Brief Notes on Matching Functions

Outline

• Basics:
  – Definition, Basic Matching Function, Analogy to the Production Function, Job-Finding and Job-Filling Rates, Theoretical and Empirical Matching Functions

• Standard Matching Function (SMF)
  – Sources of Instability in the SMF (AKA Fluctuations in Matching Efficiency), Simple Empirical Check on the Performance of the SMF

• Brief Remarks on Selected Aspects of Fluctuations in Matching Efficiency
Matching Function: A Definition

“The matching function summarizes a trading technology between agents who place advertisements, read newspapers and magazines, go to employment agencies, and mobilize local networks that eventually bring them together into productive matches.”

“The key idea is that this complicated exchange process is summarized by a well-behaved function that gives the number of jobs formed at any moment in time in terms of the number of workers looking for jobs, the number of firms looking for workers, and a small number of other variables.”

Petrongolo & Pissarides (hereafter “P&P”, 2001)
A Basic Matching Function

• Retaining our focus on labor markets, the simplest matching function is

\[ H = m(U, V), \]

where \( H \) is the number of job matches formed in a given time interval, \( U \) is the number of jobseekers, and \( V \) is the number of vacant jobs.

• \( m \) is increasing in both arguments, concave, and usually taken to be homogenous of degree 1 (CRS)

• See P&P (2001) for other commonly used regularity conditions
“The matching function is a modeling device that occupies the same place in the macroeconomist's tool kit as other aggregate functions, such as the production function ... Like the other aggregate functions, its usefulness depends on its empirical viability and on how successful it is in capturing the key implications of the heterogeneities and frictions in macro models.”

Petrongolo & Pissarides (2001)
Job-Finding and Job-Filling Rates

• The average job-finding rate per unit time among jobseekers is $m(U,V)/U$.

• The average job-filling rate per unit time is $m(U,V)/V$.

• For $m$ CRS, we can express the job-finding and job-filling rates as functions of the tightness ratio, $V/U$.

• See P&P (2001) for a summary of evidence that (largely) supports CRS specifications.

• For heterogeneous jobseekers, job-finding rates vary with individual characteristics but all job-finding rates move up and down with market tightness. An analogous statement holds for vacant jobs.
Matching Functions in the Literature


• Prominent empirical studies that feature matching functions include Pissarides (1986), Blanchard and Diamond (1989, 1990), Layard et al. (1991), and Yashiv (2000).

• On the theoretical microfoundations of matching functions and references to the literature, see Sections 3.2 to 3.6 in P&P (2001).
Theoretical & Empirical Matching Functions, 1

• Theoretical models of search and matching often distinguish between the meeting technology and match formation.
  – When two parties meet as the result of a frictional search process, they may acquire additional information about the quality and attractiveness of the prospective match. Depending on what they learn, the parties may or may not choose to consummate the match.
  – Thus, there is a distinction between the meeting rate and the matching rate. See Section 3.1 in P&P (2001) for an explicit, but simple treatment of this point.
Most empirical studies of search and matching lack data that would allow for a clean distinction between meeting and matching.

For this reason, empirical matching functions are, in most cases, best interpreted as describing outcomes that are jointly determined by the meeting technology and other features of the matching process.
Standard Matching Function (SMF)

The standard aggregate matching function relates the flow of hires to job vacancies ($V$) and job seekers ($U$) according to a CRS Cobb-Douglas function:

$$H = \mu V^{1-\theta} U^\theta$$

$$\frac{H}{V} = \mu \left(\frac{U}{V}\right)^\theta$$

Standard measurement approach:

- $V = \text{stock of open job vacancies}$
- $U = \text{stock of unemployed persons}$
1. Mismeasurement of job seekers
2. Mismeasurement of effective vacancies
3. Mismatch: Aggregating over markets that vary in tightness
4. Composition: Aggregating over markets that vary in matching efficiency
5. Search technology, screening & evaluation technology, etc.

All of 1-5 are potential sources of instability in the SMF (fluctuations in $\mu$).
A Simple Check on the Empirical Performance of the Standard Aggregate Matching Function

Elasticity parameter $\theta$ set to $1/2$ in calculating the implied yields.
Sources of Instability in the SMF – AKA Fluctuations in Matching Efficiency

1. Measuring job seekers

2. Measuring effective vacancies

3. Mismatch: Aggregating over local markets that vary in tightness
   – Examples include Layard et al. (1991), Herz and van Rens (2011), Daly et al. (2012), Sahin et al. (2012), Estevao and Smith (2013).
4. Composition: Aggregating over markets that vary in matching efficiency
   - Slide 17 below provides evidence that matching efficiency is greater in Construction than other industries. Slide 18 suggests that the industry mix of vacancies varies over time in ways that have potentially important implications for the average matching efficiency in the economy. In work underway, I am seeking to quantify this effect.

5. Search and sorting technologies, screening & evaluation technologies, etc.
   - See Kuhn and Stuterud (2001), Stevenson (2009), and Kroft and Pope (2011),
U.S. Index of Recruiting Intensity Per Vacancy, January 2001 to August 2013

Source: JOLTS data and index construction methods developed in Davis, Faberman and Haltiwanger (2013).
U.S. Index of Recruiting Intensity Per Vacancy, January 2001 to August 2013

Effective vacancies equal this index value times the number of measured vacancies.

Source: JOLTS data and index construction methods developed in Davis, Faberman and Haltiwanger (2013).
Empirical Performance of the SMF Compared to One that Incorporates Role of Recruiting Intensity

Recruiting intensity accounts for about 30% of gap that opens up between empirical & SMF-implied vacancy yield from 2007-2009.
## Mean Vacancy Duration (Number of Working days) 
**By Industry and Time Period**

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<td>Wholesale and Retail Trade</td>
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<td>15.8</td>
<td>14.5</td>
<td>15.9</td>
<td>19.9</td>
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<tr>
<td>Warehouse, Transportation and Utilities</td>
<td>18.3</td>
<td>17.3</td>
<td>15.8</td>
<td>18.1</td>
<td>23.0</td>
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<td>Information</td>
<td>26.7</td>
<td>35.3</td>
<td>29.4</td>
<td>41.2</td>
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<td>Financial Services</td>
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<td>32.5</td>
<td>26.2</td>
<td>33.8</td>
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<tr>
<td>Professional &amp; Business Services</td>
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<td>20.1</td>
<td>19.1</td>
<td>18.5</td>
<td>19.7</td>
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<td>Health and Education</td>
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<td>34.3</td>
<td>31.2</td>
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<td>Leisure and Hospitality</td>
<td>13.8</td>
<td>14.7</td>
<td>12.5</td>
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<td>Other Services</td>
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<td>18.7</td>
<td>21.6</td>
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<td>Total Non-Farm</td>
<td>19.1</td>
<td>20.0</td>
<td>18.8</td>
<td>19.9</td>
<td>22.6</td>
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## Construction Contribution to Changes in Job-Filling Rates During and After the Great Recession

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<td>Construction Employment Share As of 2007:4</td>
<td>4.7</td>
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<td>Percent of National Change Accounted for by Construction</td>
<td>43.0</td>
<td>41.9</td>
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Reproduced from Table 1 in Davis, Faberman and Haltiwanger (2012, AER P&P). Authors’ calculations using JOLTS data.
Stock-Flow Matching

• Studies of stock-flow matching models do not fit neatly into the schema on slide 10.
  – Stock-flow matching implies that the SMF involves a rather profound mismeasurement of both the $U$ and the $V$ inputs to the matching function, as well as its functional form

• I will not discuss stock-flow matching, but see Coles and Smith (1998), P&P (2001, Section 3.5), and Shimer and Ebrahimy (2010).
References, 1

• Daly, Mary C., Bart Hobijn, Aysegul Sahin, and Robert G. Valletta, 2011, “A Search and Matching Approach to Labor Markets: Did the Natural Rate of Unemployment Rise?” *Journal of Economic Perspectives,* 26, no. 3 (Summer), 3-26.
References, 2

• Estevao, Marcello and Christopher Smith, 2013, “Skill Mismatches and Unemployment in the United States,” International Monetary Fund


• Hall, Robert E. and Sam Schulhofer-Wohl, 2013, “Measuring Matching Efficiency with Heterogeneous Workers,” 26 September


References, 3

• Stevenson, Betsey, 2009, “The Internet and Job Search,” in *Studies labor Market Intermediation*, University of Chicago Press.