Appendix to "Labor Market Flows in the Cross Section and Over Time" by Steven J. Davis, R. Jason Faberman and John Haltiwanger

A. Creation of Quarterly Worker Flow Measures

We face some complications in creating our quarterly measures. First, the JOLTS sample weights are monthly, and due to sample nonresponse and benchmark revisions, the weight for a given establishment can change considerably. To deal with this, we measure each quarterly worker flow, w_{et}, for establishment e in quarter t as

$$w_{et} = [\theta_{et,3} w_{et,3} + \theta_{et,2} w_{et,2} + \theta_{et,1} w_{et,1}] / \theta_{et,3}$$

where $w_{et,m}$ is the worker flow level reported for month m of quarter t by establishment e and $\theta_{et,m}$ is the JOLTS sample weight for establishment e during month m of quarter t. Therefore, when we weight any given establishment's data by its third-month sample weight, $\theta_{et,m}$, we recover the correctly weighted data for each month of the quarter. Second, there is a timing issue in that worker flows are reported for the first through the last day of the month while employment is reported for the pay period that includes the 12th of the month. To ensure that our employment and growth rate measures are consistent with the growth rate implied by the our hires and separations measures, we measure end-of-quarter employment as $n_{et} = n_{et,3}$ (using the notation from above) and beginning-of-quarter employment as $n_{e,t-1} = n_{et} - h_{et} + s_{et}$, where h_{et} denotes total quarterly hires and s_{et} denotes total quarterly separations. We express our worker flow measures as rates by dividing them by (1/2)[$n_{et} + n_{e,t-1}$], which is the average employment measure of Davis, Haltiwanger, and Schuh (1996).

Another issue is that the JOLTS data do not include establishment entry and exit. These establishments, however, are captured in the BED data. Since entrants and exits account for a sizable fraction of employment changes, we incorporate them into our analysis using the

approach of Davis, Faberman, Haltiwanger and Rucker (2010). Their approach takes the employment density at opening and closing establishments from the BED as given and assumes the following values for their worker flow rates:

	Hiring Rate	*Quit Rate*	*Layoff Rate*	*Other Seps. Rate*
Entrants	200.0	0.0	0.0	0.0
Exits	0.0	12.4	180.2	7.4

We also note that the methodology we developed in Davis, Faberman, Haltiwanger and Rucker (2010) yields higher worker flows than the published JOLTS series. In comparing our rates with the published rates we note the following. First, until 2009, the published series completely ignored births-deaths. Since 2009, BLS has developed a birth-death adjustment for the JOLTS series that they have incorporated back to the beginning of the JOLTS sample. BLS also made additional adjustments as outlined in http://www.bls.gov/jlt/methodologyimprovement.htm. Even after these adjustments, the rates that we calculate still are above those in the published series. For the reasons we discuss in detail in Davis, Faberman, Haltiwanger and Rucker (2010), we believe our adjusted series are preferred to the published series.

This discussion about the magnitude of the published JOLTS flows vs. our adjusted flows is related to questions that have arisen about the comparability of worker flows estimated from JOLTS relative to the worker flows estimated from other sources. While our adjusted series yield higher average flows than the published series, our adjusted series are still lower than worker flow estimates obtained from administrative data (such as those from the Quarterly Workforce Indicators from the U.S. Census Bureau), as noted by Abowd and Vilhuber (2010). In this regard, an important factor with worker flows computed from administrative data is that,

as discussed in Brown, Haltiwanger and Lane (2006), such measures capture all matches regardless of duration and earnings. Brown, Haltiwanger and Lane (2006) note that there are many matches in the administrative data that appear to have very short durations and very low earnings, so that, for example, a worker is hired and separated in the same quarter with earnings for the quarter being less than $250. They show that a more restrictive measure of worker flows that excludes these short-duration jobs produces estimates that are somewhat lower than our adjusted JOLTS estimates. Investigating these measurement differences, particularly those related to short-duration employment, should be an important area for future research on economics measurement in this area.

B. Auxiliary Tables and Figures

In appendix B, we report auxiliary tables and figures related to the exercises in the main text.

Goodness of Fit of Bin-Quarter Regressions

Table B.1 reports the goodness of fit statistics for the different models estimated from the pooled bin-quarter level data of the flows. As such, the R-squared statistics provide information about how much of the pooled cross-section, time-series variation at the bin-quarter level is accounted for by the growth rate density bin effects (column 1), the growth rate density bin effects plus the aggregate growth rate variables (column 2), and the growth rate density bin effects plus the aggregate growth rate variables and the interaction of the bin effects and the growth rate variables. As discussed in the text, the bin effects alone account for a very large fraction of the cross-sectional, time-series variation at the bin-quarter level of aggregation. This pattern holds especially for hires, separations and layoffs and less so for quits. The high R-squared from the growth rate density bin effects alone translates into the important role that the growth rate density effects play in the results reported in Tables 3 and 4 and Figure 7.

The Cross-Sectional Relationship between Worker and Job Flows Over a Wider Range of Establishment-level Growth

Figure B.1 shows the analogue of Figure 6 over a wider range of establishment-level growth rates. Recall we are using the Davis, Haltiwanger and Schuh (2006) growth rate measure which is symmetric around zero and is bounded between -200 (exits) and +200 (entrants). The figure highlights that the patterns in Figure 6 hold for a wide range with an approximately linear relationship between hires and job creation and separations/layoffs and job destruction. In addition, the figure highlights that for very large contractions, layoffs dominate quits.

Estimated Coefficients for Models in Table 3

Tables B.2 and B.3 report the estimated coefficients for the specifications in Table 3. Table B.2 presents the coefficients underlying column 1 of Table 3 and Table B.3 the coefficients underlying column 2 of Table 3. Interpreting the individual coefficients and statistical significance for the growth rate terms is not especially informative since the growth rate terms are by construction highly correlated. The estimated job finding rate coefficients have sensible sign patterns and are individually statistically significant. We also find that the F-test for the combined three net employment growth rate terms is often statistically significant (in Table B.2, we reject the null that all the net employment growth rate terms are equal to zero for both hires and layoffs). Still, the standard errors on the net growth rate terms are sufficiently large that we cannot reject symmetric responses to positive and net growth rate for any of the models.

In Table B.3, the worker flow series implied by the growth rate density alone is added as an explanatory variable. This variable is always highly significant with a coefficient that always exceeds one. Many of the aggregate variables remain or become significant. The job finding rate always remains significant although the magnitude of the coefficient is always smaller in Table B.3 compared to B.2. It is still the case, as well, that in a number of models that we reject the null that the coefficients on the three net growth rate terms is equal to zero (in this case separations and quits). But again the standard errors on the positive and negative net growth rate terms are sufficiently large that we cannot reject symmetric responses to positive and negative net growth rate terms.

Comparisons of Baseline and Flexible Aggregate Implications

As is evident from Table 2, the improvement in fit from the flexible model specification is modest relative to the baseline model. Figure B.2 shows the implied worker flow series for the

baseline and flexible models relative to the actual model. The implied series for these two models exhibit very similar time series patterns.

Comparisons of Regional Within-Sample and Cross-Validation Baseline Series

Figures B.3 and B.4 show the baseline specification estimates for the Northeast-Midwest and South-West regions for the within sample and cross-validation series. It is evident in both regions that the both model based series track the actual series reasonably well. This pattern holds especially for layoffs. There are more notable deviations in the most recent recession for hires, separations and quits but the overall patterns are still very similar.

Table B.1 Fit of Statistical Worker Flows Models to Bin-Quarter Pooled Data

	Implied from Growth Rate Density	Implied from Baseline Specification	Implied from Flexible Specification
Hiring Rate	0.931	0.934	0.935
Separation Rate	0.921	0.925	0.926
Quit Rate	0.647	0.679	0.694
Layoff Rate	0.876	0.877	0.879

Notes: Table reports the R-squared values from the regression of the listed mean worker flow rate for each of 195 growth rate bins each quarter on the variables included in the listed statistical specification. Quarters cover 2001Q3-2010Q2. See text for details of the variables included for each specification.

Table B.2 Estimated Coefficients for Aggregate Growth Variables in Aggregate Worker Flow Regressions (Column 1 of Table 4)

	Hiring Rate	Separation Rate	Quit Rate	Layoff Rate
Aggregate Variable				
G_t^+	0.037	-0.874	-0.124	-0.534
	(0.608)	(0.630)	(0.256)	(0.395)
G_t^-	0.580	-0.516	0.096	-0.667
	(0.313)	(0.324)	(0.142)	(0.203)
ΔG_t	0.254	0.232	-0.130	0.478
	(0.413)	(0.428)	(0.187)	(0.268)
JF_t	0.273	0.258	0.245	-0.002
	(0.040)	(0.042)	(0.018)	(0.026)

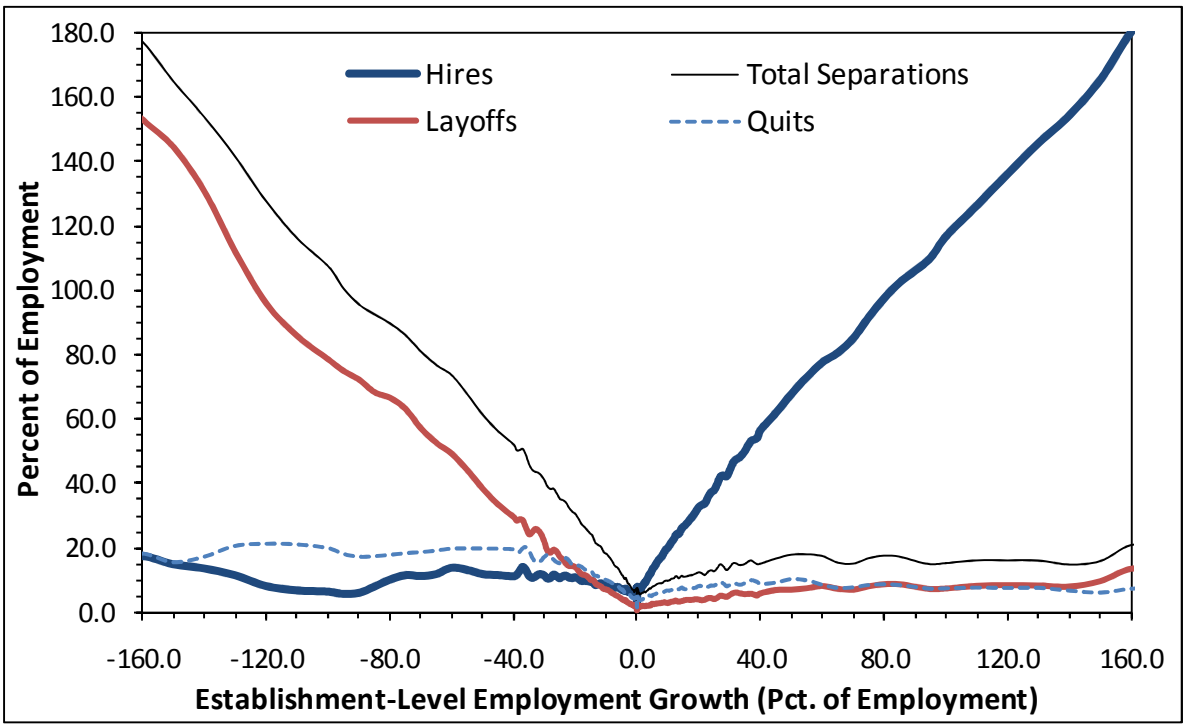
Notes: The table reports the estimated coefficients (and standard errors in parentheses) from the regression of the actual aggregate estimate of each rate on the four aggregate growth rate terms from our baseline specification. For this regressions, $T = 36$ over 2001Q3 – 2010Q2. See text for details of the estimation and aggregation methodologies.

Table B.3 Estimated Coefficients for Aggregate Growth Variables and Implied Rate Series from Growth Rate Density in Aggregate Worker Flow Regressions (Column 2 of Table 4)

	Hiring Rate	Separation Rate	Quit Rate	Layoff Rate
Aggregate Variable				
G_t^+	0.219	1.106	0.488	0.556
	(0.259)	(0.309)	(0.249)	(0.235)
G_t^-	0.033	0.907	0.683	0.066
	(0.142)	(0.103)	(0.168)	(0.132)
ΔG_t	-0.231	-0.535	-0.343	-0.043
	(0.181)	(0.190)	(0.150)	(0.147)
JF_t	0.120	0.108	0.177	-0.078
	(0.022)	(0.022)	(0.020)	(0.016)
W_t^D	1.742	1.748	2.270	1.469
	(0.154)	(0.157)	(0.494)	(0.164)

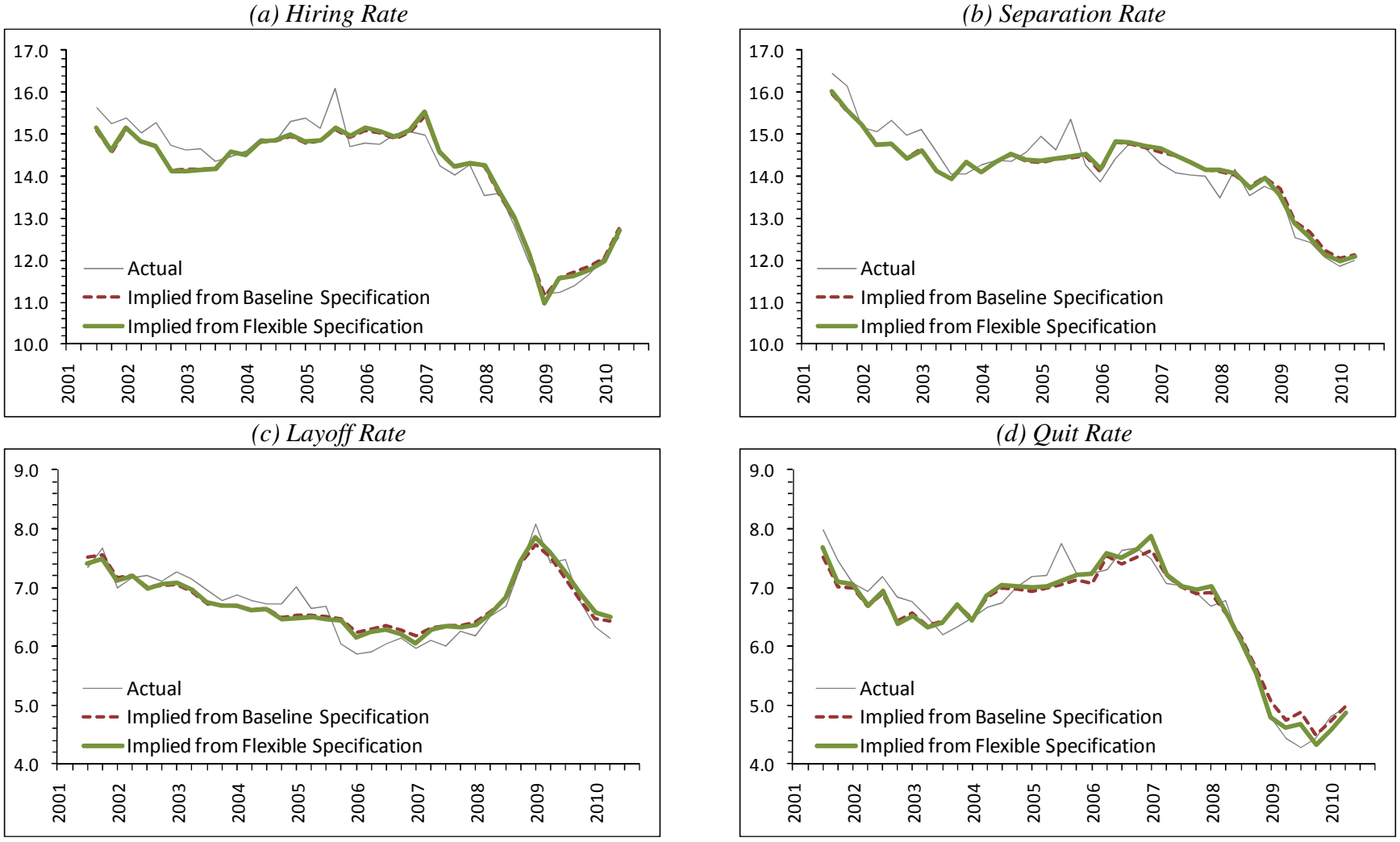
Notes: The table reports the estimated coefficients from the regression of the actual rate on the four growth rate terms and the aggregate series implied from our growth rate density alone specification. For this regression, $T = 36$ over 2001Q3 – 2010Q2.

Figure B.1



Source: Authors' calculations using JOLTS establishment data pooled over 2001Q1 – 2010Q2. Estimates are employment-weighted averages of the establishment-level growth rates within intervals. Save for the endpoints and zero growth point, estimates are smoothed using a 5-bin moving average.

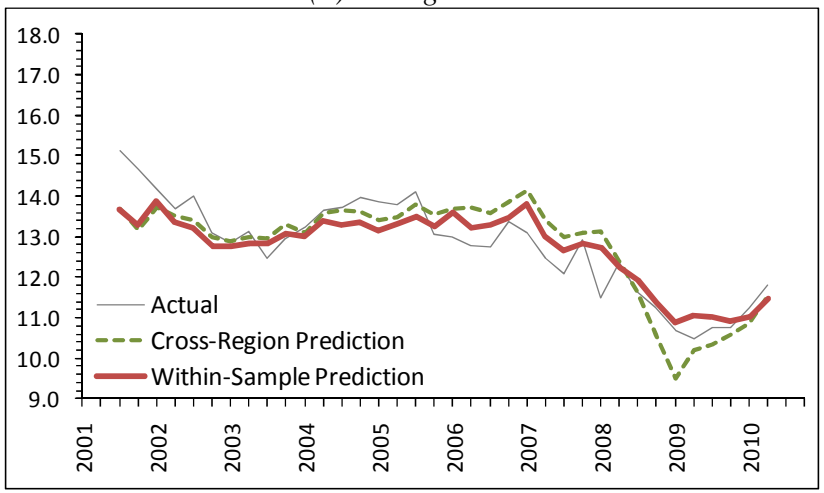
Figure B.2 Aggregate Flows Compared to Flows Generated by Alternative Statistical Models



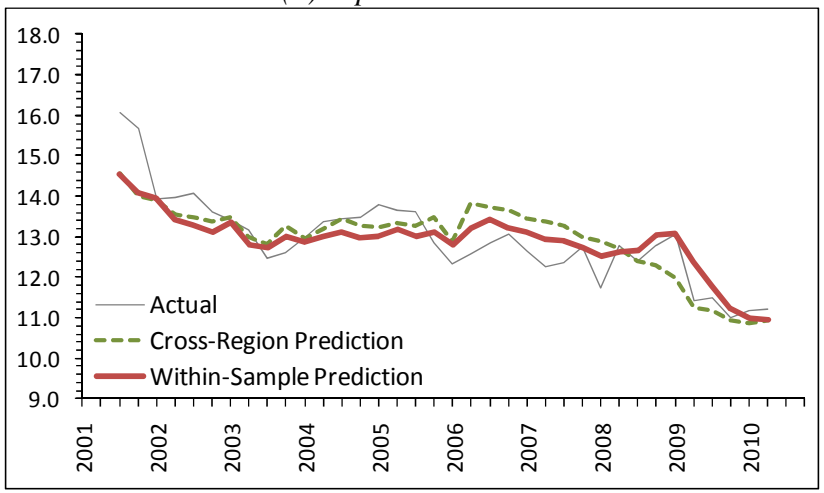
Source: Authors' calculations using estimates of worker flow-growth relationships derived from the JOLTS establishment data interacted with growth rate densities derived from BED data for 2001Q3 – 2010Q2. See text for details of the methodologies. Estimates are seasonally adjusted.

Figure B.3 Fit of Baseline Model: Within-Sample and Cross-Validation Predictions: Northeast-Midwest Region

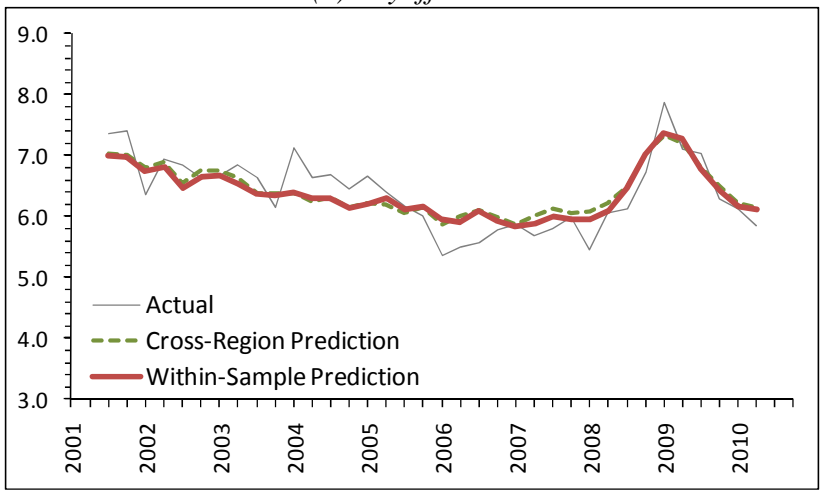
(a) Hiring Rate



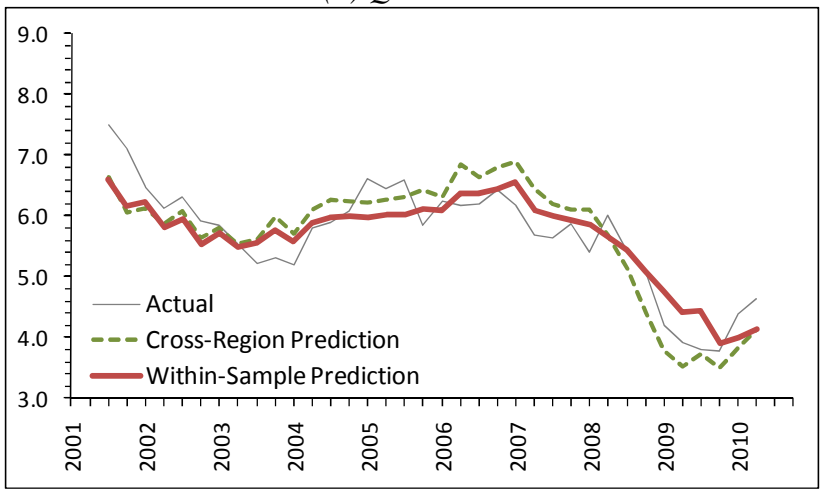
(b) Separation Rate



(c) Layoff Rate



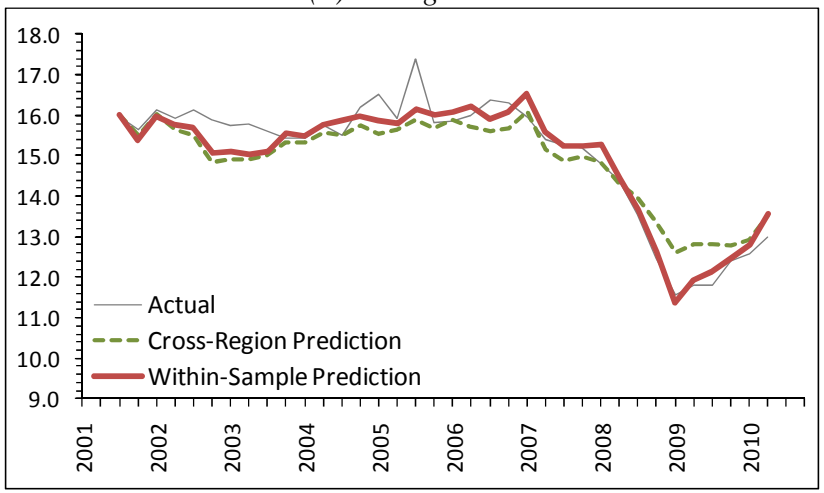
(d) Quit Rate



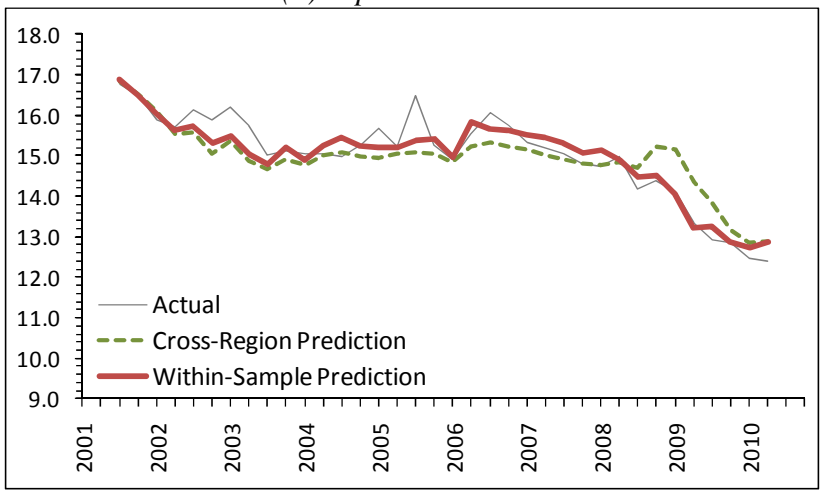
Source: Authors' calculations using estimates of worker flow-growth derived from the JOLTS establishment data interacted with growth rate densities derived from BED data for 2001Q3 – 2010Q2. See text for details of the methodologies. Estimates are seasonally adjusted.

Figure B.4 Fit of Baseline Model: Within-Sample and Cross-Validation Predictions: South-West Region

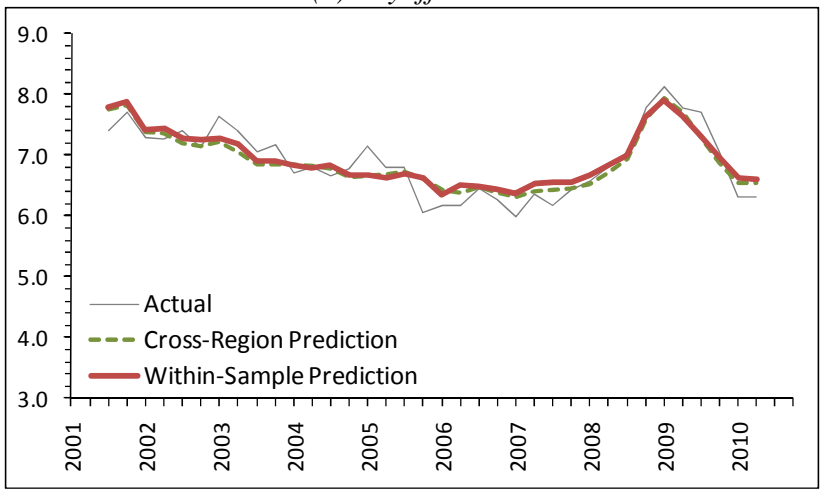
(a) Hiring Rate



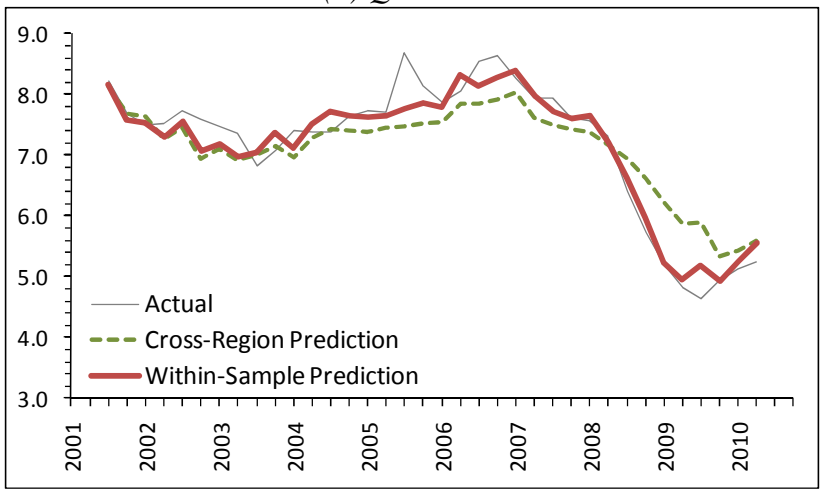
(b) Separation Rate



(c) Layoff Rate



(d) Quit Rate



Source: Authors' calculations using estimates of worker flow-growth derived from the JOLTS establishment data interacted with growth rate densities derived from BED data for 2001Q3 – 2010Q2. See text for details of the methodologies. Estimates are seasonally adjusted.