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Finally, we certainly have weak priors on how to attribute causes of serial persistence. For instance, I would have guessed a different pattern than Kennan suggests for allocating the two large roots and one zero or negative root that he finds. I have no qualms with assuming considerable persistence in labor supply disturbances; movements in labor supply should largely reflect movements in permanent income, which should obviously be persistent, or movements in real interest rates, which also appear to exhibit considerable persistence. By contrast, I would anticipate little persistence caused by the dependence of employment demand and supply on past employment. For production workers the evidence suggests small costs of adjustment for labor demand (e.g., Shapiro, 1986). We might anticipate a negative dependence of labor supply on past employment. Leisure today may be a substitute for leisure tomorrow (as modeled in the paper). Similarly, expiration of unemployment benefits could create a negative dependence. Katz (1986) has documented the strong tendency of U.S. firms to recall workers as the time benefits expire.

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#### *Comment*

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The main question raised by John Kennan is: can the employment and real wage fluctuations in 6 countries—the U.S., the U.K., Canada, Japan,

Denmark, and Austria—be explained by an equilibrium model of the labor market? Kennan addresses the question in two ways: first, by estimating a simple static two-equation equilibrium model of the labor market in each country, and second by estimating a more complex dynamic equilibrium model with explicit taste, technology, and adjustment cost parameters. To help assess the adequacy of the dynamic model, he also estimates alternative “non-equilibrium” models of the labor market.

Estimating dynamic equilibrium models is a difficult task, but it is clear that the estimated parameters and the goodness of fit measures that emerge from this study provide valuable information about the usefulness of these types of models. The novel data set on monthly employment, hours and real wages (unadjusted for seasonal variation) that Kennan has assembled for six countries also provides useful information. In commenting on the data and the estimates I will focus first on the static supply-demand model, second on the dynamic model, and third on the class of alternative models that Kennan considers.

### *1. Contemporaneous Correlations and Labor Supply Elasticities*

John Kennan’s data convincingly reveal the strong empirical regularity that there is essentially no contemporaneous correlation between real wages and employment (or hours) over the business cycle. In his Table 1, for example, the correlation between real wages and hours in the U.S. is only .057 (after a stochastic trend and seasonal factors are removed). In the U.K. it is  $-.007$ . Of course, this regularity is not a newly discovered one, as the 1977 quote from Robert Lucas at the start of Kennan’s paper suggests, and it has been a starting point for many macroeconomic models, including the misperception model of Lucas, staggered contracts models, and disequilibrium models.

Kennan gives a structural interpretation to these contemporaneous correlations by estimating aggregate labor supply elasticities with respect to the real wage. All the elasticities Kennan finds are very high—some are over 10. I found this structural interpretation to be unconvincing, given the observations. The high supply elasticities that Kennan finds are very sensitive to his identifying restrictions and his interpretation of the shocks. In some countries—most strikingly in the U.K., Canada, and Japan—the labor supply elasticities could just as plausibly be very low.

Kennan identifies the structural parameters by making *a priori* assumptions about the covariance matrix of the shocks—in particular by assuming

that labor supply and demand shocks are uncorrelated and that labor demand shocks are much larger than labor supply shocks. This method can be contrasted with Robert Hall's (1980) attempt to extract aggregate labor supply elasticities from similar correlations using exclusion restrictions (in particular by assuming that military purchases are exogenous). It is interesting to note that Hall obtained labor supply elasticities less than one-tenth as large as Kennan's. For example, Hall's elasticity estimate was .46 for labor supply measured by hours in the U.S. compared with Kennan's estimate of 10.7 for hours and 4.8 for employment.

A simple scatter diagram illustrates some problems with Kennan's structural interpretation of a high labor supply elasticity. Consider Figure 1 below where a scatter diagram of employment and real wages for the U.K. during the postwar period is shown. The observations are those used by Kennan in his Table 1. Note that the data points are clustered in a vertical ellipse, reflecting the facts that the correlation is near zero ( $-.02$ ) and that the standard deviation of employment (.39) is smaller than the standard deviation of real wages (1.38). The two lines superimposed on the scatter are Kennan's estimates of labor demand and labor supply. Note that the supply curve is relatively flat (the slope is .65) resulting in the high labor supply elasticity (1.55) that Kennan reports for the U.K. in his Table 1.

However, it is clear that the scatter of observations in Figure 1 could just as easily be interpreted as being generated by a labor demand curve shifting along a steep and relatively stable labor supply curve.<sup>1</sup> Such an interpretation would have large shocks to the labor demand curve and small shocks to the labor supply curve, and the labor supply elasticity would be as small as .1. This appears to be a plausible interpretation of the joint movement of employment and real wages in Figure 1.

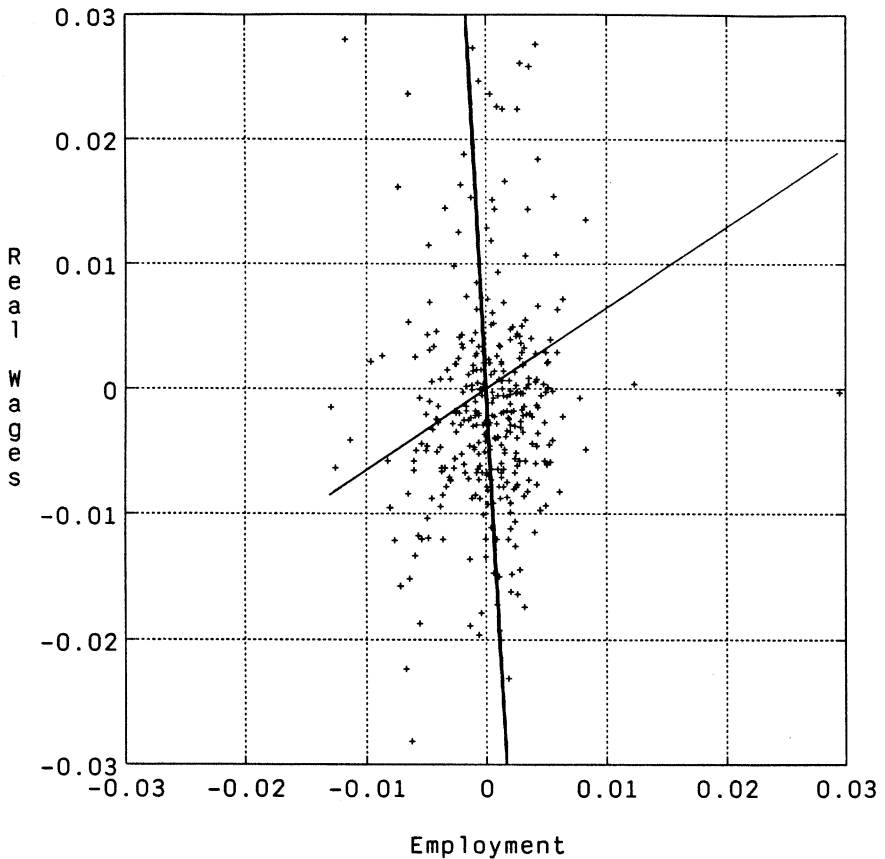
Of course not all the observations in Kennan's international cross section look like Figure 1, but because of the zero correlation the scatter diagrams are all either vertical ellipses, horizontal ellipses or simply circles. Figure 2 shows the data for the U.S., where the real-wage and employment data trace out a flat scatter diagram, and where it seems more natural to argue in favor of a flat labor supply curve. For Japan the employment and real-wage data look much like the U.K. For Canada the employment and real-wage scatter looks like a circle, yet the labor supply elasticity is estimated to be 4.9.

1. The formal statistical reason that Kennan's procedure yields the flat labor supply curve from a vertical scatter is that his normalization of the supply and demand equations forces the demand shocks measured in the *vertical* direction to be large relative to the supply shocks measured in the vertical direction. In order to trace out the scatter of points in Figure 1, Kennan's normalization implies that the labor supply shocks measured in the *horizontal* direction are larger than the labor demand shocks. If one reverses Kennan's normalization the alternative interpretation of a steep labor supply curve emerges.

## 2. Dynamic Equilibrium Models

The bulk of Kennan's paper is devoted not to simple wage-employment correlations, but to estimating dynamic equilibrium models of the labor market. From the view point of evaluating the equilibrium model, it is important to point out that the maximum likelihood estimates of the structural parameters are usually implausible. For the U.K., for example, the supply elasticities are negative. This in itself would raise questions about the plausibility of this type of representative agent model, but the structural estimates have very large standard errors. Kennan shows that

Figure 1. *EMPLOYMENT AND REAL WAGES IN THE U.K. 1953-86.*

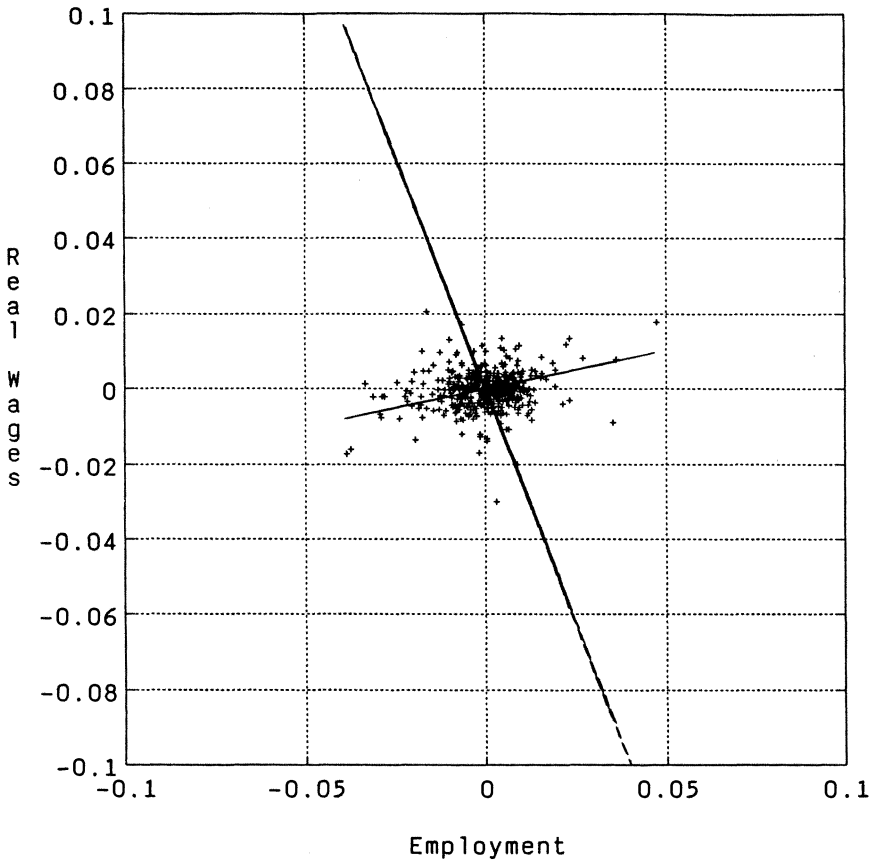


THE DATA CORRESPOND TO THOSE FOR THE U.K. IN TABLE 1 OF JOHN KENNAN'S PAPER. THE TWO LINES ARE HIS ESTIMATES OF THE LABOR DEMAND AND LABOR SUPPLY CURVES FOR THE U.K.

more plausible estimates are not significantly different from the maximum likelihood estimates in the U.K. It appears that no plausible estimates are acceptable for the U.S. using formal statistical tests, but plausible estimates for the U.S. do seem capable of yielding autoregressive coefficients that are not too far from the unconstrained reduced forms.

However, all the structural estimates for the U.K. and the U.S. require random shocks to utility that are highly serially correlated. In other words, the equilibrium model, even with cost of adjustment, does not appear to be capable of capturing dynamic movements in employment without assum-

Figure 2 EMPLOYMENT AND REAL WAGES IN THE U.S. 1948-86.



THE DATA CORRESPOND TO THOSE FOR THE U.S. IN TABLE 1 OF JOHN KENNAN'S PAPER. THE TWO LINES ARE HIS ESTIMATES OF THE LABOR DEMAND AND LABOR SUPPLY CURVES FOR THE U.S.

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ing that these movements are significantly due to serially correlated taste shocks. If one views, as I do, the essential goal of business cycle theory as explaining the dynamics of employment, as well as the co-movements with other variables, then the equilibrium model falls well short of this goal, according to Kennan's preliminary analysis. The movements in the data are explained by exogenous serial correlation of shocks to tastes.

### 3. *Alternative Models*

For comparison purposes, Kennan also estimates some alternative models of the labor market, in particular the Blanchard-Summers (1986) model with a powerful national union. As with the equilibrium model Kennan finds that the maximum likelihood estimates of the Blanchard-Summers model are implausible. For example, the demand elasticities are positive. Relatively speaking, therefore, the equilibrium models do not appear to perform any worse than available alternatives.

It should be emphasized that the model chosen by Kennan is only one of several alternatives with which he could have compared the equilibrium model, and it is probably not the best alternative in terms of the statistical criteria that Kennan is using to evaluate models. As Kennan indicates, Ashenfelter and Card (1982) consider sticky wage models as an alternative to equilibrium models. Recent work by Benabou and Bismut (1988) indicates that such sticky wage models perform well for the U.S. in the sense that the maximum likelihood estimates are plausible and cannot be rejected against unconstrained autoregressions. By these criteria they seem to perform better than the equilibrium model that Kennan considers in his paper.

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### *Discussion*

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The floor discussion began with some comments on the paper's treatment of labor supply. Martin Eichenbaum pointed out that using real wages to make inferences about labor supply is only valid in contract-free competitive economics. Hence the conclusion about labor supply elasticities need