*Online Appendix*

*Slack and Slacker: Job Seekers, Job Vacancies, and Matching Functions in the U.S. Labor Market during the Roaring Twenties and the Great Contraction, 1924–1932*

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Other Functional Forms of the Matching Function

Specifications of translog and constant elasticity substitution (CES) are also used to estimate the matching functions for robustness checks. A translog functional form is shown in Equation (A1):

(A1)

The elasticity of the matching process with respect to job seekers () is and the elasticity with respect to job vacancies () is , where are the sample averages, respectively. The degree of returns to scale can be computed as . The functional form can be tested under the null hypothesis of the Cobb-Douglas: *a*11 *=* 0*, a*22 *=* 0*, a*12 *=* 0. Testing for constant returns to scale can be performed under the null hypothesis: *a*1 *+ a*2 *=* 1*; a*11 *+ a*12 *=* 0*; a*22 *+ a*12 *=* 0. A specification of the constant elasticity of substitution (CES) in Equation (A2) is also estimated by the nonlinear least squares estimation:

(A2)

Here *ρ* is the substitution parameter from which the elasticity of substitution between *Sit* and *Vit* equals and *δ* is the share parameter for *Sit*. The CES function is a generalized function that has a variety shapes depending on the value of . The Cobb-Douglas function is a special case of the CES function, with . As converges to zero, Equation (A2) is converted to Equation (6), the Cobb-Douglas, where and . An important point in the CES matching function is that the function is already restricted to be constant returns to scale.

Appendix Table 1 provides the results from estimating translog and CES matching functions. The result from the translog matching function gives almost identical results to the Cobb-Douglas, 0.08 for job seekers and 0.82 for job vacancies, respectively. Estimates from the CES matching function suggest that the functional form be the Cobb-Douglas, the estimate for *ρ* was close to zero and insignificant, and the estimate for the matching share of job seekers was relatively small (= 0.162), which is consistent with the results from the Cobb-Douglas and translog specifications of the matching functions.

Appendix Table 1

Empirical Matching Functions for the Nation:
Translog, and CES Specifications (1924:1–1932:1)

|  |  |  |
| --- | --- | --- |
| Dependent Variable: *ln M* | [1] | [2] |
| Control Variables | Translog | CES |
| *ln S* | 0.121\*\* |  = –0.020 |
|  | (0.050) | (0.084) |
| *ln V* | 0.760\*\*\* |  = 0.162\*\*\* |
|  | (0.050) | (0.010) |
| *ln S*2 | –0.002 |  |
|  | (0.008) |  |
| *ln V*2 | 0.016\* |  |
|  | (0.009) |  |
| *ln S ☓ ln V* | –0.005 |  |
|  | (0.016) |  |
| *Time trend × 100* | 0.061\*\*\* |  |
|  | (0.000) |  |
|  |  |  |
| Month dummies | Yes | No |
| Within *R2* | 0.896 |  |
| Between *R2* | 0.949 |  |
| Overall *R2* | 0.970 |  |
| Observations | 17143 | 17143 |
|  |  |  |
| Constant Returns to Scale | No | Assumed |
| Elasticity for job seekers  | 0.08 | 0.16 |
| Elasticity for job vacancies | 0.82 | 0.84 |
| Degree of returns to scale  | 0.90 | 1.00 |

\* = Significant at the 10 percent level.

\*\*= Significant at the 5 percent level.

\*\*\* = Significant at the 1 percent level.

*Notes*:

- [1] is the results from the panel regression of translog specification with city-fixed effects and a time trend .

- [2] presents parameter estimates from the nonlinear least square estimation using pooled data.

- The results between the Cobb-Douglas and the translog functional forms are not qualitatively different and the functional form tests qualitatively support the Cobb-Douglas specification in most cases (the estimates for *log(S)*2, *log(V)*2, and *log(S)log(V)* are very small or statistically insignificant).

*Sources*: See the text of the main article.

Testing the Nonstationarity of the Variables

There is a possibility that not only time-series but also panel data tend to exhibit a time trend, indicating non-stationarity, especially when using an extended length of time. Non-stationarity can cause the phenomenon of spurious regression. Thus, panel and time series unit root tests were employed to check whether the variables used in this paper were stationary. Panel-based unit roots test were performed for each variable in the matching function. For the nationwide series, the data was aggregated from the city-level to the national level, which generated time-series data for the nation. Hence, non-stationarity tests were also performed for the time-series data. In all cases, the hypothesis of non-stationarity was rejected.

Panel Unit Root Tests

Appendix Table 2

Panel Unit Root Tests (Data for the nation) units: city-month

|  |  |
| --- | --- |
|  | Methods |
| Variable | LLC | IPS | ADF | PP |
|  |  |  |  |  |
| *ln(M)* | –245.68\* | –24.65\* |  3197.91\* |  3684.48\* |
| *ln(S)* | –29.43\* | –23.05\* |  3389.06\* |  4136.79\* |
| *ln(V)* | –43.07\* | –21.59\* |  3259.50\* |  3630.03\* |

*Sources*: See the text of the main article.

Appendix Table 3

Panel Unit Root Tests (Data for the nation) units: state-month

|  |  |
| --- | --- |
|  | Methods |
| Variable | LLC | IPS | ADF | PP |
|  |  |  |  |  |
| *ln(M)* | –12.20\* | –18.47\* |  614.84\* |  706.07\* |
| *ln(S)* | –7.56\* | –17.00\* |  613.16\* |  897.81\* |
| *ln(V)* | –14.05\* | –19.28\* |  634.64\* |  683.69\* |

*Sources*: See the text of the main article.

Appendix Table 4

Panel Unit Root Tests (Data for Illinois) units: city-month

|  |  |
| --- | --- |
|  | Methods |
| Variable | LLC | IPS | ADF | PP |
|  |  |  |  |  |
| *ln(M)* | –12.49\* | –9.78\* |  212.99\* |  181.38\* |
| *ln(S)* | –10.25\* | –8.95\* |  219.76\* |  243.06\* |
| *ln(V)* | –11.82\* | –8.94\* |  200.60\* |  178.09\* |

*Sources*: See the text of the main article.

Appendix Table 5

Panel Unit Root Tests (Data for New York) units: city-month

|  |  |
| --- | --- |
|  | Methods |
| Variable | LLC | IPS | ADF | PP |
|  |  |  |  |  |
| *ln(M)* | –6.92\* | –7.03\* |  94.93\* |  131.60\* |
| *ln(S)* | –4.52\* | –5.83\* |  84.29\* |  162.58\* |
| *ln(V)* | –6.11\* | –6.74\* |  92.38\* |  132.85\* |

*Notes*:

- LLC (Levin, Lin, and Chu panel unit-root test); IPS (Im, Pesaran, and Shin panel unit-root test); ADF (pooled Augmented Dickey-Fuller test); PP (pooled Philips-Perron unit-root test).

- \* Indicates rejection of the null hypothesis of non-stationarity at the 5 percent (or less) level of significance.

- For LLC, the null hypothesis is the unit root (assumes the common unit-root process).

- For IPS, ADF, and PP, the null hypothesis is the unit root (assumes the individual unit-root process).

- Exogenous variables for each variable’s test: city-fixed effects and an individual linear trend.

- Lag length for each variable’s test was selected based on Schwarz information Criterion.

*Sources*: See the text of the main article.

Time-Series Unit Root Tests

Time-Series Unit Root Tests (Data for the nation: the economy-wide aggregated matching function in column [3] in Table 3).

Appendix Table 6

Augmented Dickey-Fuller test

|  |  |  |  |
| --- | --- | --- | --- |
|  Test Statistic | *ln(M)* | *ln(S)* | *ln(V)* |
| *Z(t)* | –15.70\* | –7.05\* | –4.74\* |

*Notes*:

- Various numbers of lag lengths were used and the leg length of order 4 was reported.

- \* Indicates rejection of the null hypothesis of non-stationarity at the 5 percent (or less) level of significance.

*Sources*: See the text of the main article.

Appendix Table 7

Phillips-Perron test for unit root

|  |  |  |  |
| --- | --- | --- | --- |
|  Test Statistics | *ln(M)* | *ln(S)* | *n(V)* |
| *Z(rho)* | –40.98\* | –77.35\* | –39.40\* |
| *Z(t)* | –4.95\* | –7.29\* | –4.84\* |

*Notes*:

- \* Indicates rejection of the null hypothesis of non-stationarity at the 5 percent (or less) level of significance. Akaike’s information criterion (AIC), Schwarz’s Bayesian information criterion (SBIC), and Hannan and Quinn information criterion (HQIC) were used for the lag-order selection of the dependent variable (*M*) in the time-series regression model.

- AIC suggests the lag length of order 4, and SBIC and HQIC report the lag length of order 1. Both orders 1 and 4 were incorporated to estimate the economy-wide aggregate matching function by the GLS method: the Cochrane-Orcutt transformation was used to correct the serial correlation. No lags were statistically significant in the GLS estimation.

*Sources*: See the text of the main article.