Journal of Economic Dynamics & Control 69 (2016) 350–374

Contents lists available at ScienceDirect

Journal of Economic Dynamics & Control

journal homepage: www.elsevier.com/locate/jedc

Revisiting the matching function

Britta Kohlbrecher [a], Christian Merkl [a,*], Daniela Nordmeier [b]

[a] Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg, Germany
[b] Deutsche Bundesbank, Germany

ARTICLE INFO

Article history:
Received 21 August 2015
Received in revised form
10 May 2016
Accepted 23 May 2016
Available online 30 May 2016

JEL classification:
E24
E32
E20
E30

Keywords:
Matching function
Idiosyncratic productivity
Job creation
Vacancies
Time trend
Asymmetries

ABSTRACT

There is strong empirical evidence for Cobb–Douglas matching functions. We show in this paper that this widely found relation between matches on the one hand and unemployment and vacancies on the other hand can be the result of different underlying mechanisms. Obviously, it can be generated by assuming a Cobb–Douglas matching function. Less obvious, the same relationship results from a vacancy free-entry condition and idiosyncratic productivity shocks. A positive aggregate productivity shock leads to more vacancy posting, a shift of the idiosyncratic selection cutoff and thereby more hiring. We calibrate a model with both mechanisms to administrative German labor market data and show that idiosyncratic productivity for new contacts is an important driver of the elasticity of the job-finding rate with respect to the market tightness. Accounting for idiosyncratic productivity can explain the observed negative time trend in estimated matching efficiency and asymmetric business cycle responses to large aggregate shocks.

1. Introduction

We show in this paper that a labor market model with a constant contact rate for unemployed workers, a free-entry condition for vacancies, and idiosyncratic productivity shocks for new contacts generates the same equilibrium comovement between matches, unemployment, and vacancies as a model with a standard Cobb–Douglas contact function.[1] We use German administrative wage data to calibrate our model and show that a large part of the elasticity of the job-finding rate with respect to the market tightness – the parameter estimated in matching functions – is driven by idiosyncratic productivity shocks.

There is widespread empirical evidence for a Cobb–Douglas constant returns matching function across countries, occupations, or other disaggregation levels (see Blanchard and Diamond, 1990 for an early work and Petrongolo and Pissarides, 2001 for a survey). The coefficients from these matching function estimations are often used to parametrize Cobb–Douglas contact functions in theoretical models. Thus, the job-creation mechanism in search and matching models is usually exclusively driven by a theoretical contact function.[2] In reality, job creation consists of more than one margin. After workers

* Corresponding author.

[1] In what follows, "contact function" refers to the theoretical function that establishes contacts between workers and firms. Due to idiosyncratic shocks, not all of the contacts may become matches. "Matching function" refers to the empirical connection between matches on the one hand and vacancies and unemployment on the other hand.

[2] See e.g. Hall (2005), Hagedorn and Manovskii (2008), and Shimer (2005) or Christiano et al. (forthcoming) for an estimated medium-scale model.

http://dx.doi.org/10.1016/j.jedc.2016.05.018
0165-1889/

and firms get in contact (e.g. in an interview), only a certain fraction of workers is selected. Not all workers are suitable for an employer and thus only those with the best characteristics (e.g. idiosyncratic shocks) are selected. This second mechanism is also well established in the literature.[3] However, most existing macro-labor business cycle papers use a degenerate selection mechanism, i.e. idiosyncratic shocks play no meaningful role for job creation.[4] There are some works that combine a contact function, a vacancy free-entry condition, and idiosyncratic productivity (e.g. Krause and Lubik, 2007; Merz, 1999; Thomas and Zanetti, 2009; Zanetti, 2011). However, idiosyncratic productivity shocks are mainly used to model the behavior of separations. Depending on the timing, matches may also be affected. In contrast to our paper, the interaction of idiosyncratic shocks and the job-finding rate is not the focus of the analysis.

In this paper, we focus on the potential role of idiosyncratic productivity for job creation. Other than the existing literature, we show how idiosyncratic shocks affect the shape of the estimated matching function, i.e. the elasticity of the job-finding rate with respect to the market tightness. Imagine that every worker gets in contact with a firm with a constant probability. This is a special case of a Cobb–Douglas contact function in which the overall number of contacts does not respond to vacancies. We denote this as "degenerate" contact function henceforth. Due to a different idiosyncratic productivity, firms only select those workers with large enough realizations.[5] Even though the aggregate number of contacts would not respond to vacancies in such a case, both vacancies and the job-finding rate are procyclical. A positive aggregate productivity shock would still lead to a rise of the ex ante expected profits in firms' vacancy free-entry condition and thereby stimulate vacancy creation. In addition, larger aggregate productivity makes it profitable for firms to hire workers with less favorable characteristics (i.e. lower idiosyncratic productivity). This increases the job-finding rate.

We show analytically and numerically that the degenerate contact function with idiosyncratic productivity shocks generates an equilibrium comovement between matches, unemployment, and vacancies that is observationally equivalent to a Cobb–Douglas constant returns contact function up to a first-order Taylor approximation. One of our contributions is to show that dynamic labor market models with two standard modeling ingredients (vacancy free entry and idiosyncratic productivity) generate a simulated time-series behavior that is in line with the results from matching function estimations. Obviously, many theories generate procyclical employment/hours. However, the combination of a vacancy free-entry condition and idiosyncratic productivity generates a Cobb–Douglas and close to constant returns comovement between matches, unemployment, and vacancies.[6]

We prove that the shape of the idiosyncratic productivity distribution at the hiring cutoff determines the precise nature of the comovement, i.e. the coefficients in an estimated matching function. One of the key contributions of this paper is the link between high quality German administrative labor market data, the idiosyncratic shock distribution for new contacts, and the aggregate matching function. We use administrative wage data to impose discipline on the shape and dispersion of the idiosyncratic shock distribution. This allows us to run meaningful counterfactual exercises.

To assess the relative importance and implications of idiosyncratic productivity, we combine a traditional Cobb–Douglas contact function and idiosyncratic productivity in a dynamic model calibrated to German data. We calibrate the idiosyncratic shock distribution by using residual wages for new employment spells and we target the elasticity of the job-finding rate with respect to the market tightness in the data obtained from a matching function estimation. Due to idiosyncratic productivity shocks, the required weight on vacancies in the calibrated contact function is much smaller than the coefficient from the matching function estimation would suggest. Idiosyncratic productivity drives a large part of the observed elasticity, namely about three quarters in our baseline calibration. Thus, our paper reveals that the conventional practice to use matching function estimations in order to parametrize contact functions has caveats. More precisely: assume that the weight on vacancies in the traditional contact function is parametrized with the values obtained from a matching function estimation. Then, in a model with idiosyncratic shocks, the model based comovement between matches, unemployment, and vacancies will not be in line with the data any more. In this scenario, a matching function estimation based on simulated data generates a larger weight on vacancies than in the empirical data. This is also relevant from a normative perspective. According to Hosios' (1990) rule, an economy is constrained efficient when the bargaining power is equal to the elasticity of the contact function with respect to vacancies.

For small business cycle shocks or up to a first-order Taylor approximation, the relative importance of the contact function and idiosyncratic shocks does not matter much from a positive perspective. However, for the nonlinear dynamics of the labor market it is very important to understand the driving forces of match formation. We give two examples where idiosyncratic shocks for new contacts provide a rationale for puzzling empirical phenomena. First, we explain the negative time trend in matching function estimations (Petrongolo and Pissarides, 2001; Poeschel, 2012) by a decline in vacancy posting costs (e.g. due to new technologies). Second, we show that large aggregate shocks lead to asymmetric responses on the labor market (see also Kohlbrecher and Merkl, 2016). The response of unemployment and the job-finding rate to a large negative productivity shock is more than twice as large as to a positive shock of equal size. The reason is that for large

[3] For a seminal contribution with idiosyncratic productivity see Jovanovic (1979). Traditional search models (e.g. McCall, 1970; Mortensen, 1987) rely on exogenous wage distributions. If they are interpreted as the result of some underlying idiosyncratic productivity heterogeneity, they fall into the same category of models. The stochastic job-matching model (Pissarides, 2000, chapter 6) combines a traditional Cobb–Douglas contact function and permanent idiosyncratic productivity shocks.

[4] See the upper panel in Fig. 6 in the Appendix for an illustration.

[5] Brown et al. (2015) and Lechthaler et al. (2010) use similar mechanisms in the context of more complex models.

[6] We are not aware of any other model (except for the matching function) that generates such a time-series behavior.