturn, and decline in an upturn. The joint and countercyclical movements of unemployment flows might conceal different behavior of their components, however. For example, an increased number of outflows during a recession may correspond to discouraged unemployed workers who drop out of the labor force. Similarly, the decline in inflows during the expansion phase of the cycle may reflect the fact that workers joining the labor force go straight into jobs, rather than transiting through unemployment. Surprisingly, we find that the absolute number of unemployed workers who exit unemployment into employment is higher during recessions than expansions.

Inflows into unemployment include flows from employment (firm or worker initiated separations, shown as S in Figure 1) or flows from out-of-the labor force (labelled E, new entrants or re-entrants into the labor force). The number of separations is much larger rather - by a factor of 2 to 3 - than the number of new entrants. Available detailed data for French and German indicate (not reported) that *both* flows move countercyclically. Thus in expansions less people flow into unemployment, not simply because separations are lower, but also because flows from outside the labor force decline.[5] As is well established for the United States (see for example Akerlof et al 1988 and references therein), layoffs are countercyclical while quits are procyclical. In France, for

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cycle. That increases in unemployment are to a first approximation associated with increased inflows into unemployment was suggested by Darby et al (1986) for US data and by Hughes (1986), Junakar and Price (1983), and Hughes and Hutchinson (1986) for the UK. This may be reinforced by annual averaging of the original monthly data, which purges the highest frequency movements. In unreported "Granger causality" tests with these flows, innovations in both series tend to help predict the other.

[5]This corresponds to new entrants or re-entrants flowing directly into jobs (A on Figure 1) rather than through unemployment. Indeed, out-of-the labor force flows (A+E) do not exhibit any cyclical pattern in the German data.

which detailed data are available, quits into unemployment are dwarfed by quits into other jobs and quits from the labor force, and represent a minor component of total unemployment inflow.[6]

Outflows from unemployment can be either job finds (F in Figure 1) or exits from the labor force (D) including the "discouraged worker" effect (see Perry (1977) or Clark and Summers (1979)). Distinguishing between the two interpretations is important, as labor markets are seen as efficient under the first interpretation, and inefficient under the second. In fact, exits from unemployment to employment in European data are numerically larger than exits from the labor force; the majority of workers who leave unemployment do so because they have found a job.[7] In France and Germany, the fraction of outflows attributable to new employment is relatively constant over the cycle (for Germany, between 60 and 70%). The evidence for Germany presented in Figure 3 shows that the countercyclical behavior of outflows from unemployment primarily reflects unemployed workers flowing into jobs in increasing numbers.[8] More generally, the relative stability of total employment and labor force stocks in the face of such large flows renders implausible the hypothesis that these exits are merely workers leaving the labor force. Examination of US and Japanese data leads to the same conclusion.[9]

[Figure 3 about here]

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[6]These findings are reported in Burda and Wyplosz (1990), and are similar to those of Pissarides and Wadsworth (1989) and Akerlof et al. (1988) for the United States and the United Kingdom. Comparable official data for Germany are not available. It should be mentioned however, that the most significant increase in job separations in France and Spain is due to the increasing use of one-year contracts (see Bentolila and Saint-Paul (1992) for a discussion of the Spanish experience).

[7]This contrasts sharply with the findings of Clark and Summers (1979), who attribute up to half of unemployment flows in the US to entry and exit from the labor force. Interestingly, movements from and into the labor force represent an increasing proportion of unemployment flows over the sample for both France and Germany, but remain well under US levels.

[8]These data exclude exits into apprenticeships, full-time schooling, and retraining programs.

[9]The correlation of real US GNP growth with log differenced U-to-E exits from Abowd and Zellner's (1986) adjusted CPS survey data is -0.832; the correlation of exits with one-year lagged real growth is -0.55.

1.3. Other Flows[10]

Evidence is also available for the other flows identified in Figure 1. Employment inflows are generally *pro*cyclical, while outflows are less consistently so. Even though flows between employment and unemployment are countercyclical, they are offset by procyclical flows between employment and out-of-the labor force and by employment-to-employment flows. During an expansion, for example, fewer workers are laid-off and fewer unemployed workers return to employment, but more workers change jobs directly without passing through unemployment. In addition, direct entries into the labor force occur more often through employment than through unemployment while more employed workers quit the labor force, possibly because the need for a second-earner decreases in good times.

Based on available German data, total out-of-the labor force (OLF) gross flows do not exhibit any marked cyclical pattern. This is because the flows between OLF and employment are procyclical while the (far smaller) flows between OLF and unemployment are countercyclical. During expansions, movements into and out of the labor force tend to occur more directly through jobs than through unemployment.

1.4. Summary

The following facts characterize the European data on gross labor flows (and are consistent with data elsewhere):

1. Unemployment inflows and outflows are highly coherent, both over cycles and along a common trend. Such is not the case for employment and out-of-the labor force flows.

2. Unemployment inflows and outflows are countercyclical, as are their components (layoffs, job finds, discouraged workers, new entrants and re-entrants), except for quits which are procyclical.

3. Jobs losses represent by far the largest component of flows into unemployment. Quits into unemployment represent a minor component of

[10]In this section we summarize the more detailed analysis found in Burda and Wyplosz (1990).

total inflows.

4. Accessions to jobs represent the largest component of exits from unemployment, at least for Germany for which the data is most convincing.

5. Employment inflows and outflows are procyclical. Since the flows between employment and unemployment are countercyclical, the other components of employment flows (i.e. employment to employment and between employment and out-of-the labor force) are strongly procyclical.

6. Out-of-the labor-force (OLF) inflows and outflows do not exhibit any particular cyclical pattern. Since flows between OLF and unemployment are countercyclical and flows between OLF and employment are procyclical, during recessions (expansions) entrants tend to pass more frequently through unemployment (employment).

2. Challenges to Economic Theory and Explaining the Worker Flow Puzzle

2.1. A Challenge to Macroeconomic Theory

The stylized facts identified in the last section challenge the conventional wisdom which assumes that business cycles affect the labor market primarily by movements along a derived demand for labor. In this view, unemployment outflows are procyclical, while inflows into unemployment are countercyclical. Models in this category are those based on agents' misperception of relative prices of labor and goods (Friedman 1968, Lucas 1973), or nominal contracts cum aggregate demand shifts (Fischer 1977, Taylor 1979). The same is true of models which emphasize labor supply, e.g. search models with workers misperceiving relative wage offers (Lucas and Prescott 1974). Similarly, real business cycle models which stress productivity shocks and intertemporal substitution of labor supply (Kydland and Prescott 1982, Eichenbaum and Singleton 1986) associate business cycle *upturns* with an increase of exits of workers from unemployment into productive activity. The common element of all these models which is contradicted by our findings is the paradigm of the "representative agent." A representative firm will not simultaneously hire and fire representative workers, nor is it likely to accelerate this process during a downturn. To come to grips with the facts, theory needs to allow for heterogeneous firms, heterogeneous workers, or both.[11]

The conventional wisdom has profoundly influenced the interpretation of high and persistent European unemployment. With the exception of Junakar and Price (1983) and Hughes (1987) most studies have stressed a declining job finding rate as the proximate cause of the rise in European unemployment. One example is Pissarides (1986), who attributes almost all of the increase in unemployment in the UK since the early 1970s to declines in the job finding rate. Similarly, Blanchard and Summers (1986) have interpreted falling job finding rates as evidence of insiders restricting access to jobs to unemployed outsiders. Yet as is evident from Figure 2, the rise in unemployment in Europe has been accompanied by a dramatic increase in turnover for at least some segment of the labor force.

2.2. Is There Really a Puzzle?

The most remarkable of facts discussed is that, in the aggregate, both hirings and firings increase in recessions. The puzzle disappears if we allow some firms to fire workers in downturns while others do the hirings. This would represent a case of *firm heterogeneity*. In the absence of firm heterogeneity, we would have $S \cdot F=0$, either separations or hiring, but never both simultaneously. This type of heterogeneity has been stressed by Davis and Haltiwanger (1990, 1992, 1993) and Boeri and Cramer (1993) and will be discussed below.

Another possibility is that the same firms actually do both the firings and the hirings. This could be the result of *worker heterogeneity*. This heterogeneity might be evidenced in varying ages and qualities of workers, human capital, and other characteristics. One implication of this view is that upon job loss workers may have

[11] Darby et al. (1985, 1986) and Davis and Haltiwanger (1990) reach the same conclusion.

significantly different exit probabilities. A second implication is that firms may take exploit this heterogeneity to improve the average quality of their workforce by firing and hiring in downturns, when the opportunity cost of such activity is lowest.

At a given job finding rate, it is true that an increase in inflows into unemployment raises the level of unemployment which, in turn, leads to an increase in outflows (see Saint-Paul (1991)). On the other hand, it is not possible to explain the high correlation of unemployment flows simply as an artifact of higher unemployment stocks. The difficulty with this argument is that the job finding (or hazard) rate systematically falls in downturns as documented in the last column of Table 2. The data suggest that outflows do rise but less than proportionately to the stock, so the finding rate is procyclical while outflows are countercyclical.

Labor economists have proposed the *matching function* as one means of linking the hazard or job finding rate and labor market conditions.[12] Such a function captures the process by which workers and jobs meet to form employment relationships. It maps stocks of unemployment U vacancies V into a flow O of new matches:

$$O = x(U,\ V) \qquad (1)$$

If this function does not exhibit increasing returns, the exit rate declines in downturns. The matching process becomes less efficient from the worker's perspective because of congestion of unemployed workers. In contrast, it becomes more efficient from the perspective of the firm, which faces more potential applicants. Put differently, the hazard or escape probability is positively related to the abundance of vacancies relative to the unemployed. Thus, the matching function is in principle capable of explaining the observed behavior of exits of unemployment. In the next section, we check whether such functions can be successfully estimated with data from Western European economies.

[12] See Pissarides (1991) for an extensive discussion of the matching function and its origins.

2.3. Estimates of the Matching Function in Europe

In this section we present empirical estimates of matching functions for France, Germany, Spain and the United Kingdom. Matching functions have been estimated on time series for the US by Diamond and Blanchard (1989), for the UK by Pissarides (1986) and Layard et al. (1991), but fewer studies exist for the continental European economies.[13] To obtain comparable results we use total exits from unemployment, limiting the extent to which the estimated functions shed insight on employment inflows or job creation.

Preliminary testing with monthly data suggests that, in most cases, the logarithms of gross unemployment exits, unemployment and vacancy stocks are integrated of order one (Table 3) but these tests are known to have little power against alternatives which are highly persistent around a deterministic trend. For this reason, two estimation procedures were employed. In the first, we looked for a long run relationship by checking for cointegration and then adopted an error-correction model to estimate the speed of convergence to the long run relationship. The second approach is to estimate the matching function assuming a single linear time trend over the entire sample. To save space, we report in Table 4 results obtained using the second approach.

Table 3 about here

The table presents the results for the Cobb-Douglas specification (for all countries save Spain we can accept it against a CES alternative). For each country, the first line presents the unconstrained estimate of the matching function's parameters, the coefficients on the logarithm of lagged unemployment and vacancies. The last column displays the speed of convergence to the long run found with the second-step

[13]Buttler and Cramer (1991) estimated a matching function based on German time series job placements mediated by the employment office. Using short panels of monthly district-level labor office data, matching functions have been estimated for Germany (Burda 1993a) and for the Czech and Slovak republics (Burda 1993b).

error-correction model. The second line for each country shows the result when we impose the constant returns to scale constraint, the penultimate column indicating whether the restriction is rejected.[14]

The results support the existence of a matching function. The coefficients are sensible and similar to other results obtained for the UK (Pissarides (1986) and Layard et al. (1991). The elasticity of matches (in the broad sense, including exits from the labor force) with respect to unemployment is usually between 0.5 and 0.7; when constant returns is imposed, they range between 0.7 and 0.8. Except for Spain, the error-correction coefficient suggests rapid adjustment, which confirms that labor markets are extremely active. The assumption of constant returns to scale is decisively rejected in France and Spain, for which the unconstrained estimates suggest that returns are mildly decreasing.[15]

For our purposes, the existence of matching functions is an implicit test of the hypothesis that total unemployment stocks affect matches sufficiently strongly to explain the rise in outflows during downturns. In principle, the generally good fit suggests that the labor flow puzzle can be explained by the workings of a "black box" aggregate matching function.[16] Yet at the same time the matching function accounts for the dynamics of unemployment, not job creation and destruction per se. As will be stressed below, jobs are a necessary, but not sufficient condition for employment. In the next section we examine the evidence on job dynamics and evaluate the links between workers and jobs.

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[14] Chow-tests generally accept sub-sample stability at the 1% level for all countries except Spain.

[15] The quality of the data will affect these estimates. Vacancy data are notoriously poor; many firms do not report to the agencies gathering the data, or report them only when labor markets are tight. Such measurement error will bias the estimated coefficient on vacancies towards zero.

[16] If ranking is occurring or if long term unemployed lose their human capital, the stocks of unemployment of different duration will enter the matching function with different coefficients. This hypothesis was put forward by Budd, Levine and Smith (1987) and Layard and Nickell (1986). It implies that the reaction of outflows to unemployment will be even faster in the early phase of a downturn. Estimates, not reported, provide mixed evidence in this direction.

[Table 4 about here]

3. Gross Job versus Worker Flows

3.1. Job Flows: The Evidence

The notion of a *job* captures aspects of employment which are independent of worker or worker-firm match attributes. In a series of important papers, Davis and Haltiwanger (1990, 1992, 1993) have drawn attention to the cyclical behavior of gross job, rather than worker, flows. They measure job creation as total gross changes in employment in growing establishments and job destruction as the sum of changes in shrinking establishments. Three key facts emerge. First, job destruction is strongly countercyclical while job creation is mildly procyclical or even acyclical. Second, the variance of job destruction over the business cycle is much higher than that of job creation. Thus recessions are accompanied by job losses because destruction increases sharply, while job creation declines modestly. Third, gross establishment size changes are characterized by significant heterogeneity in US data.[17] Even at the four-digit level, the lion's share of job creation and destruction is among establishments within the same industry, rather than between industries. At any moment of time, some firms in a given industry are creating jobs while others are destroying them. The available evidence seems to support this hypothesis for Europe, although not to the same extent (see Boeri (1993) and Contini and Revelli (1993)).

The existence of large gross flows of jobs and workers are a signal of heterogeneity in labor markets. The evidence on intra-industry variability and of large gross job flows in both directions indicate heterogeneity among firms, while large gross worker flows in excess of job creation and destruction must be related to worker heterogeneity. Following the description of worker flows in Figure 1, we know that if workers were homogeneous we would observe both JD=S+B (job destruction (JD) equals total exits over the year from employment (S+B)) and JC=F+A (job creation equals inflows into employment (F+A)). With data for

[17] This has also been stressed by Leonard (1987).

Germany from Boeri and Cramer (1992) and Boeri (1993),[18] Figure 4 shows that there are about twice as many inflows into employment as there are job creations and nearly three times more more exits from employment than job destruction. The difference is not entirely explained by labor force entries and exits -- retirees who are replaced by new entrants, for example -- as is visible in the left hand-side panel. We will see that estimated numbers for Germany provide an upper bound because of double-counting. That S exceeds JD implies that a significant number of job matches (on average 2 to 3 percent of employment in the figure) are destroyed despite the fact that the jobs themselves survive. This match destruction may correspond to temporary layoffs (less common in Europe), firms firing and replacing workers under the guise of restructuring, or worker quits. They are suggestive of active "churning" or "musical chairs" reallocation of heterogeneous workers across heterogeneous existing jobs.

[Figure 4 about here]

3.2. Job versus Worker Flows

Job flow data are apparently at odds with the worker flow stylized facts: during a recession, exits of unemployed workers into employment increases while at the same time job creation declines. Thus unlike gross unemployment flows, gross job flows move in opposite or orthogonal directions over the cycle. The natural conclusion is that worker flows in downturns, while insufficient to explain employment (for which net job creation is a necessary condition), contain elements of worker reallocation which are not revealed by job flows.

A common response to this argument is that worker reallocation cannot be an important factor in slack labor markets because the stock of

[18]The job destruction flows series described by Boeri (1993) is computed on the basis of establishment level social security records at annual frequencies. The worker flow data -- all exits from employment by target -- are computed annually by the Federal Labor Office and represent the universe of transitions out of employment, excluding job-to-job switchers. (Arbeitskräftegesamtrechnung, Bundesanstalt für Arbeit; for a description, see Reyher and Bach (1988)).

vacancies is low. If high worker turnover represented reallocation, so the argument goes, one would expect high levels of vacancies or V/U ratios. This argument is incorrect for two reasons. First, the matching function approach itself suggests that in periods of slack labor markets vacancies are more "efficient" in locating workers; vacancy durations should be shorter and may not exist long enough to show up in stock data. Indeed, the annual gross flow of vacancies reported by national labor ministries is several times the stock in the countries we survey. Second, the source of vacancy data are the reporting of job openings at state employment agencies, which in periods of high unemployment is a less preferred method of search for firms (for evidence on Germany, see Franz (1987) and Franz and Smolny (1993)).

3.3. Jobs versus Employment: Measurement and Pitfalls

Obviously, worker and job flows must be related. For example, if all jobs were constantly filled, there would be no difference between jobs and employment; net changes in employment would be equal to both net job creation (the excess of gross creation over gross destruction) and net employment flows (inflows into less outflows from employment). Yet, Davis and Haltiwanger (1993) show that the creation and destruction of workplaces in the United States can only account for between 34 and 56% of worker flows. Similar results have been obtained for Germany by Boeri and Cramer (1992) and Boeri (1993), for Belgium by Leonard and van Audenrode (1993), and for Italy by Gavosto and Sestito (1992).[19]

The Davis-Haltiwanger measure of job creation and destruction is based on gross employment changes for growing (in the case of job creation) and shrinking (in the case of job destruction) enterprises. As a result, it inevitably double-counts the workers who move from shrinking

[19]The French social security administration UNEDIC reported gross job creation in 1987 (a year of net job creation) of 1792736 (of which 965547 came from newly created firms and 827189 from expanding enterprises), or about 44.3% of all movements into employment (excluding job switches) and between 44.9% and 59.5% of U-to-E flows. Job destruction in 1987 was 1665109 (910885+754224), representing 37.7% of total exits from employment and 49.9% of inflows into unemployment from employment. Source: Le Monde, April 11 1989, and Figure 1.

to growing enterprises (or vice-versa). For this reason, net employment changes and net job changes must differ. Indeed, the job flows literature stresses that its standard measure of total job reallocation (the sum of destruction and creation) is an upper bound on worker flows attributable to job creation and destruction. In general, measurement of job creation and destruction is more difficult than that of worker turnover. That Davis-Haltiwanger's (1990, 1992, 1993) measure of job destruction has larger variance and lower persistence at quarterly than annual sampling frequencies suggests that temporary layoffs, quits, and purging of bad staff matches during periods of contraction blur the true picture on job creation.

In both a theoretical and empirical sense, it is unrealistic to assume that total employment is equal to the number of jobs. To the contrary, there is a need to clarify the difference between jobs (which have profitability assigned to them which is independent of match quality) and employment (which depends on worker and firms satisfaction with the match). This is the objective of the equilibrium model of jobs and employment we present in Section 4, in which the existence of a job or a workplace is a necessary but not a sufficient condition for employment.

4. A Model of Gross Job and Worker Flows

4.1. The Setup

The following model recognizes that job creation is costly and that worker reallocation may be preferable to job destruction if the job itself has economic value. Yet this preference will depend on the relative valuation of employment (filled jobs) versus vacancies (unfilled existing jobs and planned job creation). Secondly, we preserve the notion, now common in the literature, that matching is a prerequisite condition for job creation.[20] The model therefore draws a crucial

[20]The assumption that job matching is necessary for job creation but that job creation is not necessary for matching follows Mortensen and

distinction between vacancies corresponding to an existing position (unfilled jobs) versus those for which a workplace has yet to be created (planned positions).

Each firm employs a single worker to produce output y. The size of the labor force is fixed and normalized to unity. Vacancies posted by firms (v) and unemployed workers (u) cannot contact each other costlessly. They are matched according to matching function (1). We assume $x_1>0$, $x_2>0$, $x_{11}<0$, $x_{22}<0$, $x_{12}>0$, and $x_{11}x_{22}-(x_{12})^2=0$ (constant returns to scale). For any individual firm there are three possible states of economic activity: (1) producing y with a worker (a filled job), (2) searching for a worker to fill an unfilled job, and (3) simply "having an idea" without having made the capital outlay to create the position (a planned position). The sum of firms in the latter two states constitute the stock of vacancies (v), which can be thought of as advertisements at the employment agency or in the local newspaper.[21] The upper half of Figure 5 summarizes the possibilities for firms. Under constant returns in matching, the hiring or engagement rate at which vacancies are filled is $h(\theta)\equiv x/v=x(\theta^{-1},1)$, where θ is the vacancy-unemployment ratio v/u. The job finding rate from the perspective of the unemployed is $f(\theta)\equiv x/u=\theta h$. Note that $h'<0$ and $f'>0$.

Employment presupposes the existence of a job or workplace, which either existed already, or is created when the match occurs at fixed job creation cost K. Jobs continue to exist until *destroyed*, which occurs each instant with probability δ. This event can be thought of as economic depreciation or obsolescence. At the same time, job-employee matches can *sour*, or go bad, with probability s. This can be thought of as a match-specific source of heterogeneity which is independent of job destruction.

Pissarides (1993), who consider a model of endogenous job creation and destruction only. In the present model there is no incentive to create the workplace until a worker has been located.

[21]Vacancies in this model are assumed costless to advertise, and only one vacancy may be posted per firm. The model could easily accommodate a flow cost, but at the expense of additional algebra. For a discussion, see Pissarides (1991).

In reality, these separations correspond to either quits or "opportunistic layoffs", i.e. firing a worker without intention of closing the job. For our purposes here, this probability is exogenous, but it is plausible that these will respond to economic conditions.[22]

The model draws a clear distinction between job creation and worker reallocation which is related to the two types of vacancies in the model. Employment (e) is the total number of workers in employment relationships. Jobs ($j \geq e$) equal employment plus unfilled jobs. Vacancies (v) can be either unfilled jobs (j-e) or planned positions (v-(j-e)).[23] The lower half of Figure 5 illustrates the distinction between unemployment, employment, and vacancies.

4.2. Valuation of States

Let J, V^h and V^c denote the capital values of the states of having an occupied job, an unfilled job, and a planned position, respectively. Let y denote the value of a match, w denote the wage paid the worker, and r denote the real interest rate. For risk-neutral firms, the three asset valuations must obey the following arbitrage equations:

$$rJ = y - w + \delta(V^c - J) + (1-\delta)s(V^h - J) + \dot{J} \tag{2}$$

$$rV^h = \delta(V^c - V^h) + (1-\delta)h(J - V^h) + \dot{V}^h \tag{3}$$

$$rV^c = h(J - V^c - K) + \dot{V}^c \tag{4}$$

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[22] In fact, the same economic forces that inspired Davis and Haltiwanger's (1990, 1992) or Caballero and Hammour's (1992) work on recessions as cleansing periods could motivate firms to rid themselves of "bad apples", while leaving the jobs themselves intact. From the worker's perspective quits improve poor match quality. These however are procyclical (see Parsons (1986), Akerlof et al. (1988)) in response to improved labor market opportunities and cannot account for the stylized facts of Section 2.

[23] To repeat, the latter category are simply plans which, when matched with an appropriate worker and the capital outlay K, can lead to job creation. Think of a new idea for a crêpe stand in the mind of an entrepreneur, who has neither acquired the crêpe stand nor found a worker to man it.

All three equations state that at any point in time, the instantaneous return on the asset equals its opportunity cost. The return to having a worker in place (normal return measured by the value times the interest rate) equals the sum of current operating profit, the own capital gain on the asset, plus the expected value of two potential capital losses: the first if the job is destroyed, the second if it survives but the employee-worker relationship "sours." In the latter case the capital loss is smaller since the job itself (which is costly to replace) survives. In the second equation, the instantaneous return equals the expected capital loss from obsolescence plus the expected capital *gain* which accrues if the job is not destroyed and filled in that instant, plus the own capital gain. In the last equation, the current return of a planned position is simply the hiring rate times the capital gain from creating a job, net of the one-off job creation cost, plus own appreciation.

When an unemployed worker and a firm with a vacancy meet, there is surplus to be shared, and this sharing function is performed by the wage. The wage here is assumed to be determined by

$$w = y\,\omega(\theta) \qquad \text{with } \omega'>0,\ 0<\omega<\frac{y-[r+\delta+(1-\delta)s]K}{y} \tag{5}$$

where we assume that ω is bounded from above by the share available to labor when capital in production earns a "normal return" in production. The wage function (5) may be interpreted as a "wage offer curve" of a monopoly union or as the outcome of centralized Nash cooperative bargaining between an employers' association and a labor union.[24]

[24] In the steady state it resembles, but is not the same as the wage function derived by Pissarides (1985, 1991), who assumes that bargaining takes place at the match level and that the wage performs no other role than allocating the match surplus. As Hosios (1991) notes, this rules out any signalling role for wages.

4.3. Vacancy Supply, Equilibrium and Model Solution

In order to close the model we require some relationship which determines the total supply of vacancies. One option is to fix the total supply of vacancies, as in Blanchard and Diamond (1989) or Hosios (1991). Following Pissarides (1991) we take the other extreme, assuming that free entry of new firms drives the value of planned positions to zero.[25] The condition $V^c=0$ implies that the stock of vacancies v, or equivalently the ratio $\theta=v/u$, is a "jumping variable" which looks forward and is not bound by the past.

Solution of the model proceeds as follows. First, the condition $V^c=0$ implies J=K: as firms enter the market and open vacancies to keep V^c value-less they eliminate all possible rent on the value of a job match; in equilibrium the value of a filled job just equals its cost K. From (3) this occurs by raising θ, which lowers h, V^h and thereby J. From (2) it follows that

$$V^h = K - \frac{y(1-\omega(\theta)) - (r+\delta)K}{(1-\delta)s} \tag{6}$$

so $V^h<K$ always. It follows then that $V^h= V^h(\theta)$ with $V^{h\prime}>0$. Yet at the same time, from (3), V^h must evolve according to

$$\dot{V}^h = [r+\delta+(1-\delta)h]V^h - (1-\delta)hK \tag{7}$$

This nonlinear differential equation is unstable.[26] We treat it as saddle-stable and require that V^h take whatever value necessary (i.e., jump in case of unexpected disturbance) such that $\dot{V}^h=0$:

[25]This condition has been used by Pissarides (1985, 1991) in modelling vacancies in models of equilibrium unemployment.

[26]At $\dot{V}^h=0$, we have $d\dot{V}^h/V^h=[r+\delta+(1-\delta)h]-(1-\delta)h'\theta'(K-V^h)$ which is globally positive, since $h'<0$ and $K-V^h>0$.

$$V^h = \frac{(1-\delta)hK}{r+\delta+(1-\delta)h} \tag{8}$$

Since $h=h(\theta)$, equating (6) and (8) determines θ uniquely as an implicit function $\theta=\theta(y,\delta,s,r,K)$:

$$K - \frac{y(1-\omega(\theta)) - (r+\delta)K}{(1-\delta)s} = \frac{(1-\delta)hK}{r+\delta+(1-\delta)h} \tag{9}$$

The partial derivatives of θ can be signed by total differentiation; for details see the Appendix:

$$\partial\theta/dy > 0, \qquad \partial\theta/\partial s < 0, \qquad \text{and } \partial\theta/\partial\delta < 0$$

with the last inequality holding in the more plausible "bad news case" in which an increase in the job destruction rate is associated with an increase in labor market slack.

4.4. Jobs, Employment, and Gross Flows

The primary objective of the model is to study the dynamics of jobs j (both filled and unfilled) as well as employment e. Gross job creation is assumed equal to the share of total matches represented by the share of potential positions in total vacancies, so the net stock of jobs evolves according to

$$\dot{j} = [(v-(j-e))/v]x - \delta j = \theta h(\theta) - [\delta+h(\theta)]j + h(\theta)(1-\theta)e \tag{10}$$

where the dot denotes differentiation with respect to time. The remaining fraction $(j-e)/v$ of job matches represent the filling of vacant jobs.

Employment in turn originates through matching of vacancies and unemployed, net of all separations:

$$\dot{e} = x(1-e,v) - [\delta+(1-\delta)s]\ e = \theta h(\theta) - [\delta+(1-\delta)s+\theta h(\theta)]\ e \tag{11}$$

For given θ, the two-dimensional dynamic system in e and j given by (10) and (11) is globally stable.[27] The steady state is:

$$\bar{e} = \frac{\theta h(\theta)}{\delta+(1-\delta)s+\theta h(\theta)} \tag{12}$$

$$\bar{j} = [1 + \frac{(1-\delta)s}{\delta + h(\theta)}]\ \bar{e} \tag{13}$$

so $\bar{e}<\bar{j}$ always. Note that $\bar{j}/\bar{e}$ is a positive function of θ; the tighter labor markets are, the greater the stock of jobs that are not filled at any instant relative to those that are.

The dynamics of the model are illustrated in the phase diagram of Figure 6. The slope of the $\dot{j}=0$ locus depends on the sign of $\theta-1$. In what follows we consider only the case of $\theta<1$ (the $\theta>1$ case yields similar results). Under the assumption that the elasticity of h with respect to θ is less than unity[28], an increase in θ will increase $\theta h(\theta)$ and shift both $\dot{e}=0$ and $\dot{j}=0$ curves rightward. Their intersection lies on the EJ curve defined by equations (9) and (13). As θ increases $\bar{e}$ and $\bar{j}$ both increase and move away from each other.

[Figure 6 about here]

[27]It is straightforward to show that both eigenvalues of the system have negative real parts.

[28]This holds for the Cobb-Douglas matching function and is supported by the empirical results of Section 2.

It is worth noting that in the steady state, there will be vacancies of both types in the labor market (planned positions and unfilled jobs). To see this we need merely to check whether $v>\bar{j}-\bar{e}$, that is, if the number of vacancies exceeds the number of unfilled jobs in equilibrium. Equivalently, we require

$$\theta > \frac{\bar{j}-\bar{e}}{1-\bar{e}} = \frac{\theta h(\theta)(1-\delta)s}{(\delta+h(\theta))(\delta+(1-\delta)s)}$$

which always holds. However, when model parameters change, θ may decline below $(\bar{j}-\bar{e})/(1-\bar{e})$ evaluated at the previous values. In this case, j, e or both will need to jump downwards. In the next section we consider the response of the economy to exogenous variation in y, the gross output produced in a successful match. Allowing for discrete downward jumps in e and j, Δe and Δj, we have from (10) and (11):

$$\begin{aligned}
&\textbf{Unemployment outflows } O = x(1-e,\ v) = (1-e)\theta h(\theta) \\
&\textbf{Unemployment inflows } I = [\delta+(1-\delta)s]e + \Delta e \\
&\textbf{Job creation } JC = [(v-(j-e))/v]x = [\theta + (1-\theta)e - j]h(\theta) \\
&\textbf{Job destruction } JD = \delta j + \Delta j
\end{aligned} \tag{14}$$

4.5. Job and Worker Flow Dynamics: Small versus Large Shocks

Consider the effect of a decline in y, the value accruing from a match (think of either a decline in demand or a negative productivity shock). From the comparative statics results above we have $d\theta/dy>0$, so $\theta=v/u$ must fall to some new value, say θ'. The economy can achieve this reduction by four means: cancelling planned positions, closing open jobs, laying off workers, and destroying filled jobs. The "choice" taken by the economy is assumed to minimize loss of equilibrium asset values of the respective states. In the first instance, vacancies can be costlessly reduced to j-e, since the equilibrium value of unfilled planned positions is zero.[29] Given j and e, v has lower bound (j-e), or equivalently, θ has lower bound $\frac{j-e}{1-e}$. Further reduction of θ is only possible by destroying unfilled jobs (j in excess of e), laying off workers (reducing e), or destroying filled jobs (reducing j and e simultaneously). Even though j and e cannot increase in jump increments, downward jumps in aggregate employment and jobs are assumed possible.[30]

The decline in θ due to an exogenous decrease in y is associated with four cases, which we consider in order of increasing magnitude:

Case 1: $\theta' > \frac{j-e}{1-e}$ *(Elimination of planned positions).* Here firms simply cancel ads at employment agencies which do not correspond to existing unfilled jobs. The job stock and employment stock are unaffected at the time of the shock; adjustment to the new steady state values of j and e occurs through natural wastage as shown by the smooth evolution in Figure 7. From (13) it can be seen that worker and job flows move in opposite directions; inflows and job destruction decline monotonically and outflows job creation jump downward, rising afterwards. These do not match the evidence presented in sections 1 and 3.

Case 2: $\theta' < \frac{j-e}{1-e}$, $V^h < J - V^h$ *(Closing of unfilled jobs).* Following the shock, the value of closing an unfilled job $V^h - V^c = V^h$ is less than the capital loss associated with layoffs $(J - V^h)$; j jumps discretely downwards to some value j'>e, and convergence occurs through attrition (see Figure 7). From (13) the implication for flows is a jump increase in job destruction

[29] Similarly, in Pissarides (1991), in which vacancies correspond to our notion of "planned positions," immediate adjustment occurs through jumps in the stock of vacancies.

[30] How exactly the allocation occurs across firms is not specified. One could assume that the assignment is random.

(corresponding to unfilled jobs) without immediate effect on unemployment; worker flows follow the pattern of Case 1.

Case 3: $\theta' < \frac{j-e}{1-e}$, $V^h > J - V^h$, $j>1$ *(Layoffs).* Here the capital value of open jobs exceeds the capital loss associated with layoffs. Now e rather than j declines discontinuously in Figure 7; the unemployment rate rises discretely on impact. The condition $j>1$ ensures that reduction of e reduces θ.[31] While j is lower in the steady state, its adjustment is achieved solely through wastage.

Case 4. $\theta' < \frac{j-e}{1-e}$, $V^h > J - V^h$, $j<1$ *(Destruction of filled jobs.)* Here the value of open jobs exceeds the capital loss associated with layoffs, but layoffs alone actually raise, rather than reduce, θ! For θ to decline, both j and e must both jump downward as in the last panel of Figure 7, after which they converge to their long run levels. The unemployment rate rises instantaneously, which triggers a jump increase in the number of matches.

[Figure 7 about here]

In both Cases 3 and 4, we are able to replicate the "hugging" of worker flows as the consequence of a jump increase in unemployment *without varying the underlying job destruction and separation rates.* The ensuing jump increase in matches and labor turnover can be associated with either an increase or a decrease in job creation. For large negative shocks with $j<1$, it is possible to replicate discrete jumps in job destruction identified by Davis and Haltiwanger and others. Note also that the share of excess labor turnover is countercyclical: $(O-JC)/(j-e) = h(\theta)$ so a drop in θ leads to a higher ratio of flows per unfilled job; this result is due to the extra margin for hiring workers offered by vacant positions independent of job creation.

---

[31] The derivative $d(\frac{j-e}{1-e})/de = (j-1)/(1-e)^2$ is positive as long as $j>1$.

5. Conclusion

This paper began with a puzzle: how can it be that gross labor flows are so large and countercyclical, dominating net movements in the stocks? And why do they seem to "hug" each other, while gross measures of job creation and job destruction move in opposite directions? It ends with a resolution of the puzzle based on the assumption that exits from unemployment can be represented by a non-increasing returns matching function and a balanced view of the relative importance of worker and job flows.

Both results warrant further research. No matter how theoretically tractable, the matching function is still only short-hand for potentially complex phenomena. Hosios (1990) has shown how the matching function can proxy for a variety of economic processes. Yet the exact nature of heterogeneity and mismatch underlying the matching function remains unexplored. The results presented here and elsewhere point towards the need to address explicitly heterogeneity of both firms and workers in aggregative models. Just as better firms may replace fragile ones during downturns, employers may attempt to improve the quality of their workforce by purging their workforce of bad matches in recessions and "scooping" better workers from the larger pool of unemployed. The model presented in Section 4 only represnts a first attempt at distinguishing between jobs and employment. More explicit incorporation of the "opportunity cost" approach to the business cycle (see Saint-Paul 1993) are likely to lead to a richer set of insights.

Appendix: Comparative Statics

The starting point is equation (9), which fixes the value of θ as a function of the underlying model parameters:

$$K - \frac{y(1-\omega(\theta))-(r+\delta)K}{(1-\delta)s} = \frac{(1-\delta)h\ K}{r+\delta+(1-\delta)h} \qquad (9)$$

Total differentiation of (9) with respect to θ, s, y and δ and setting the appropriate elements to zero yields

$$d\theta/dy = -\frac{1-\omega(\theta)}{\Delta}$$

$$d\theta/ds = \frac{[y(1-\omega(\theta))-(r+\delta)K]^2/[s(1-\delta)]}{\Delta}$$

$$d\theta/d\delta = \frac{K/[s(1-\delta)] - [y(1-\omega(\theta))-(r+\delta)K]/[s(1-\delta)^2] + \dfrac{(1+r)hK}{[r+\delta+(1-\delta)h]^2}}{\Delta}$$

where $\Delta \equiv \dfrac{h'(r+\delta)s(1-\delta)K}{[r+\delta+(1-\delta)h]^2} - y\omega' < 0$. It follows that $d\theta/dy>0$ and $d\theta/ds<0$ unambiguously, whereas $d\theta/d\delta$ has ambiguous sign. A sufficient condition for $d\theta/d\delta<0$ (the "bad news" case) is $(1+r)K>y$, which can be interpreted as requiring that the flow value of a match not be too high relative to the capital cost of job creation, or that the capital intensity (K/y) of jobs is sufficiently high; that is, greater than $(1+r)^{-1}$.

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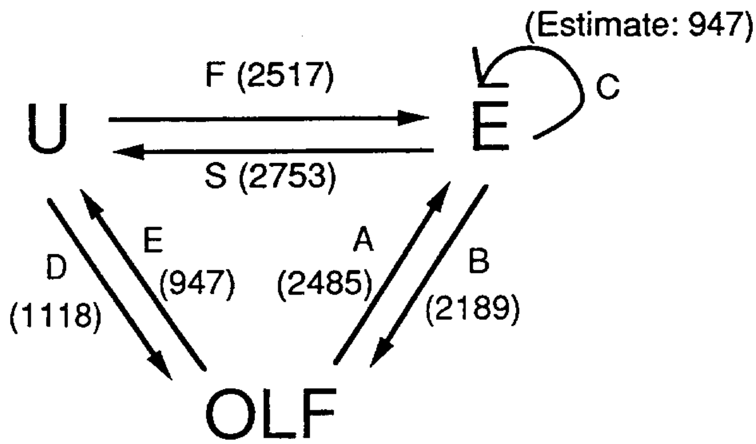
FIGURE 1.

LABOR FLOWS IN 1987

(1000 workers)

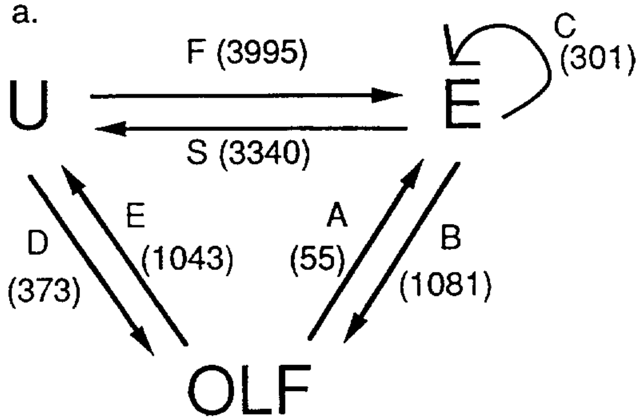
GERMANY



Source: Arbeitskräftegesamtrechnung

FRANCE

a.



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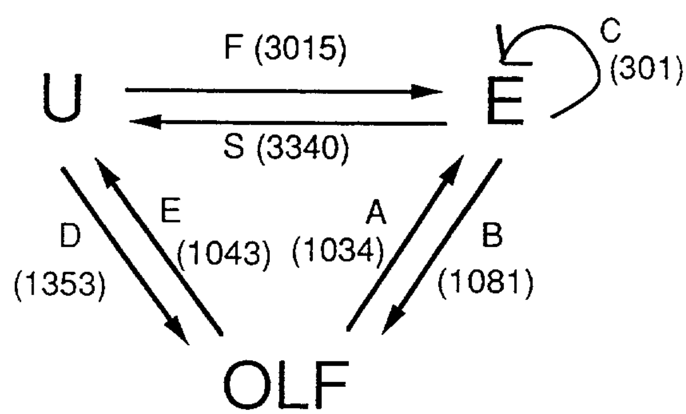
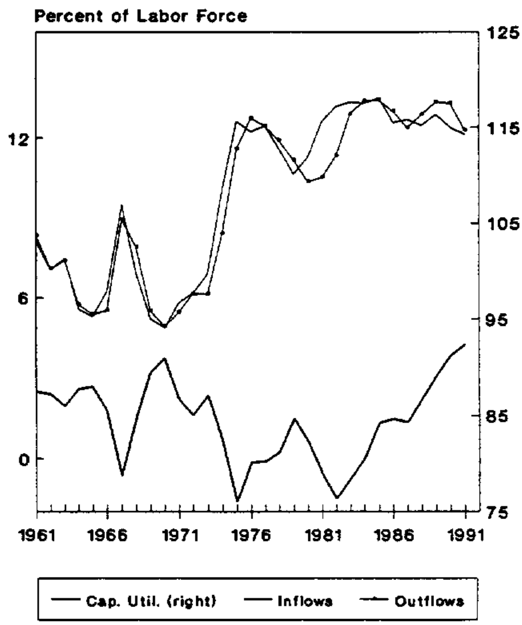


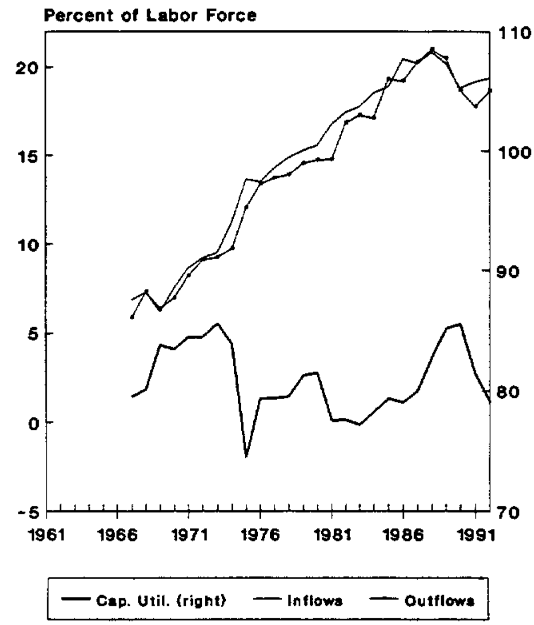
Sources: Bulletin Mensuel des Statistiques du Travail (Ministère du Travail), Les Mouvements de Main-d'Oeuvre dans les Etablissements de 50 salariés ou plus.

Figure 2. Unemployment Flows and the Business Cycle

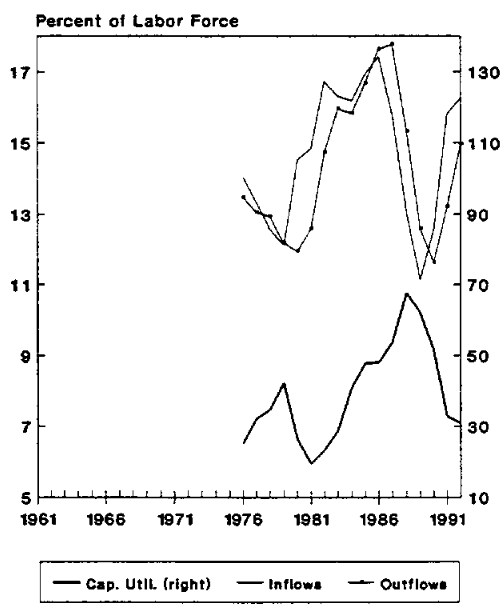
Germany



France



U.K.



Spain

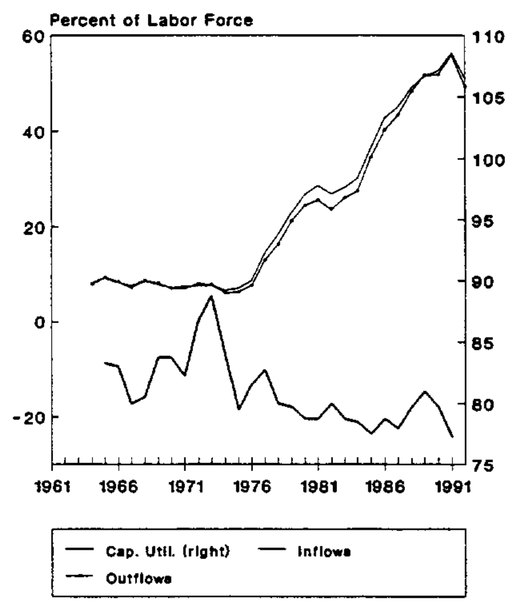
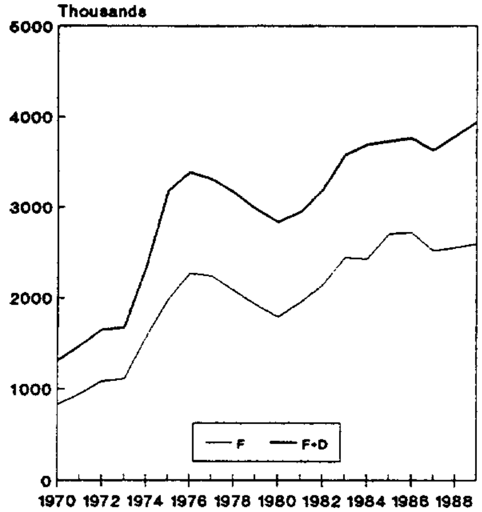


Figure 3.

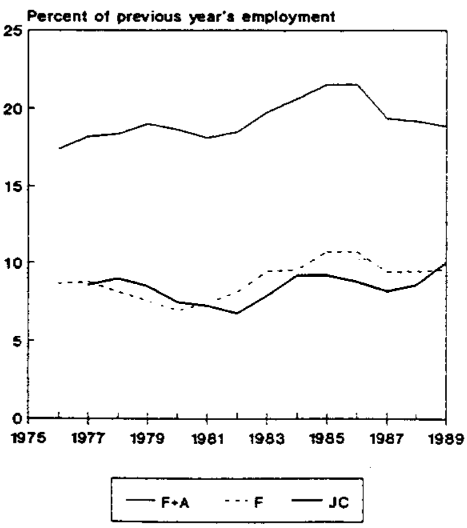
UNEMPLOYMENT OUTFLOWS INTO
EMPLOYMENT (F) AND OUT-OF-THE
LABOR FORCE (D) IN GERMANY



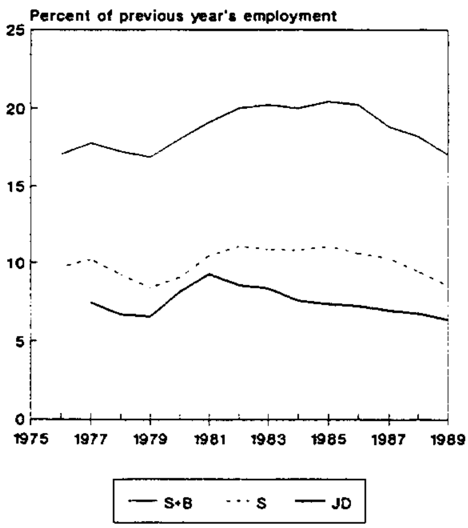
Source: Bundesanstalt für Arbeit, Arbeitskräftegesamtrechnung

Figure 4. Job and Worker Flows in Germany

JOB CREATIONS AND
EMPLOYMENT INFLOWS



JOB DESTRUCTIONS
EMPLOYMENT OUTFLOWS



Sources: Bundesanstalt für Arbeit, Arbeitskräftegesamtrechnung, Boeri (1993)

FIGURE 5: STATES FOR WORKERS AND FIRMS IN THE MODEL

firms (=e+v)

jobs j

unemployment	employment (jobs filled)	unfilled jobs	planned positions
u	e	j-e	v-(j-e)

labor force (≡1)

vacancies v

FIGURE 6

THE PHASE DIAGRAM AND ADJUSTMENT TO A NEW EQUILIBRIUM

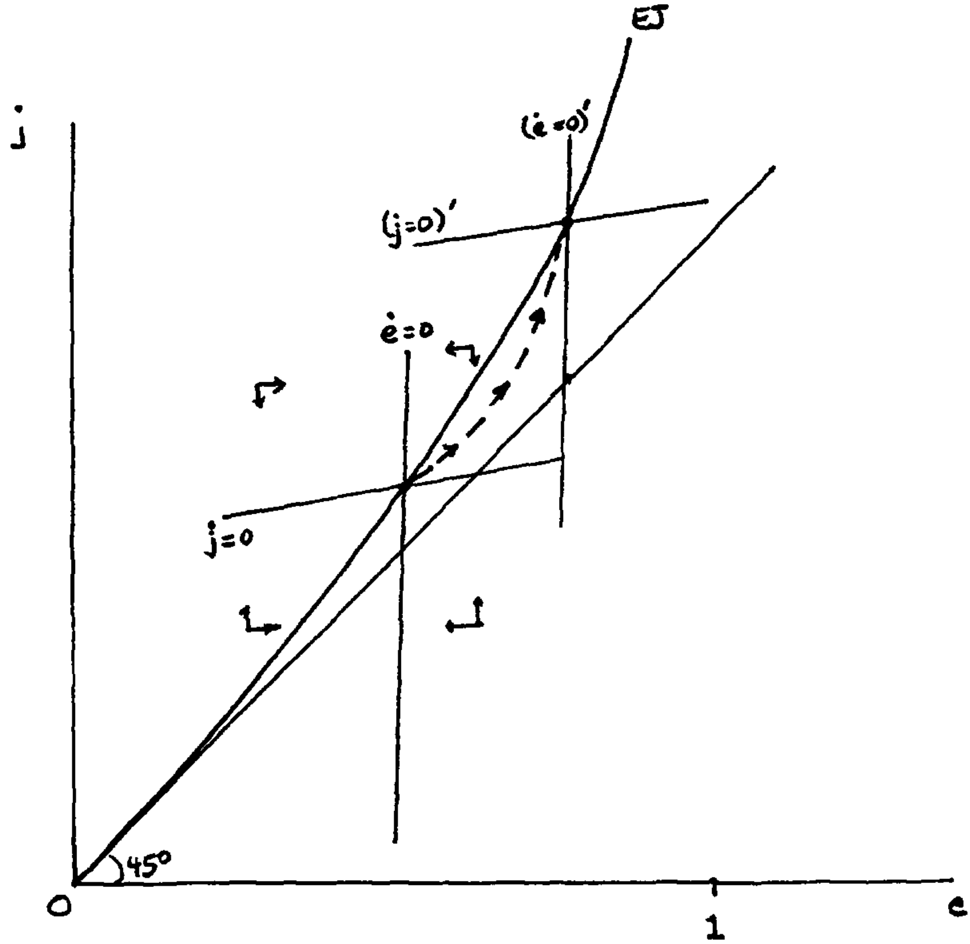


FIGURE 7

FOUR POSSIBLE ADJUSTMENT FOLLOWING A DECLINE IN **y**

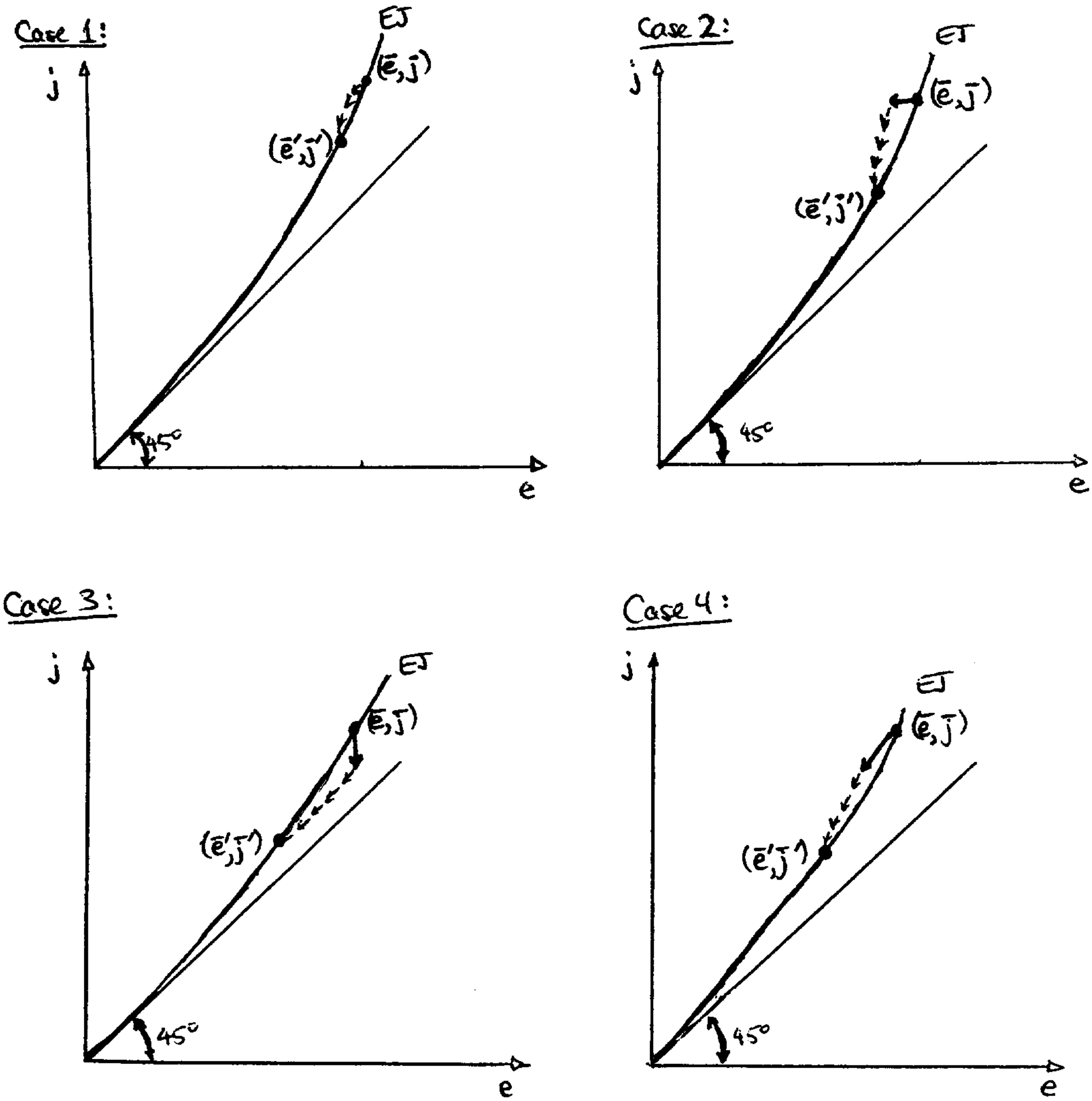


Table 1. Gross Labor Market Flows in 1987
(Thousands)

	Unemployment			Employment		
Country	Inflows	Outflows	Average Stock	Inflows	Outflows	Average Stock
France	4,115	4.128	2,728	4,528	4,814	15,685
Germany	3,726	3,636	2,497	6,046	5,811	27,070
Spain	6,473	6,213	2,924	NA	NA	NA
U.K.	3,032	3,478	2,696	1,680	1,694	25,641
U.S.A.	19,770	20,227	8,312	27,077	28,432	107.150
Japan	2,041	2,015	1,732	5,515	5,132	59,110

Sources: France: Ministère du travail; Germany: Bundesanstalt für Arbeit; Spain: Bank of Spain; U.K.: Employment Gazette; U.S.A.: Data supplied by J.Abowd; Japan: Ministry of Labor. Employmeny stocks are from OECD.
Note: US and Japanese data are based on labor market surveys and therefore are not directly comparable with European data. US data refer to 1985. For France, employment flows (which cover establishments with more than 50 employees) include job to job realloactions.

Table 2. Cyclical Behavior of Unemployment Flows
(Elasticity with respect to capacity utilization)

Country	Inflows	Outflows	Exit Rate
France 67:2-92:3	-0.64 (-1.57)	-0.60 (-1.84)	0.90 (2.34)
Germany 61:2-89:4	-0.84 (-2.43)	-0.75 (-2.69)	2.71 (6.28)
Spain 65:1-92:3	-0.57 (-1.95)	-0.57 (-1.79)	0.73 (2.22)
U.K. 76:2-92:4	-0.06 (-2.10)	-0.03 (-0.92)	0.09 (2.78)
Japan 80:3-90:3	-0.24 (-0.68)	-0.24 (-2.34)	0.87 (4.21)
U.S.A. 61:1-92:3	-0.23 (-2.31)	-0.37 (-4.57)	0.64 (8.79)

Source: See Table 1 and *Main Economic Indicators*, OECD
Note: Reported is the coefficient and t-statistic on the log of capacity utilization of a regression of the log of inflows, outflows or the exit rate (the ratio of outflows to lagged unemployment) on itself lagged, a constant, seasonal dummies and a linear time trend. The sample period is indicated underneath each country.

Table 3. Augmented Diskey-Fuller Tests

Country	Inflows	Outflows	Stocks
France	1%	1%	5%
Germany	5%	1%	1%
Spain	5%	10%	Not
U.K.	1%	1%	1%

Tests using a constant, a time trend, and up to 48 lags of the (log) dependent variables, depending on significance.

Table 4. The Matching Function in Europe

Country Period	lnU	lnV	$\bar{R}^2$ (s.e.)	t-test (CRTS)	ECM
France					
71:05-93:01					
1.OLS w/AR1	0.52	0.09	0.95	-5.77**	-0.52*
	(13.7)	(2.59)	(0.08)		(-6.65)
2.OLS w/AR1	0.73	0.27	0.95	--	
	--	(13.8)	(0.08)		
Germany					
68:3-91:12					
3. OLS w/AR1	0.68	0.27	0.97	-1.54	-0.31*
	(25.1)	(11.3)	(0.07)		(5.26)
4. OLS w/AR1	0.71	0.29	0.98		
	--	(28.6)	(0.10)		
Spain					
77:12-92:12					
5. OLS w/AR1	0.12	0.14	0.97	-8.78**	-0.09
	(1.67)	(3.0)	(0.07)		(-2.42)
6. OLS w/AR1	0.78	0.22	0.92		
	--	(3.42)	(0.08)		
U.K.					
85:01-93:01					
7. OLS	0.67	0.22	0.93	-2.14*	-0.55*
	(21.1)	(6.78)	(0.06)		(-6.03)
8. OLS	0.73	0.27	0.91		
	--	(18.9)	(0.06)		

Notes to Table 4: All regressions report standard errors based on White's heteroskedasticity-consistent covariance matrix. Constants, eleven seasonal dummies, and time trend estimates are supressed. CRTS reports a t-test of constraining the coefficients of lnU and lnV to add to unity (constant returns to scale). One (two) asterisk(s) indicates rejection of CRTS at the 5% (1%) confidence level. ECM gives the speed of adjustment to the long run, given by a first stage regression in the log levels without a time trend (the cointegrating equation). A star indicates that the hypothesis that the residual is stationary cannot be rejected at the 5% confidence level.