Vacancy Durations and Entry Wages: Evidence from Linked Vacancy-Employer-Employee Data

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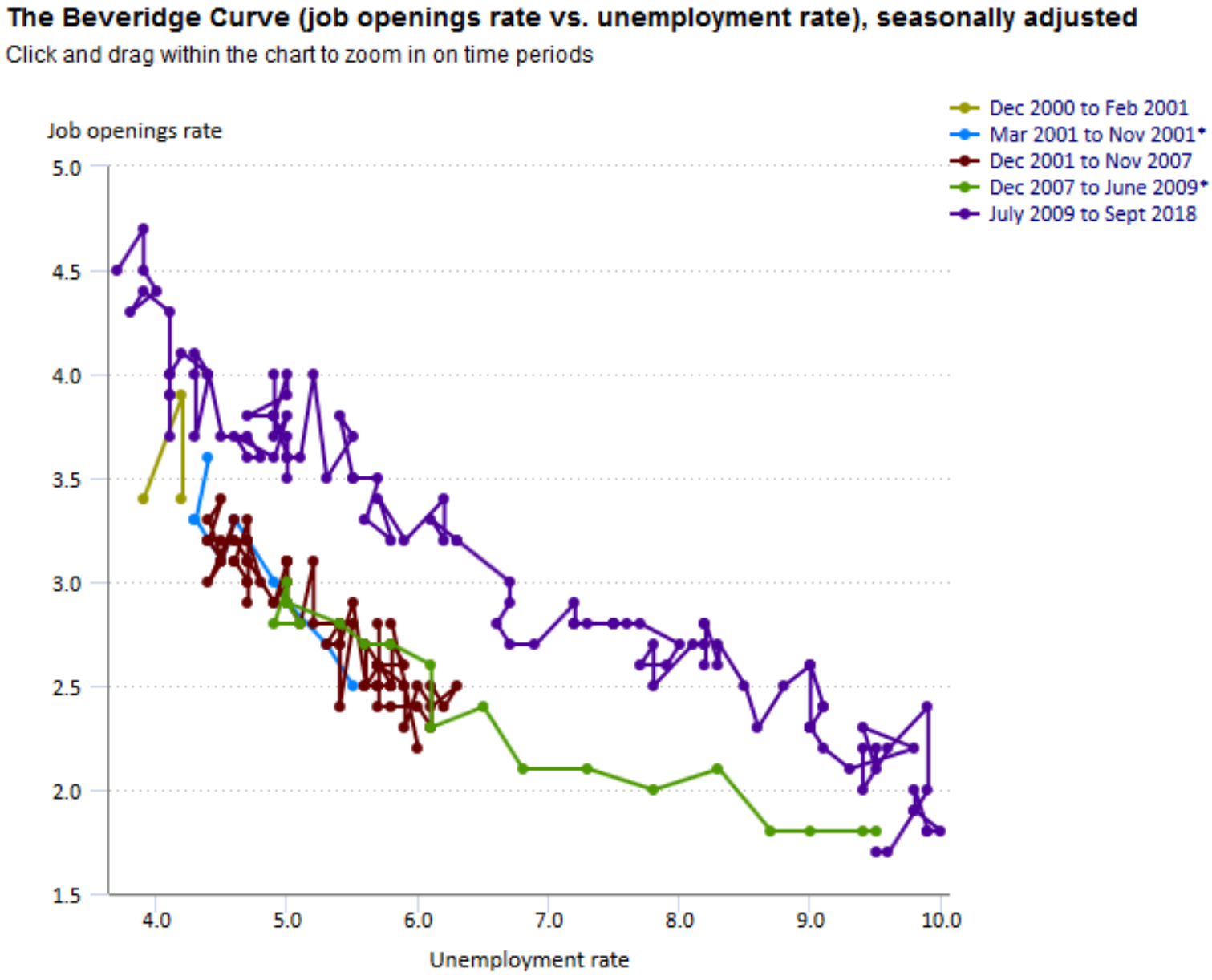
- These data allow use to study in more detail than previously possible the determinants of vacancy filling/duration.
- How firms fill vacancies has important implications for the evolution of matching efficiency in the labor market.

The U.S. Beveridge Curve



The Icelandic Beveridge Curve

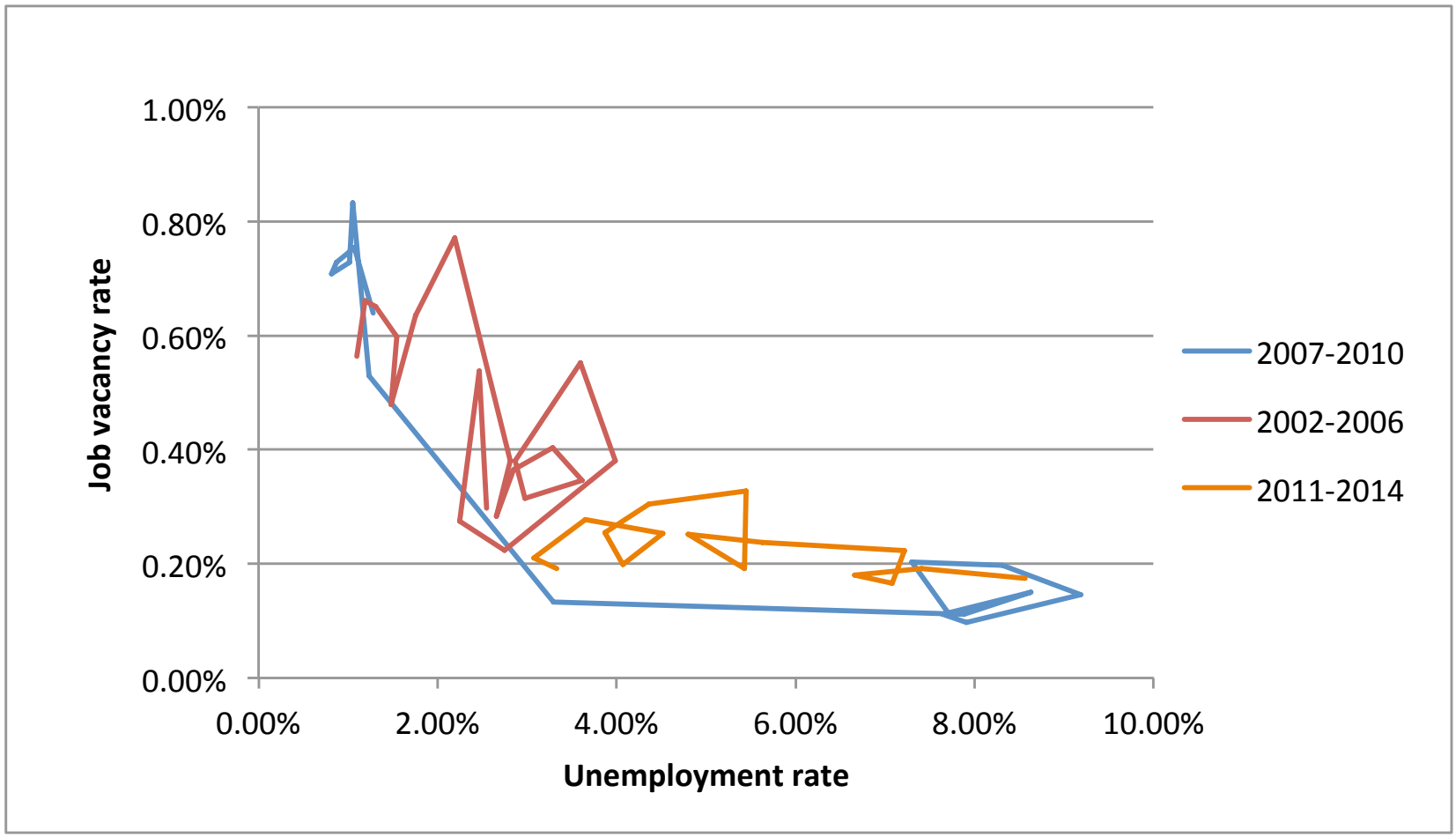


Figure 6. The Icelandic Beveridge curve divided into three periods, 2002M01-2014M12.

Source: Gudmundsdottir (2015).

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  3. labor market history of the worker matched to the vacancy

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  1. characteristics of the firm posting the vacancy
  2. characteristics of the worker matched to the vacancy
  3. labor market history of the worker matched to the vacancy
  4. wage data (including the starting wage)

Vacancy data in the U.S. and the related literature

- Job Openings and Labor Turnover Survey (JOLTS) collected by the BLS: a monthly survey of 16,000 establishments in the U.S. since 2000 (see Davis, Faberman and Haltiwanger, 2013)
- The Conference Board's Help Wanted OnLine (HWOL) database: aims at collecting the universe of online job advertisements since 2005 (see Sahin, Song, Topa and Violante, 2014)
- The Employment Opportunities Pilot Projects (EOPP) data from 1982: sample of 1,512 vacancies with information on vacancy duration and starting wages (see Faberman and Menzio, 2017)
- Various recent papers use online job board data (e.g., Marinescu and Wolthoff (2018), Banfi and Villena-Roldan (2017), Hershbein and Kahn (2018), ...)
- Earlier studies: Abraham (1983, 1987), van Ours and Ridder (1991, 1992), ...

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  - Our data is well suited to test for this relationship, because we not only observe starting wages and vacancy duration, but also worker-level characteristics including labor market histories.

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  - Our data is well suited to test for this relationship, because we not only observe starting wages and vacancy duration, but also worker-level characteristics including labor market histories.
  - These models have important implications for the evolution of matching efficiency over the business cycle (Kaas and Kircher, 2015).

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3. The Concept of a Vacancy and Vacancy Duration in the Data
4. Replication of Davis, Faberman and Haltiwanger (DFH)
5. Vacancy Durations and Wages in New Jobs
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The Data

Combine two datasets: Austrian Social Security Database (ASSD) and register data on individual vacancies.

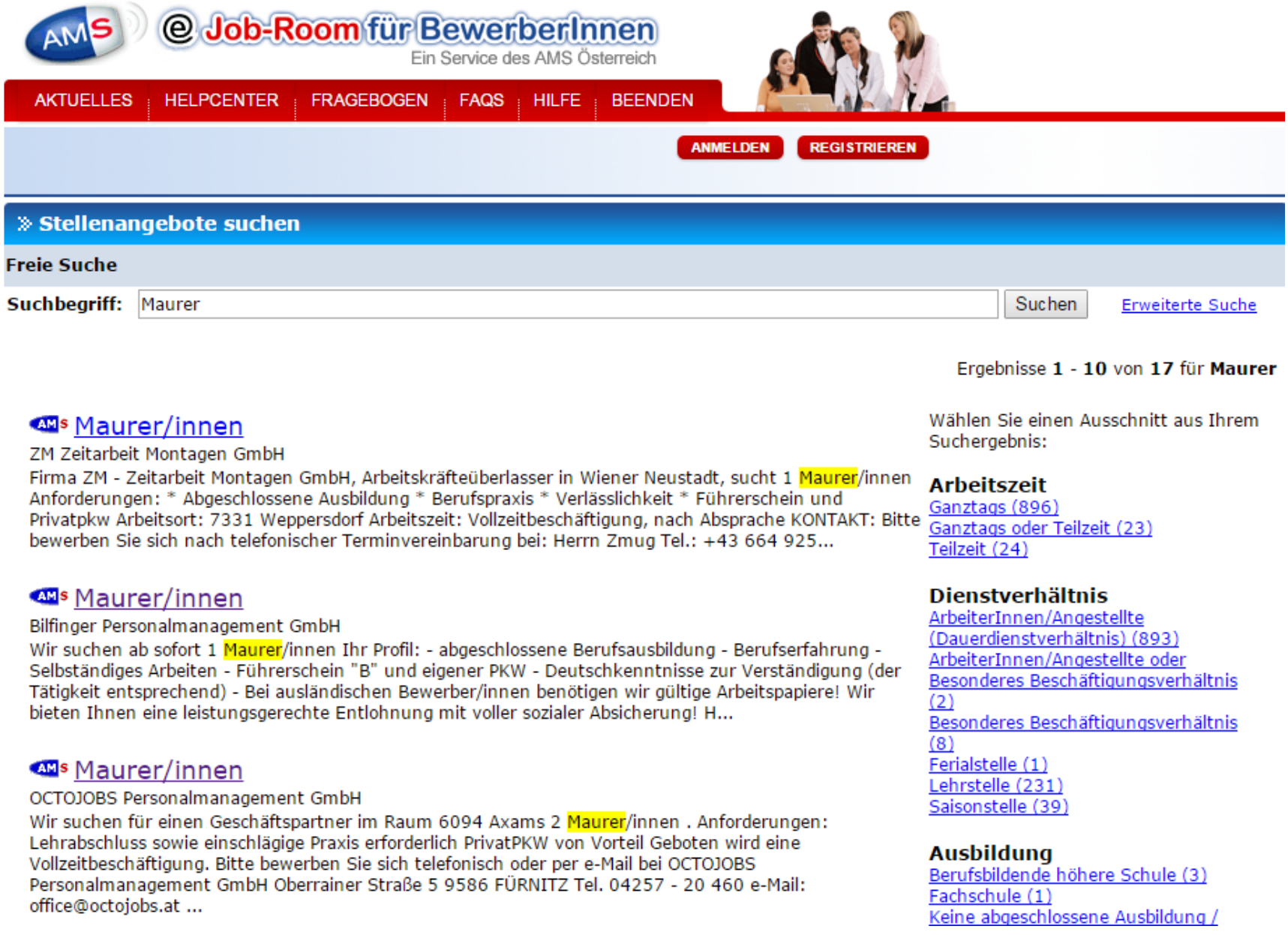
ASSD:

- Covers the universe of private sector workers ($\sim$ 80% of total workforce)
- Records, among other things, each employment and unemployment spell, as well as worker and employer characteristics and wages
- Has been used extensively: E.g., Card, Chetty & Weber (2007), Lalive, Landais and Zweimüller (2015), Alvarez, Borovickova and Shimer (2016).

Vacancy Data

- Information on all vacancies posted in the Austrian Public Employment Service (AMS)
- Records, among other things, the completed duration of a vacancy, job characteristics and requirements
- Covers years 1987 - 2014, but some variables only show up after some time. Most of the analysis is restricted to years 1997-2014

The AMS website



The AMS website, continued

Treffer 1 von 17 nächster Treffer >>

Suchkriterien des Unternehmens

Unternehmen:	ZM Zeitarbeit Montagen GmbH
Dienstverhältnis:	ArbeiterInnen/Angestellte (Dauerdienstverhältnis)
Berufsgruppe:	MaurerIn
Arbeitsort:	7331 Weppersdorf
Arbeitszeit:	Ganztags
Ausbildung:	Lehre

Stellenbeschreibung

Firma ZM - Zeitarbeit Montagen GmbH, Arbeitskräfteüberlasser in Wiener Neustadt, sucht
1 Maurer/in

Anforderungen:
* Abgeschlossene Ausbildung
* Berufspraxis
* Verlässlichkeit
* Führerschein und Privatpkw

Arbeitsort: 7331 Weppersdorf

Arbeitszeit: Vollzeitbeschäftigung, nach Absprache

ANGABEN DES UNTERNEHMENS GEMÄß GLEICHBEHANDLUNGSGESETZ:

Das Mindestentgelt für die Stelle als Maurer/in beträgt 2.150,96 EUR brutto pro Monat auf Basis Vollzeitbeschäftigung. Bereitschaft zur Überzahlung.

Difference to Other Datasets

Main advantages compared to other datasets:

- Can be matched to worker- or firm-level data.
- Flow sampling: All vacancies are recorded irrespective of their length.
- Direct measure of vacancy duration/filling rate: Many previous studies infer vacancy duration/filling rate from repeated stocks of vacancies.
- Administrative data: lower measurement error.

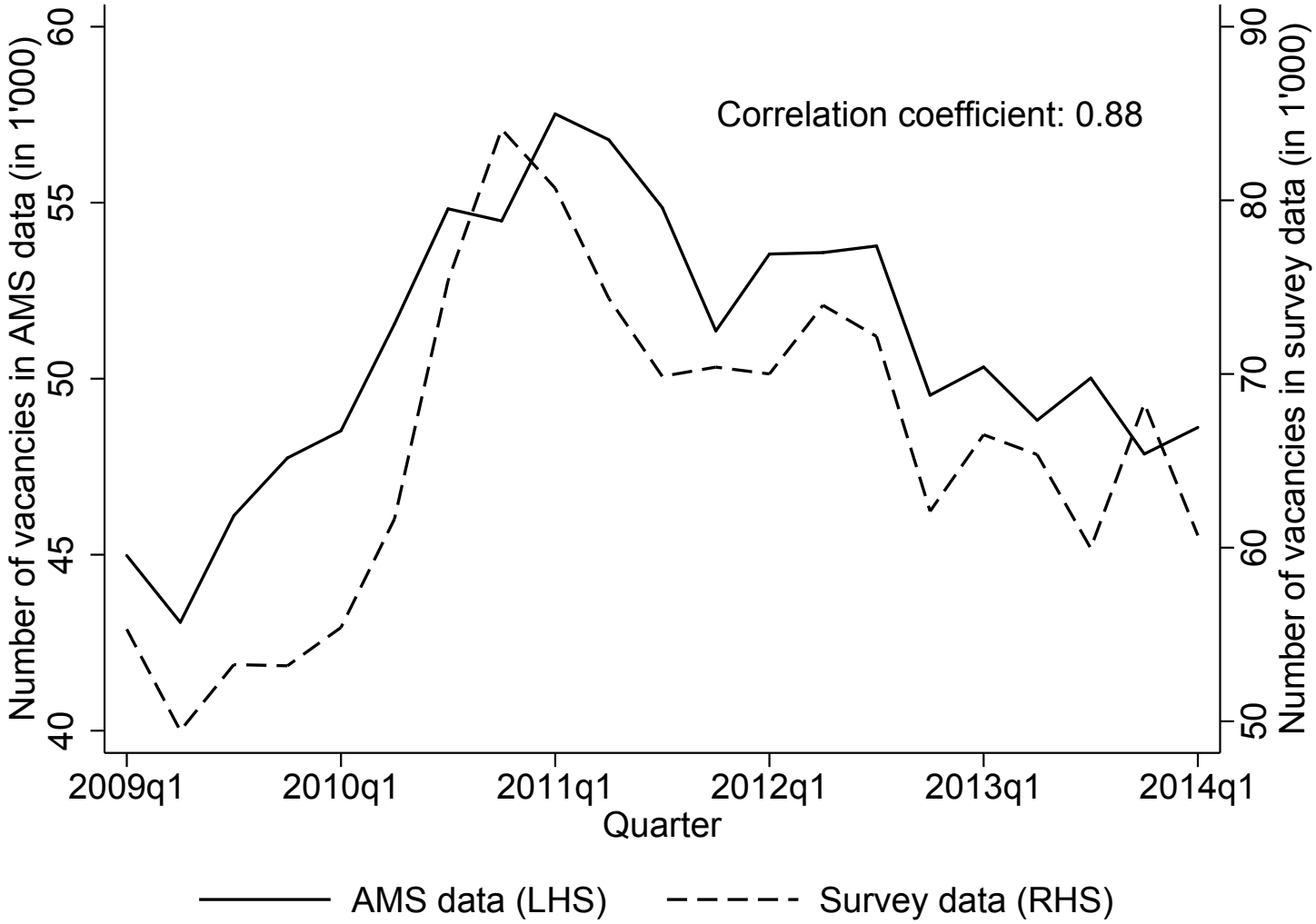
Matching Vacancies to Firms and Workers

- Matching the AMS vacancy data to firms in the ASSD data:
  - The firm identifier in the AMS vacancy data is different from the firm identifier in the ASSD data.
  - The AMS provided a mapping of firm identifies in both data sets, but the mapping exists only in 55% of all cases (in our baseline sample).
  - Different firm/establishment logic at the AMS and at the agency responsible for the ASSD data.
  - ASSD does not include public sector employees/employers, whereas the AMS data include public-sector vacancies.
- Matching the AMS vacancy data to workers in the ASSD data:
  - Vacancy can result in hire through AMS (23%), hire elsewhere (63%), or vacancy could be withdrawn (14%).
  - We know the worker identifier in the first case.

Summary statistics by sample restriction

	All	Firm Sample	Worker Sample
At least apprenticeship (%)	50.3	54.2	48.4
Manufacturing (%)	10.3	12.1	16.8
Wholesale & Retail (%)	14.8	10.8	13.8
Accommodation & Food (%)	23.3	31.2	23.1
Real Estate & Prof. & Admin (%)	26.1	26.0	21.8
Permanent contract (%)	78.4	72.9	79.4
Fixed working time (%)	21.2	23.9	28.2
Small firm (%)	44.6	41.8	41.7
Vienna (%)	17.0	12.0	8.7
Hired through system (%)	23.3	23.3	100.0
Full time (%)	75.2	100.0	100.0
Start of observation period	1997	1997	1997
Observations	5.35e+06	2.18e+06	439,341

Vacancies in our data vs. in representative survey data



Source: Statistik Austria, Survey of Job Openings.

▸ Additional descriptive statistics

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The concept of a vacancy

The Bureau of Labor Statistic defines a vacancy as:

Positions that are open (not filled) on the last business day of the month. A job is "open" only if it meets all three of the following conditions:

1. *A specific position exists and there is work available for that position*
2. *The job could start within 30 days*
3. *There is active recruiting for workers from outside the establishment location that has the opening*

Measuring Vacancy Duration

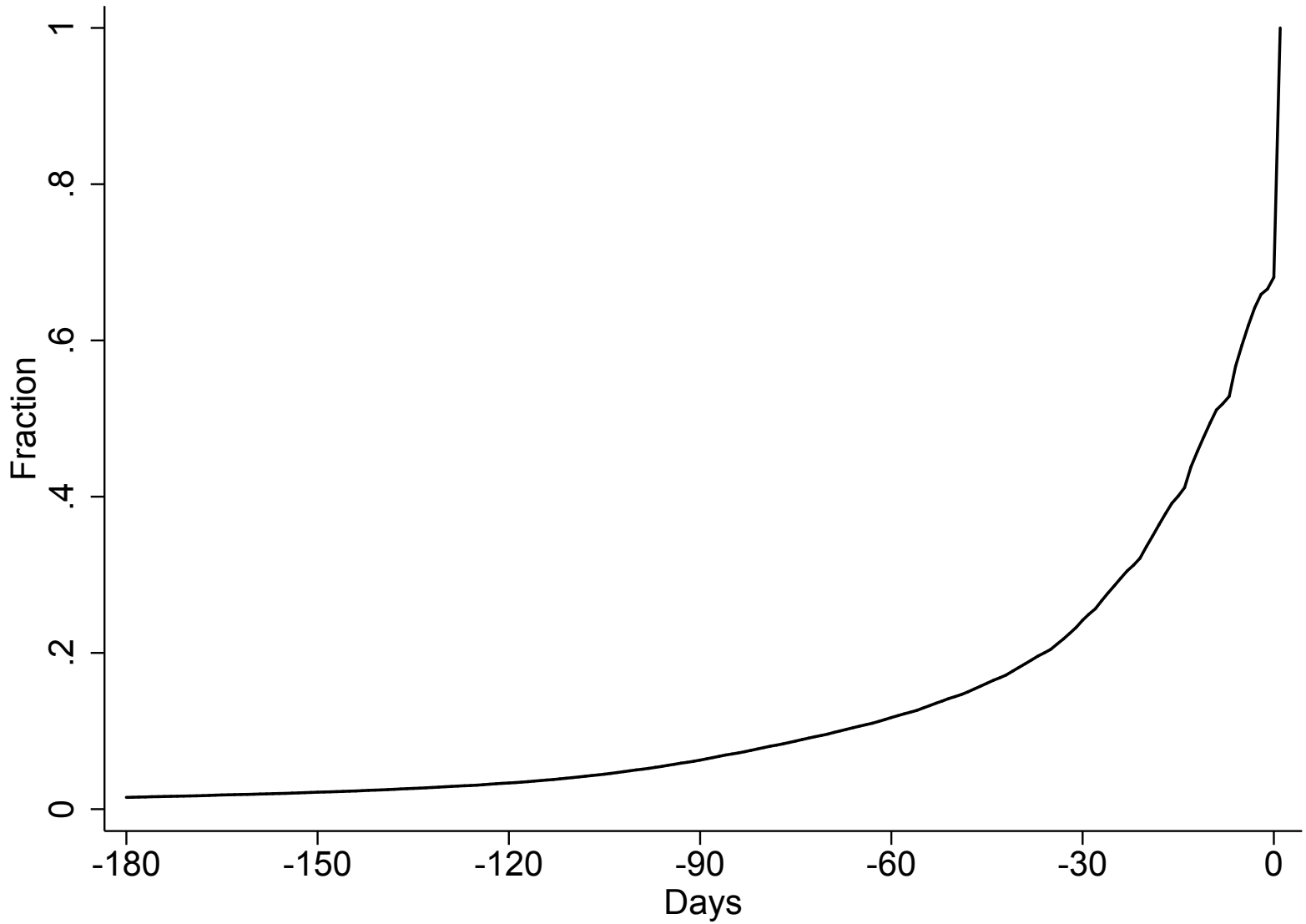
- The AMS data contains a measure of vacancy duration = days between match date and date of availability of the job.
  - Consistent with the concept of vacancy in JOLTS, except that job must be immediately available instead of in next 30 days.
- We compute two alternative measures of vacancy duration:
  - *JOLTS vacancy duration* = days between match date and posting date (but at most 30 days prior to desired start date).
  - *Posting duration* = days between match and posting date.
- Date of posting is recorded in data only since 2007, but month can be imputed from panel data for entire sample period. For the period before 2007, we impute day of posting as the 15th of the month.

Summary Statistics of Vacancy Durations

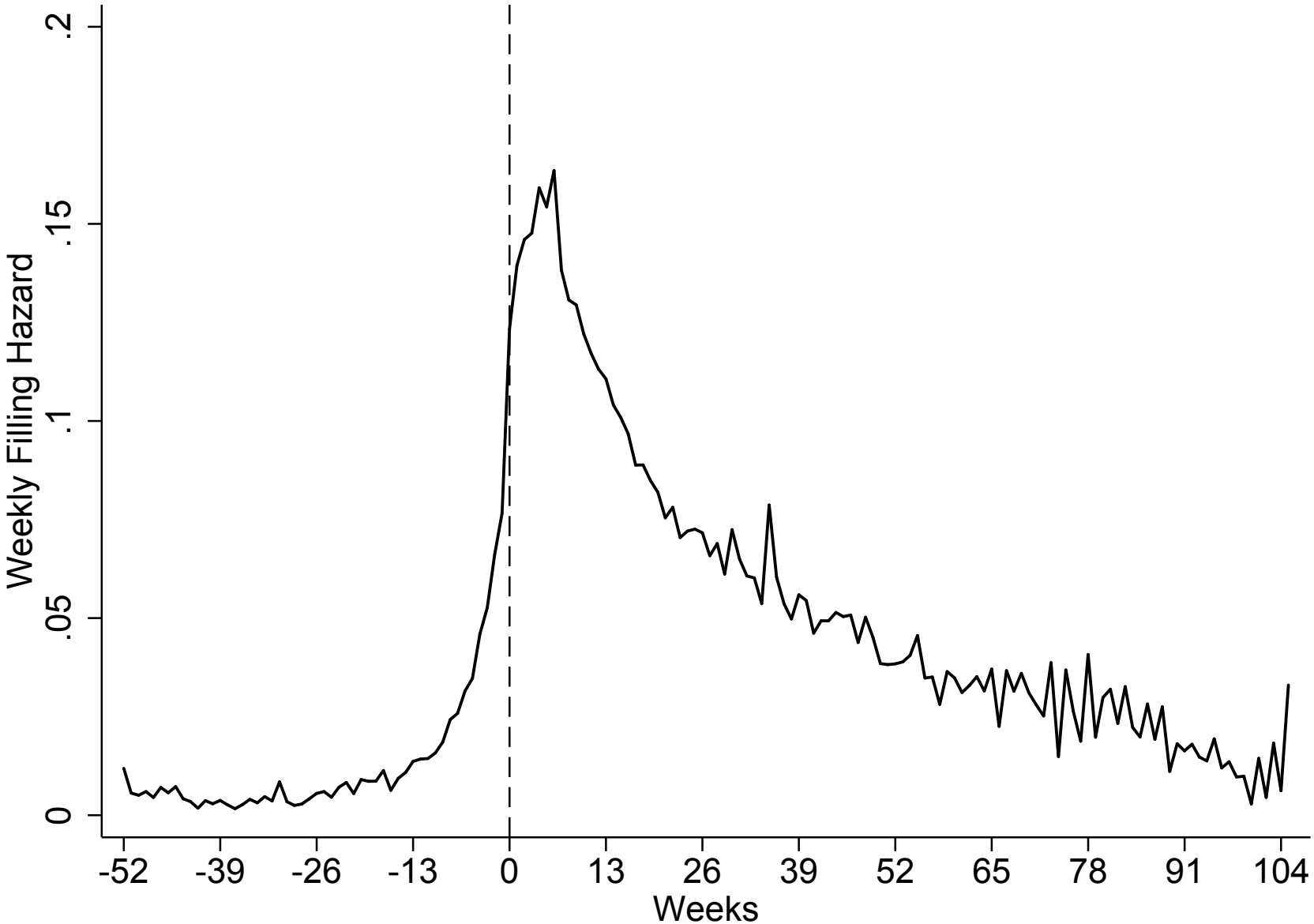
Table: Median and Average Vacancy Duration, in Days

	Median	Mean	Fraction=0
AMS Vacancy Duration	15	30.8	24.2
JOLTS Vacancy Duration	30	41.3	7.6
Vacancy Duration Since Posting	33	48.2	5.8

Cumulative fraction posted, by time to desired start date



Vacancy filling rate, before and after date of availability



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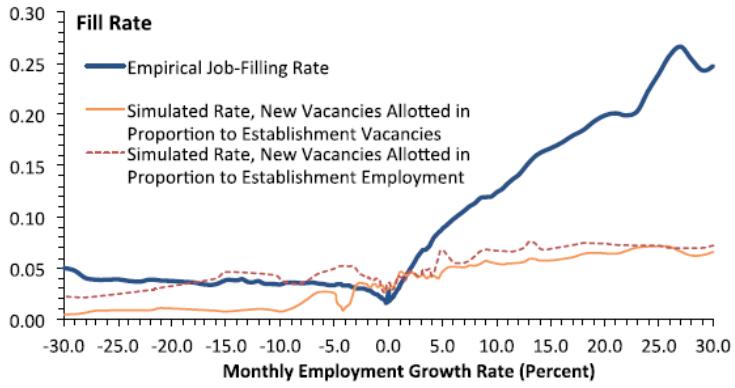
Hiring Intensity and Establishment Growth

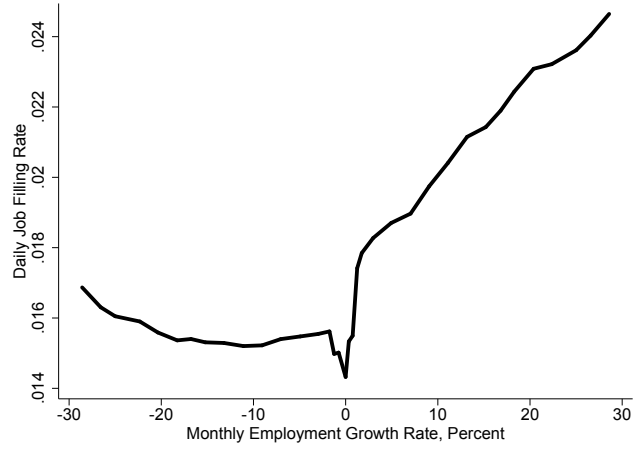
- Davis, Faberman and Haltiwanger (2013) document that growing firms increase their hiring intensity: not only higher vacancy rate, but also more hires per posted vacancy. Results are based on survey data.

- Using administrative data, we can confirm their findings. We can also show that the vacancy filling rate increases for growing firms.

Hiring Intensity and Establishment Growth



(a) Vacancy-filling rate in DFH (Figure 8)



(b) Vacancy-filling rate in Austrian data

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Vacancy Durations and Wages in New Jobs

- A central assumption in many search-theoretic models of the labor market is that firms post wages. In these models, a higher posted wage is associated with a higher job filling rate, because more workers apply to the job (directed search) or more workers accept the job (random search).
- Faberman and Menzio (2017) test relationship between vacancy duration and starting wage with data from 1980-82 from the Employment Opportunity Pilot Project (EOPP).
  - They find a *positive* relationship between vacancy duration and the starting wage.

Vacancy Durations and Wages in New Jobs

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157					
	(0.012)***					
Wage growth						
Log job duration						
Firm growth						
Firm age						
Log firm size						
Quarter FE	Yes					
Early Posting FE	No					
Controls	No					
Region FE	No					
Industry FE	No					
Occ. FE (6 dig.)	No					
Individual FE	No					
Observations	290822					
R^2	0.011					

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157	0.157				
	(0.012)***	(0.012)***				
Wage growth						
Log job duration						
Firm growth						
Firm age						
Log firm size						
Quarter FE	Yes	Yes				
Early Posting FE	No	Yes				
Controls	No	No				
Region FE	No	No				
Industry FE	No	No				
Occ. FE (6 dig.)	No	No				
Individual FE	No	No				
Observations	290822	290822				
R^2	0.011	0.012				

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157	0.157	0.017			
	(0.012)***	(0.012)***	(0.012)			
Wage growth						
Log job duration						
Firm growth						
Firm age						
Log firm size						
Quarter FE	Yes	Yes	Yes			
Early Posting FE	No	Yes	Yes			
Controls	No	No	Yes			
Region FE	No	No	No			
Industry FE	No	No	No			
Occ. FE (6 dig.)	No	No	No			
Individual FE	No	No	No			
Observations	290822	290822	281097			
R^2	0.011	0.012	0.043			

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157	0.157	0.017	-0.034		
	(0.012)***	(0.012)***	(0.012)	(0.008)***		
Wage growth						
Log job duration						
Firm growth						
Firm age						
Log firm size						
Quarter FE	Yes	Yes	Yes	Yes		
Early Posting FE	No	Yes	Yes	Yes		
Controls	No	No	Yes	Yes		
Region FE	No	No	No	Yes		
Industry FE	No	No	No	Yes		
Occ. FE (6 dig.)	No	No	No	Yes		
Individual FE	No	No	No	No		
Observations	290822	290822	281097	281097		
R^2	0.011	0.012	0.043	0.112		

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157	0.157	0.017	-0.034	-0.029	
	(0.012)***	(0.012)***	(0.012)	(0.008)***	(0.010)***	
Wage growth					-0.023	
					(0.033)	
Log job duration					0.023	
					(0.002)***	
Firm growth					-0.054	
					(0.007)***	
Firm age					-0.002	
					(0.000)***	
Log firm size					0.009	
					(0.005)*	
Quarter FE	Yes	Yes	Yes	Yes	Yes	
Early Posting FE	No	Yes	Yes	Yes	Yes	
Controls	No	No	Yes	Yes	Yes	
Region FE	No	No	No	Yes	Yes	
Industry FE	No	No	No	Yes	Yes	
Occ. FE (6 dig.)	No	No	No	Yes	Yes	
Individual FE	No	No	No	No	No	
Observations	290822	290822	281097	281097	176158	
R^2	0.011	0.012	0.043	0.112	0.120	

Regressions w/ log vacancy duration as dependent variable

	(1)	(2)	(3)	(4)	(5)	(6)
Log entry wage	0.157	0.157	0.017	-0.034	-0.029	-0.041
	(0.012)***	(0.012)***	(0.012)	(0.008)***	(0.010)***	(0.019)**
Wage growth					-0.023	
					(0.033)	
Log job duration					0.023	
					(0.002)***	
Firm growth					-0.054	
					(0.007)***	
Firm age					-0.002	
					(0.000)***	
Log firm size					0.009	
					(0.005)*	
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Early Posting FE	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes	No
Industry FE	No	No	No	Yes	Yes	No
Occ. FE (6 dig.)	No	No	No	Yes	Yes	No
Individual FE	No	No	No	No	No	Yes
Observations	290822	290822	281097	281097	176158	126854
R^2	0.011	0.012	0.043	0.112	0.120	0.568

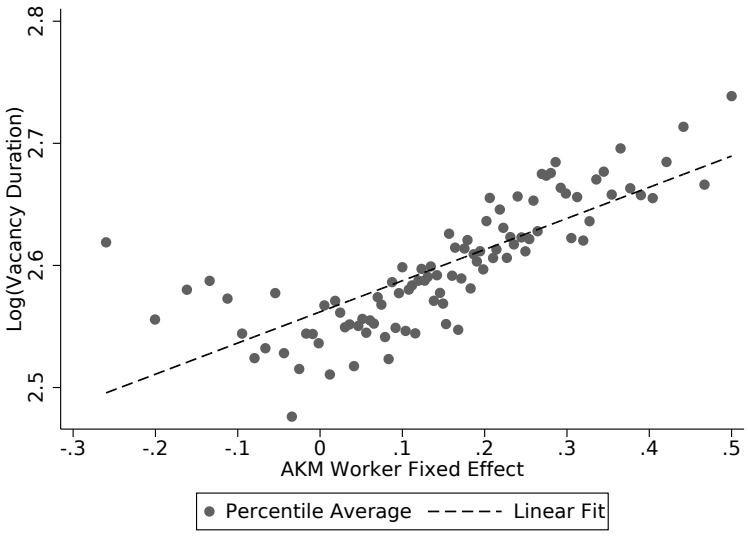
High-Wage Workers and High-Wage Firms

- Key issue: Unobserved worker-level heterogeneity.
- To approximate "types", we decompose wages into worker and firm effects as in Abowd, Kramarz and Margolis (1999),

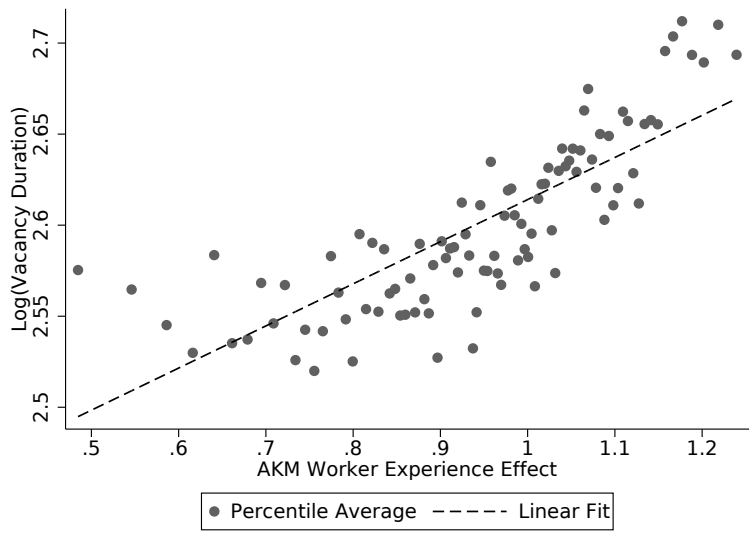
$$\log w_{it} = \theta_i + \psi_{\mathbf{J}(i,t)} + x'_{it}\beta + \varepsilon_{it},$$

  where θ_i and $\psi_{\mathbf{J}(i,t)}$ identify the fixed worker and firm effects and x_{it} are variable worker characteristics (experience).
- We estimate AKM with the universe of private sector workers (1985-2014).
- We relate the AKM effects to vacancy duration:
  - How long do different firms wait for identical workers?
  - How long do identical firms wait for different types of workers?

Vacancy Durations and Worker Effects



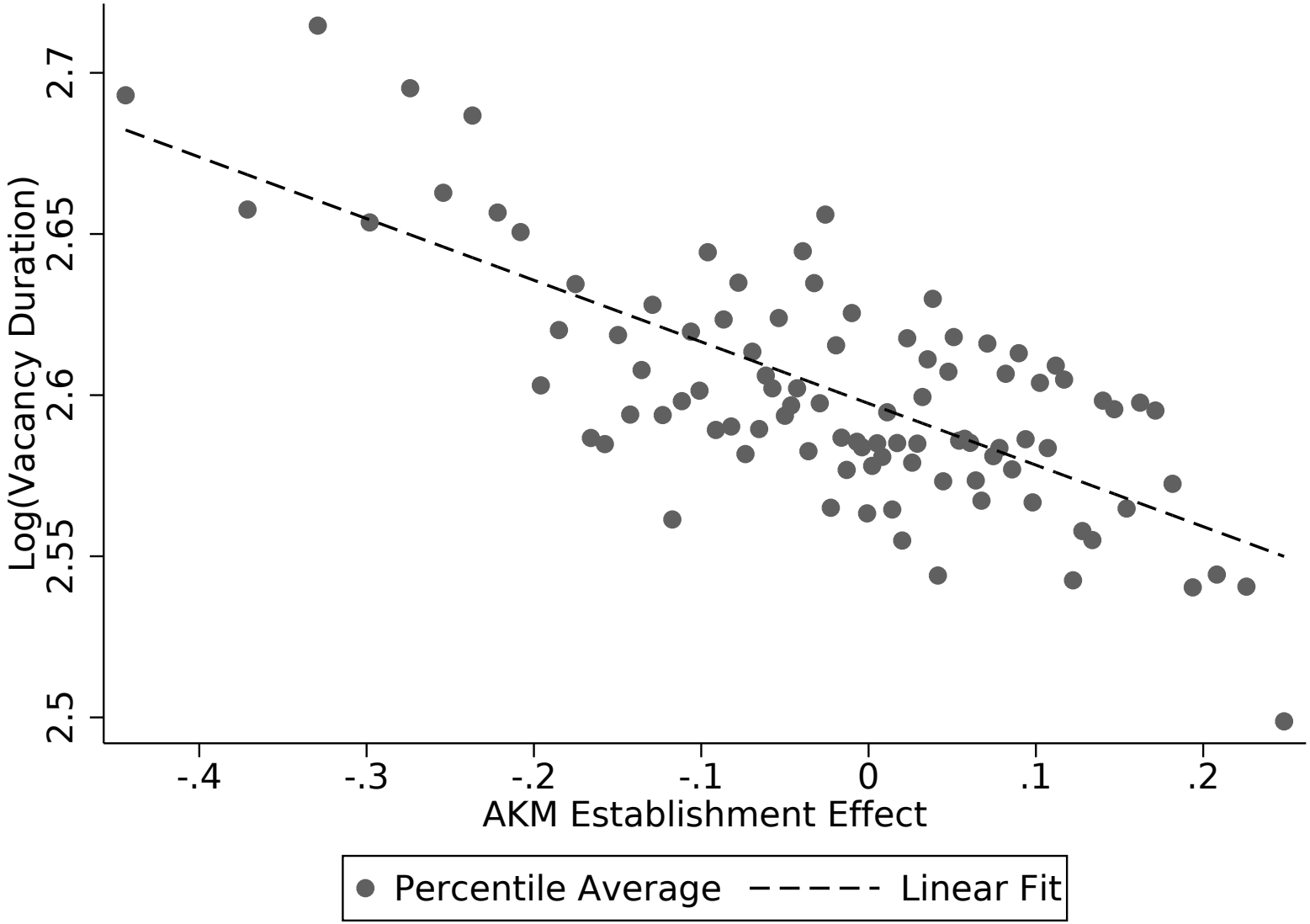
(a) AKM worker effect and log vacancy duration



(b) AKM worker experience effect and log vacancy duration

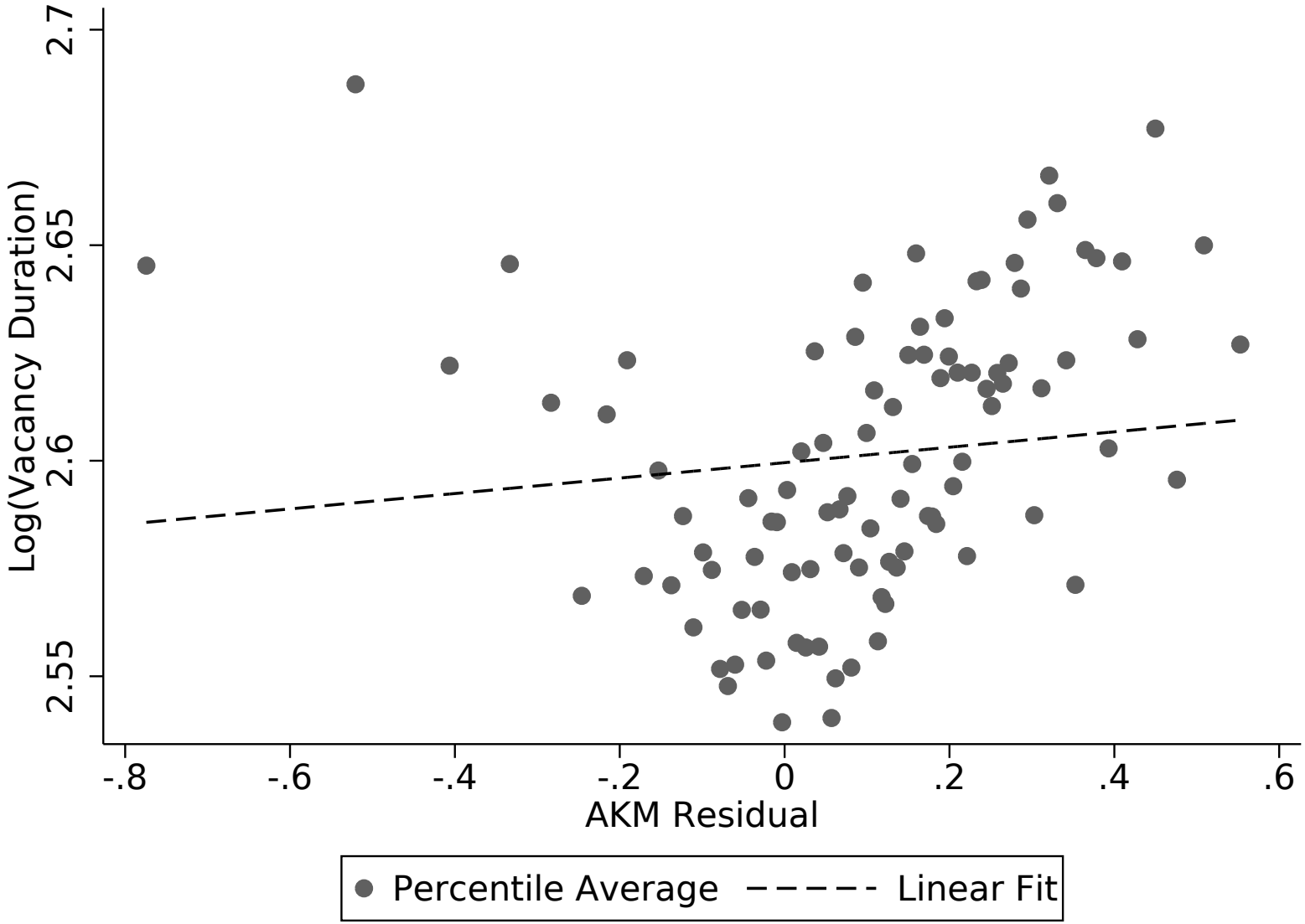
Note: The plots show partial correlations (added variable plots), controlling for AKM effects and time fixed effects.

Vacancy Durations and AKM Firm Effects



Note: The plot shows a partial correlation (added variable plot), controlling for AKM effects and time fixed effects.

Vacancy Durations and AKM Residual



Note: The plot shows a partial correlation (added variable plot), controlling for AKM effects and time fixed effects.

Regressions w/ log AMS vacancy duration as dep. variable

	(1)	(2)	(3)	(4)	(5)
Log entry wage	0.157				
	(0.012)***				
AKM establishment effect					
AKM worker fixed effect					
AKM worker exp. effect					
AKM residual					
Quarter FE	Yes				
Early Posting FE	No				
Controls	No				
Region FE	No				
Industry FE	No				
Further Controls	No				
Occupation FE (6 digits)	No				
Individual FE	No				
Observations	290822				
R^2	0.011				

Regressions w/ log AMS vacancy duration as dep. variable

	(1)	(2)	(3)	(4)	(5)
Log entry wage	0.157				
	(0.012)***				
AKM establishment effect		-0.172			
		(0.036)***			
AKM worker fixed effect		0.512			
		(0.018)***			
AKM worker exp. effect		0.392			
		(0.015)***			
AKM residual		0.113			
		(0.012)***			
Quarter FE	Yes	Yes			
Early Posting FE	No	No			
Controls	No	No			
Region FE	No	No			
Industry FE	No	No			
Further Controls	No	No			
Occupation FE (6 digits)	No	No			
Individual FE	No	No			
Observations	290822	278606			
R^2	0.011	0.018			

Regressions w/ log AMS vacancy duration as dep. variable

	(1)	(2)	(3)	(4)	(5)
Log entry wage	0.157				
	(0.012)***				
AKM establishment effect		-0.172	-0.194		
		(0.036)***	(0.038)***		
AKM worker fixed effect		0.512	0.248		
		(0.018)***	(0.018)***		
AKM worker exp. effect		0.392	0.274		
		(0.015)***	(0.018)***		
AKM residual		0.113	0.008		
		(0.012)***	(0.011)		
Quarter FE	Yes	Yes	Yes		
Early Posting FE	No	No	Yes		
Controls	No	No	Yes		
Region FE	No	No	No		
Industry FE	No	No	No		
Further Controls	No	No	No		
Occupation FE (6 digits)	No	No	No		
Individual FE	No	No	No		
Observations	290822	278606	271198		
R^2	0.011	0.018	0.046		

Regressions w/ log AMS vacancy duration as dep. variable

	(1)	(2)	(3)	(4)	(5)
Log entry wage	0.157				
	(0.012)***				
AKM establishment effect		-0.172	-0.194	-0.209	
		(0.036)***	(0.038)***	(0.025)***	
AKM worker fixed effect		0.512	0.248	0.063	
		(0.018)***	(0.018)***	(0.015)***	
AKM worker exp. effect		0.392	0.274	0.046	
		(0.015)***	(0.018)***	(0.015)***	
AKM residual		0.113	0.008	-0.030	
		(0.012)***	(0.011)	(0.008)***	
Quarter FE	Yes	Yes	Yes	Yes	
Early Posting FE	No	No	Yes	Yes	
Controls	No	No	Yes	Yes	
Region FE	No	No	No	Yes	
Industry FE	No	No	No	Yes	
Further Controls	No	No	No	No	
Occupation FE (6 digits)	No	No	No	Yes	
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		(0.012)***	(0.011)	(0.008)***	(0.019)
Quarter FE	Yes	Yes	Yes	Yes	Yes
Early Posting FE	No	No	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
Region FE	No	No	No	Yes	No
Industry FE	No	No	No	Yes	No
Further Controls	No	No	No	No	No
Occupation FE (6 digits)	No	No	No	Yes	No
Individual FE	No	No	No	No	Yes
Observations	290822	278606	271198	271198	123824
R^2	0.011	0.018	0.046	0.113	0.571

Alternative Specifications

	(1) Baseline	(2) JOLTS	(3) Posting	(4) Linear	(5) Extensive
AKM establishment effect	-0.209	-0.112	-0.118	-4.376	-4.444
	(0.025)***	(0.019)***	(0.019)***	(0.837)***	(0.758)***
AKM worker fixed effect	0.063	0.062	0.059	0.146	-2.629
	(0.015)***	(0.011)***	(0.011)***	(0.384)	(0.466)***
AKM worker exp. effect	0.046	0.038	0.031	-0.214	-1.896
	(0.015)***	(0.011)***	(0.011)***	(0.408)	(0.478)***
AKM residual	-0.030	-0.016	-0.015	-0.866	-1.031
	(0.008)***	(0.007)**	(0.006)**	(0.233)***	(0.257)***
Quarter FE	Yes	Yes	Yes	Yes	Yes
Early Posting FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Occupation FE (6 digits)	Yes	Yes	Yes	Yes	Yes
Observations	271198	326842	330781	406351	406351
R^2	0.113	0.210	0.333	0.101	0.126

Further Robustness of Results

Results are very similar if we:

1. use only EUE-transitions in estimation of AKM effects
2. restrict AKM sample to at least 10 firm observations and 10 worker observations
3. trim sample at 1st/99th percentile or 5th/95th percentile of entry wages
4. restrict the sample to men only
5. restrict the sample to ages 25-54 only
6. adjust for selection with sampling weights based on industry, region and educational requirement of job

▸ Go to results

Agenda

1. Introduction
2. The Data
3. The Concept of a Vacancy and Vacancy Duration in the Data
4. Replication of Davis, Faberman and Haltiwanger (DFH)
5. Vacancy Durations and Wages in New Jobs
6. Theoretical Framework
7. Conclusion

Theoretical Framework

- Aim is to match three key findings:

  (1.) Starting wages and vacancy durations are positively correlated
  (2.) Vacancies posted by high-wage firms last shorter
  (3.) Vacancies filled by high-wage workers last longer

- In addition, we find that growing firms fill their vacancies faster (as DFH).

- To understand these findings, we extend the model of Kaas and Kircher (2015) to ex-ante worker heterogeneity.
  - Their model is a natural starting point because it (1) characterizes directed search in the context of firm heterogeneity and (2) was calibrated explicitly to match the facts documented in DFH.
  - Note that our finding (3) is also consistent with a model of random search (Burdett and Mortensen, 1998), but only if unemployed workers differ in reservation wage values.

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- Job seekers and vacancies are matched according to matching function $m_i(\lambda_i) = (1 + k\lambda_i^{-r})^{-\frac{1}{r}}$. If contract attracts λ_i workers of type i per vacancy, then vacancy filling rate is m_i.

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- In equilibrium, unemployed workers of type i are indifferent between searching in different markets.
- There are exog. and endog. firm death ($\delta(x)$), and exog. and endog. layoffs for each type of worker i.

Calibration

- There are 5 types of firms. We assume the following shape of the production function and the vacancy cost function:

$$F(\boldsymbol{L}, y, x) = yx \sum_{i=1}^{N} (a_i(x) L_i^{\alpha})$$

$$C(\boldsymbol{V}, \boldsymbol{L}, y, x) = \sum_{i=1}^{N} \left(\frac{c_i}{1+\gamma} \left(\frac{V_i}{L_i} \right)^{\gamma} V_i \right)$$

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- We calibrate the model for two types of workers, where we set c_i such that the job filling rate is 0.11 for the low-type and 0.094 for the high-type worker.
- In our baseline model with worker heterogeneity, we calibrate the parameters $a_i(x)$ to match the cross-sectional dispersion in AKM worker effects.

Calibrated Parameter Values in Kaas and Kircher (2015)

TABLE 1—PARAMETER CHOICES IN THE BENCHMARK CALIBRATION

Parameter	Value	Description
β	0.999	Annual interest rate 5 percent
k	6.276	Matching function scale parameter
r	1.057	Matching function elasticity parameter
α	0.7	Production function elasticity
c	8.317	Recruitment cost scale parameter
γ	2	Recruitment cost elasticity parameter
$\left(x_0^i\right)$	(0.366, 0.736, 1.166, 2.031, 4.138)	Employment shares (5 size classes)
$\left(\sigma^i\right)$	(98.82, 1.0, 0.153, 0.025, 0.002)%	Firm shares (5 size classes)
$\left(\delta^i\right)$	(1.71, 0.27, 0.16, 0.088, 0.016)‰	Exit rates
$\overline{x}$	0.312	Transitory productivity range
π	0.027	Adjustment probability
b	0.1	Unemployment income ($b/w \approx 0.7$)
K	329.6	Entry cost
s_0	0.48%	Quit rate

Source: Kaas and Kircher (AER, 2015).

▸ Calibration of c and a_i

Simulation Results, Model w/ Worker Heterogeneity

		Model Extension w/ Worker Heterogeneity		
	Data	$\gamma = 1$	$\gamma = 0.5$	$\gamma = 0.1$
Corr. of Worker and Firm Types	—	0.00	0.01	0.01
Elast. of Vacancy Duration to				

▸ Additional Results ▸ Results for Model w/ Positive Assortative Matching

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... AKM Worker Fixed Effect	0.25	0.23	0.26	0.26
... AKM Residual	0.01	-25.3	-24.7	-8.8

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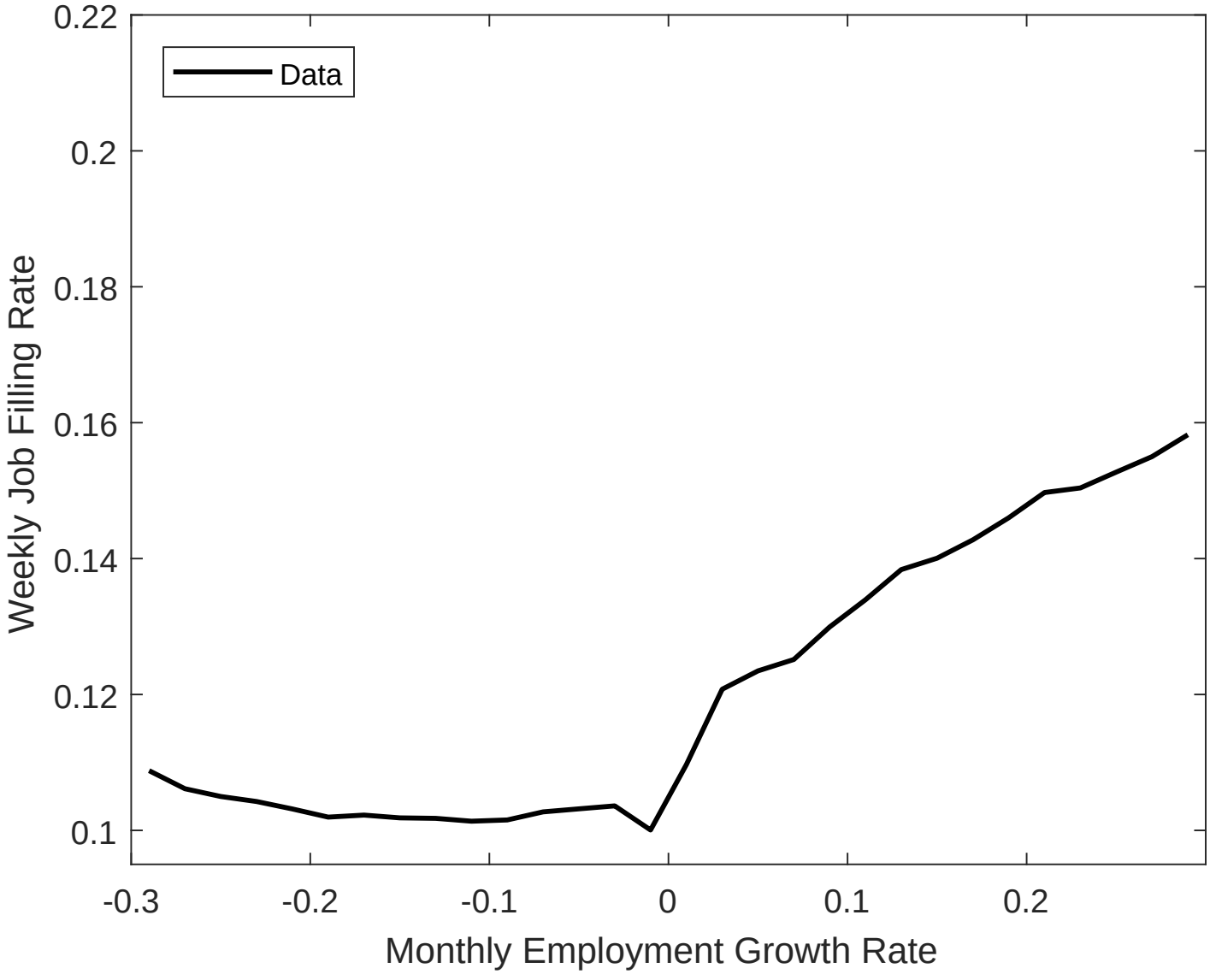
The Importance of the Vacancy Cost Elasticity γ



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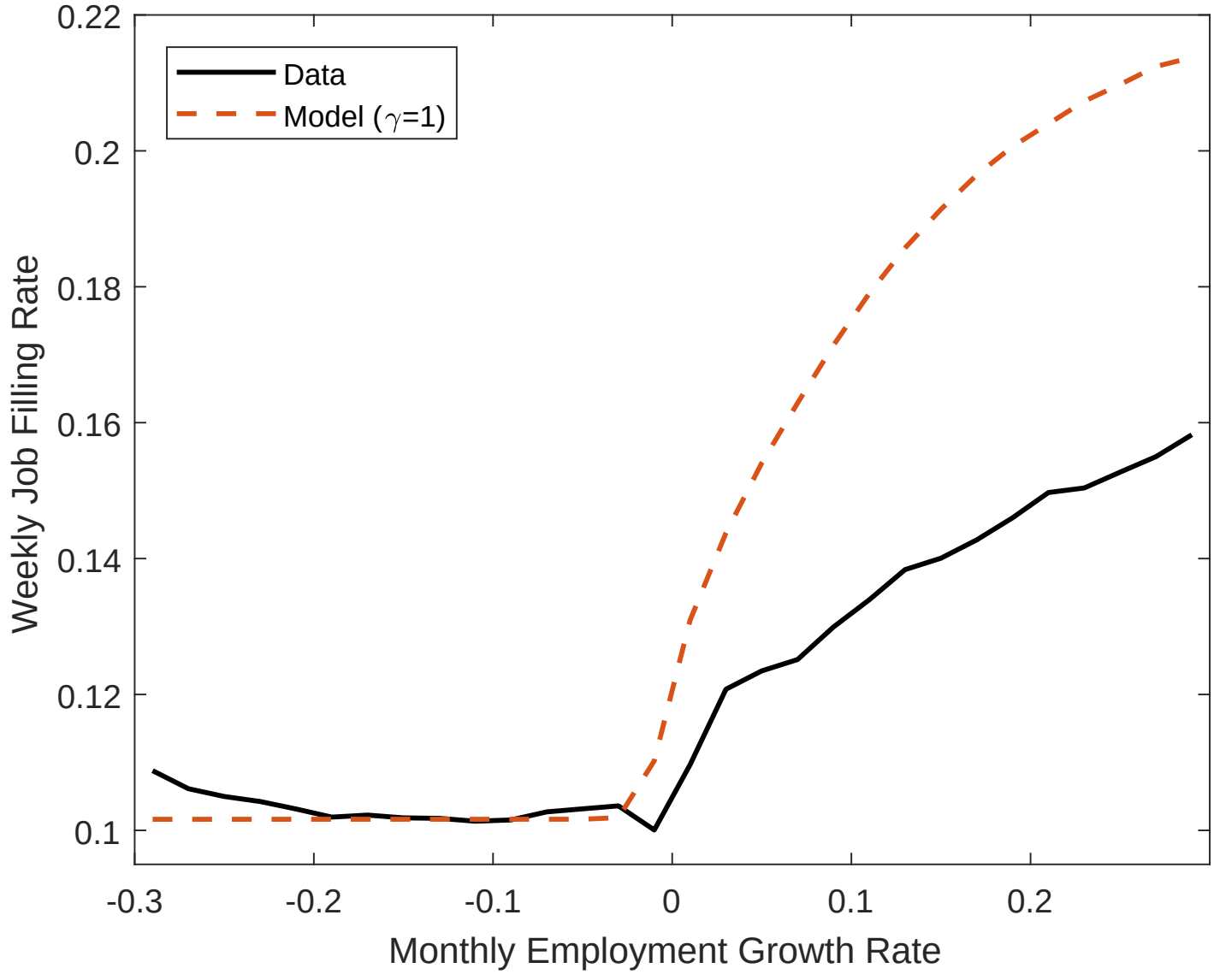

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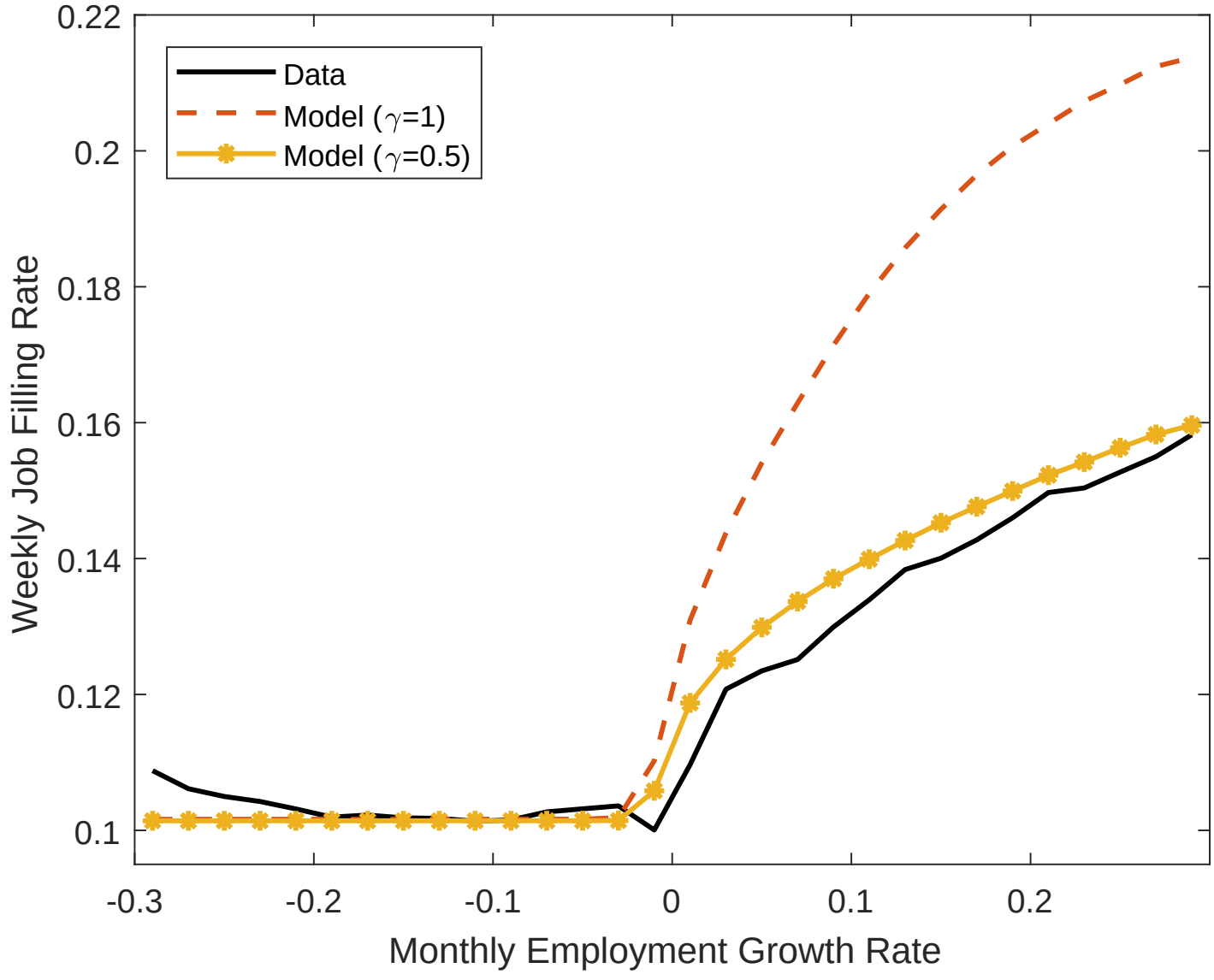

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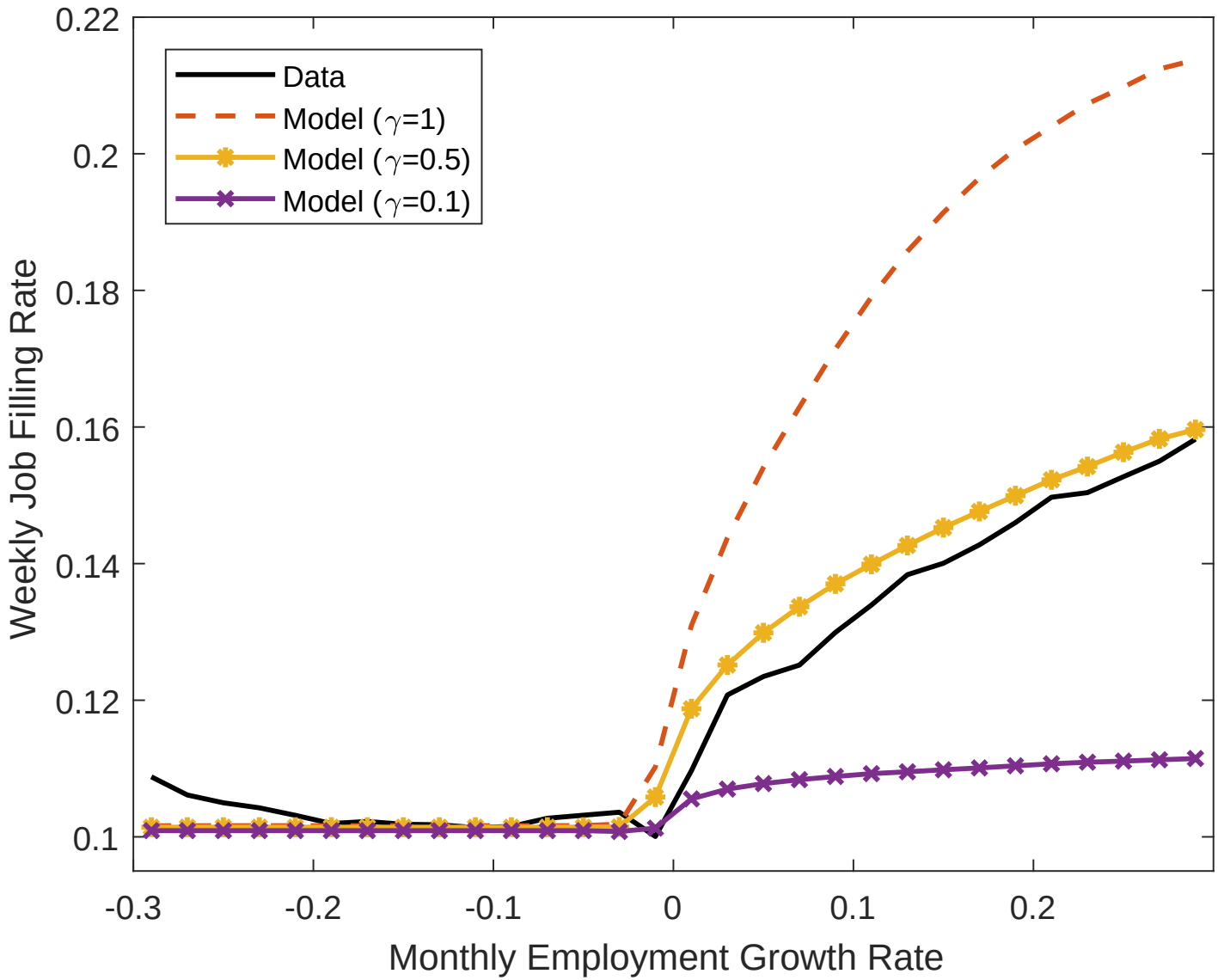

▸ Same Figures in Model w/ Worker Heterogeneity

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A tentative conclusion: firms rely mostly on other recruiting channels for vacancy filling. This rests on important assumptions:

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3. With non-wage amenities, the starting wage is less informative about the value of the job?
   - Results suggest that dispersion in non-wage amenities (as in Hall and Mueller, 2018) goes some way to reconcile results quantitatively.

Conclusion

- We analyze a novel data source on vacancy posting and filling
- Main empirical findings that stand out:
  - (1.) Conditional on controls, we find a negative but small association between starting wages and vacancy durations
  - (2.) Vacancies posted by high-wage firms last shorter
  - (3.) Vacancies filled by high-wage workers last longer
- We extend the model of Kaas and Kircher (2015) to the case of ex-ante worker heterogeneity:
  - Qualitatively, the model matches our three findings
  - In the model, there is a tension between matching (1) the DFH-type evidence and (2) the response of vacancy filling to firm-level wages
  - This suggests that firms rely mostly on other recruiting channels (other than posted wages) for vacancy filling