

# Online Supplementary Appendix

## (Not for Publication)

In this supplementary appendix, we present additional tests for robustness and further findings. We demonstrate that the correlations between AKM fixed effects and the utilization/success probabilities of various search channels, as presented in the main text, persist across multiple firm and worker attributes. Furthermore, we include findings using AKM fixed effects from periods before 2010, as outlined in the main text. Moreover, we confirm the result of workers ascending the firm rank hierarchy through job postings even after accounting for advance notification of layoff information in the administrative data. Lastly, we show the correlations between AKM firm fixed effects and the utilization/success rates of the remaining search channels not examined in our main analysis.

## **S Robustness and Further Results**

### **S.1 Channel Use and Success Conditional on Firm Characteristics**

This section shows that higher-ranked firms have a greater likelihood of utilizing and succeeding in hiring through job postings, and a lower likelihood of using and succeeding in hiring through networks and the public employment agency, even when we condition on sector, firm size category, or occupation.

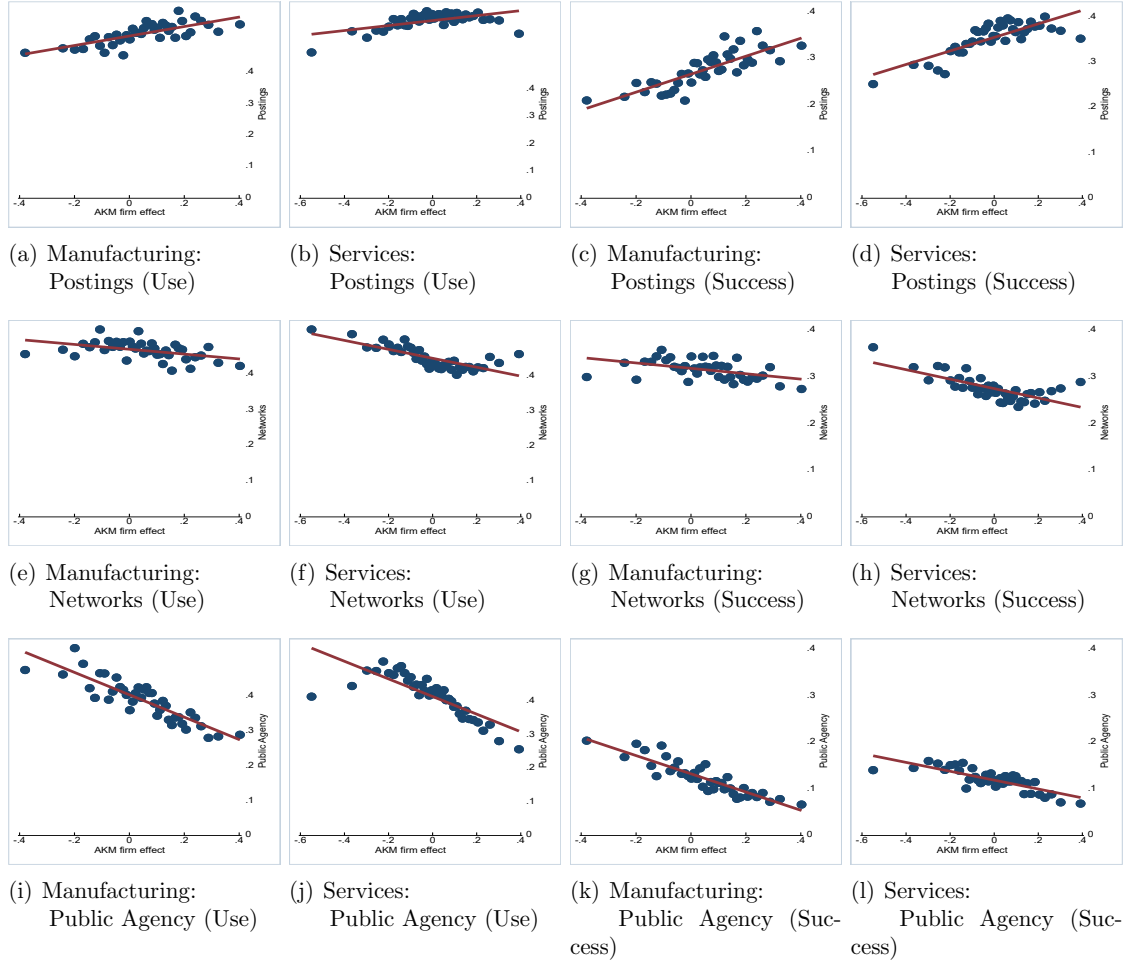


Figure S.1: Use and success of search channels by AKM firm fixed effect and sector

Notes: The figures show binscatter plots that relate the firm’s AKM fixed effect to the probability of using (left) and succeeding (right) through the channel. “Manufacturing” include two-digit WZ2008 industry codes 10-44, “Services” include industry codes 45-99. Controls: educational requirements, quadratic polynomial of firm age, six firm size categories, and financial, demand and workforce constraints.

Figure S.1 groups firms into two sectors (manufacturing and services) and illustrates the probability of utilization and success through search channels across the AKM firm effect distribution. Figure S.2 and S.3 portray the same for three firm size categories: small (1-10 employees), medium (10-100 employees), and large (more than 100). Figures S.4 and S.5 present similar insights for the firm’s skill level of the target occupation. All these graphs are conditional on the respective other controls. For instance, in the sector-specific graphs of S.1, we control for firm size, age, educational requirements, and constraints faced by the firm. See the respective table notes for details.

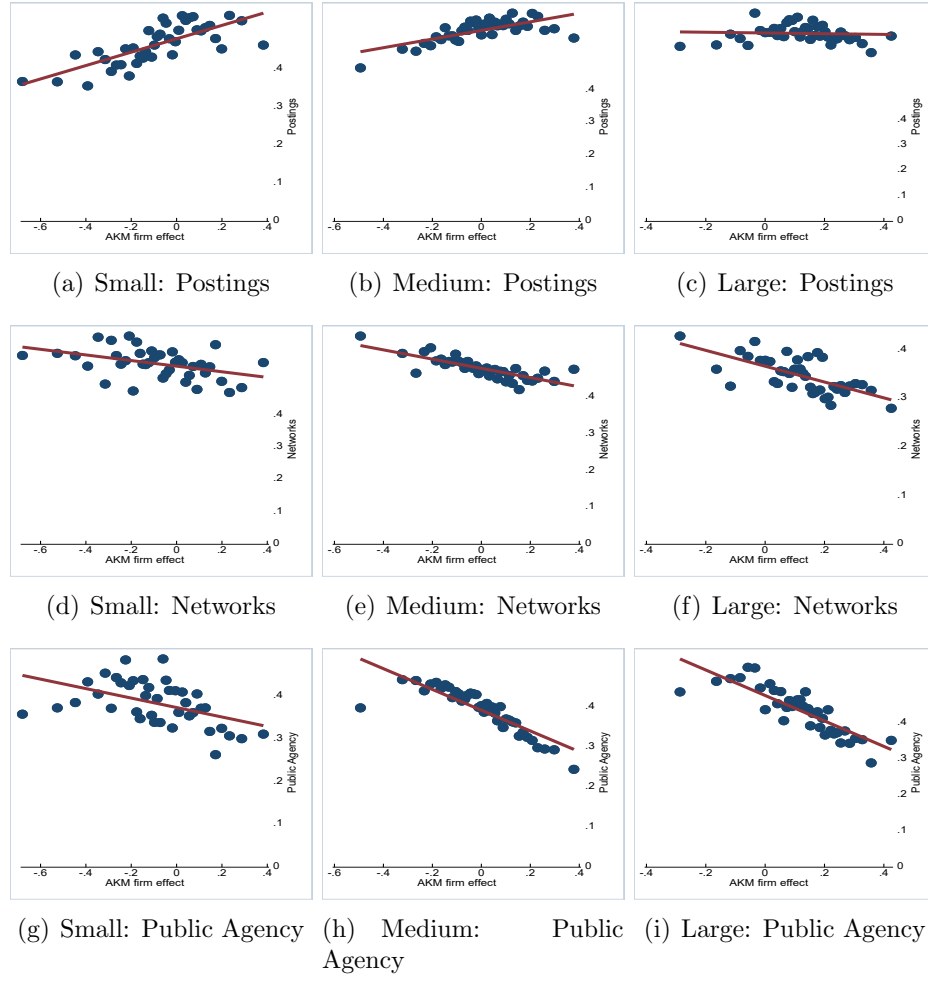


Figure S.2: Use of search channels by AKM firm fixed effect and firm size

Notes: The figures show binscatter plots that relate the firm's AKM fixed effect to the probability of using the channel. "Small" refers to firms with 1-10 workers, "medium" refers to firms with 11-100 workers, and "large" refers to firms with more than 100 workers. Controls: educational requirements, quadratic polynomial of firm age, one-digit industry codes, and financial, demand and workforce constraints.

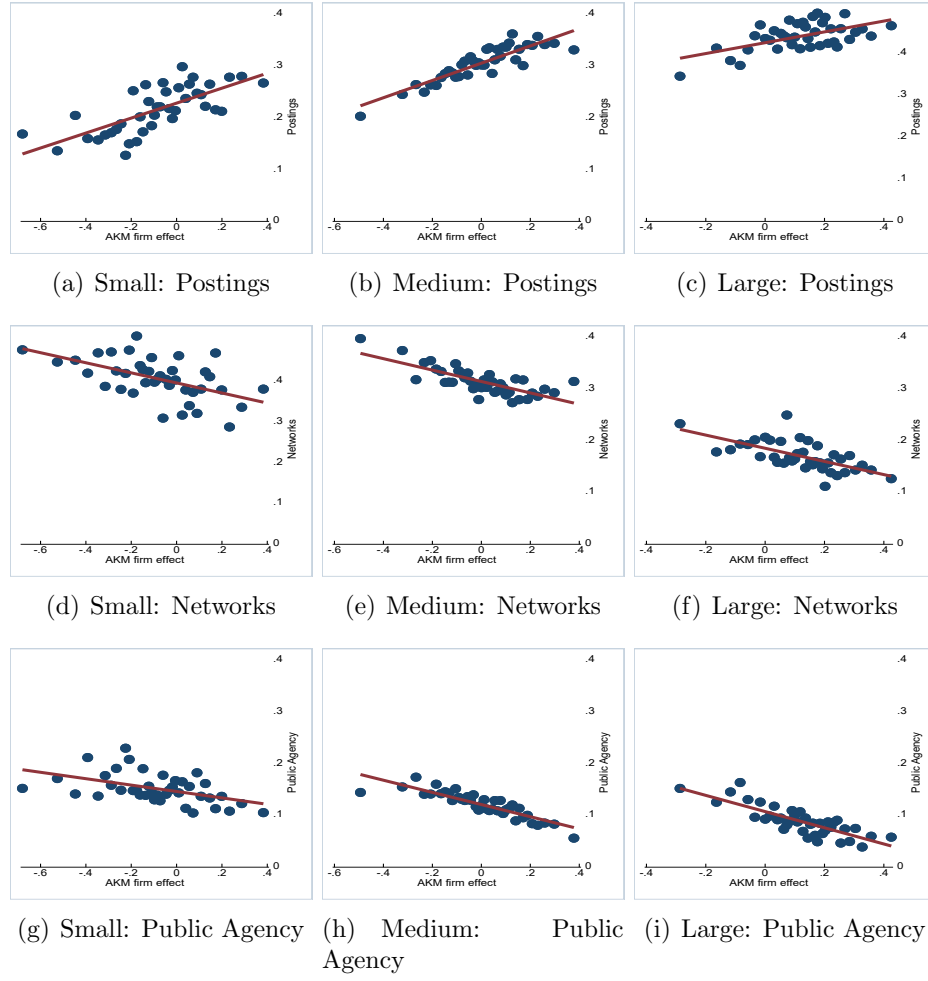


Figure S.3: Success of search channels by AKM firm fixed effect and firm size

Notes: The figures show binscatter plots that relate the firm's AKM fixed effect to the probability of succeeding to hire through the channel. "Small" refers to firms with 1-10 workers, "medium" refers to firms with 11-100 workers, and "large" refers to firms with more than 100 workers. Controls: educational requirements, quadratic polynomial of firm age, one-digit industry codes, and financial, demand and workforce constraints.

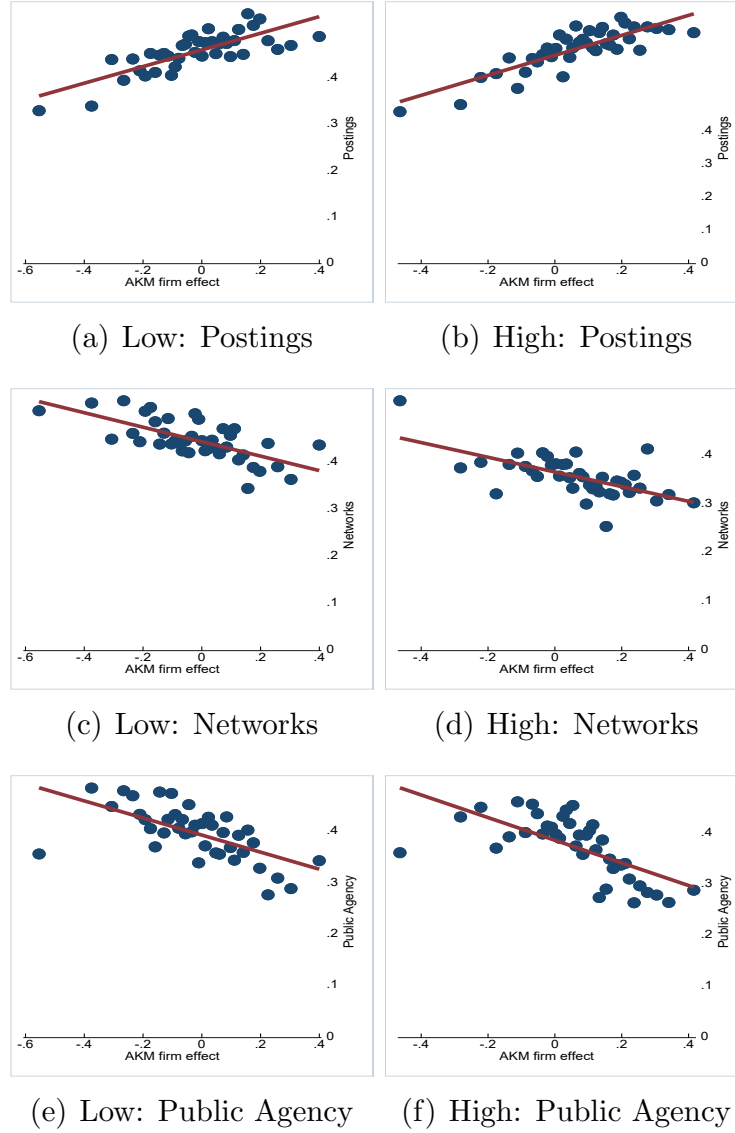


Figure S.4: Use of search channels by AKM firm fixed effect and skill level of target occupation

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of using the channel. "Low" refers to target occupations with low skill levels (isco-88 skill levels 1-2). "High" refers to target occupations with high skill levels (isco-88 skill levels 3-4). Controls: educational requirements, six firm size categories, quadratic polynomial of firm age, one-digit industry codes, and financial, demand and workforce constraints.

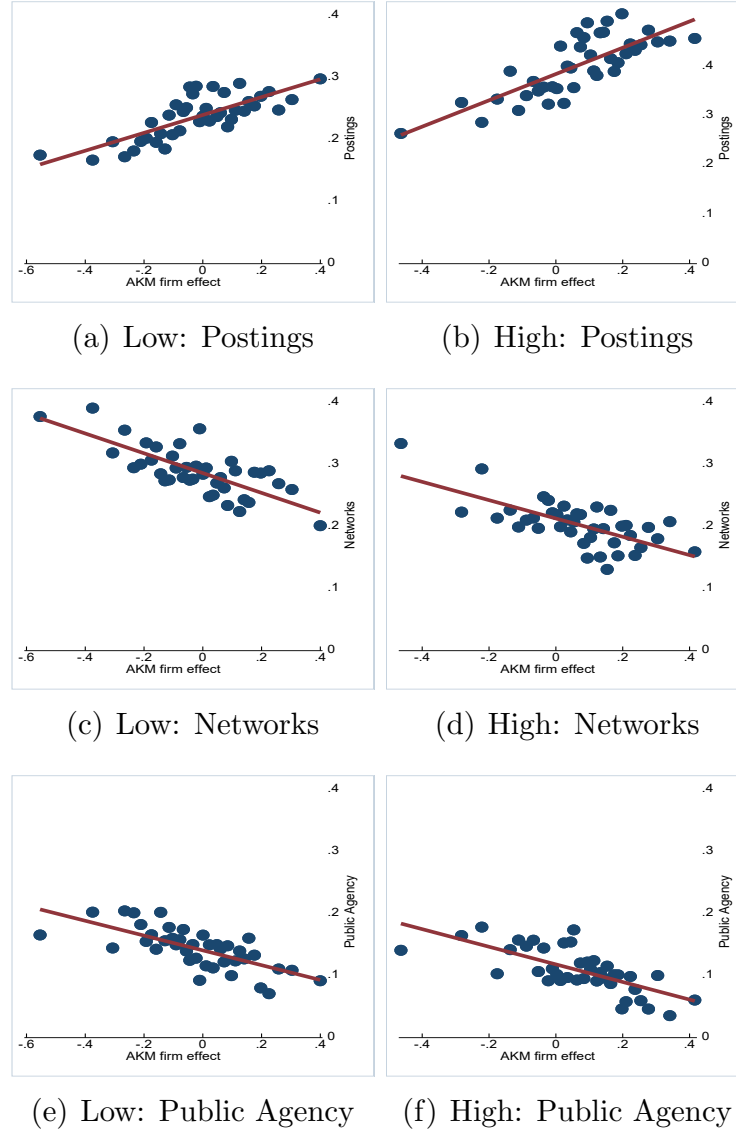


Figure S.5: Success of search channels by AKM firm fixed effect and skill level of target occupation

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of succeeding through the channel. "Low" refers to target occupations with low skill levels (isco-88 skill levels 1-2). "High" refers to target occupations with high skill levels (isco-88 skill levels 3-4). Controls: educational requirements, six firm size categories, quadratic polynomial of firm age, one-digit industry codes, and financial, demand and workforce constraints.

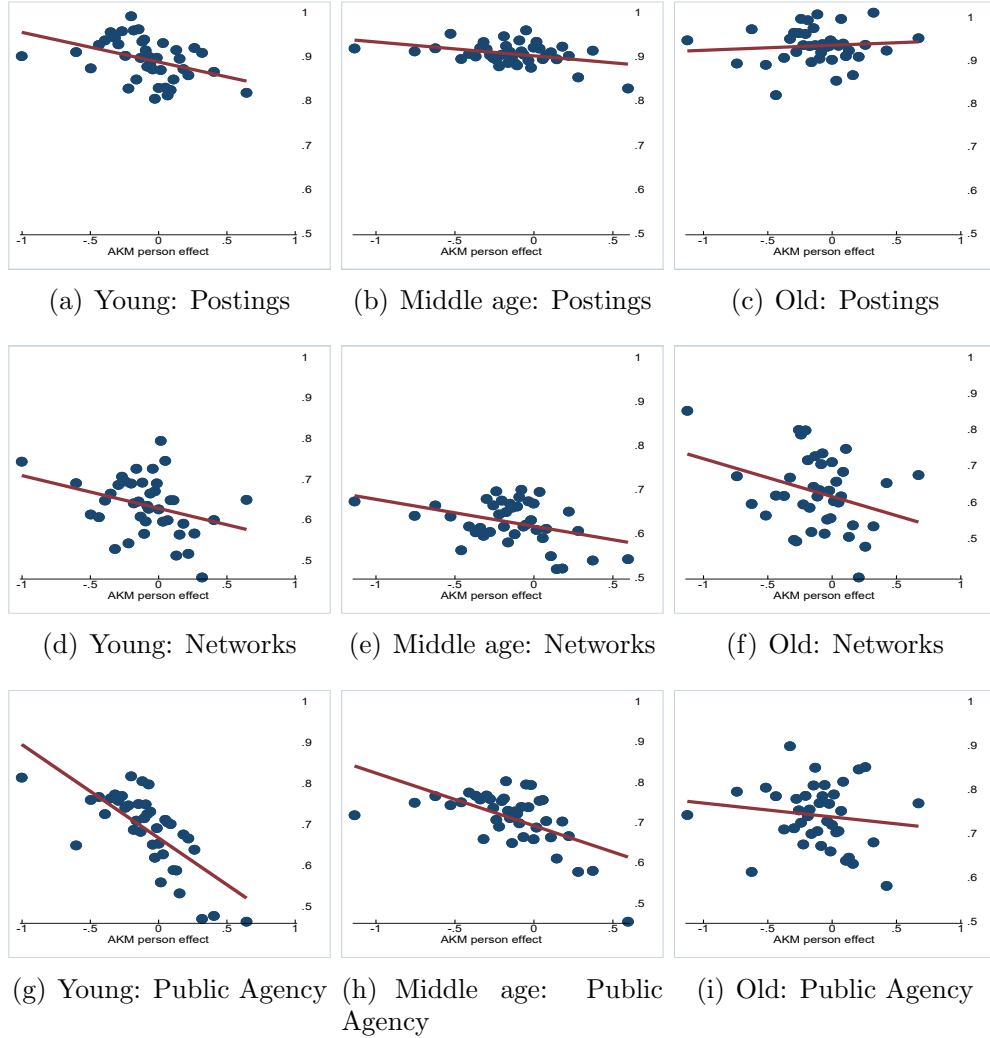


Figure S.6: Use of search channels by AKM worker fixed effect and worker age

Notes: The figures show binscatter plots that relate the worker’s AKM fixed effect to the probability of using the channel. “Young” includes workers younger than 30, “middle age” includes workers aged 30-50, and “old” includes workers older than 50. Controls: gender, employment status (dep. employed, self-employed, unemployed, non-participation), one-digit occupation, and year dummies.

## S.2 Channel Use and Success Conditional on Worker Characteristics

In this section, we examine the correlations between the likelihood of utilizing and succeeding through channels with the AKM worker effect, conditioned on age, education, and occupation groups. To accomplish this, we categorize workers into three age groups: young (under 30 years old), middle-aged (30-50 years old), and older (over 50 years old). We also categorize workers into three education groups: low (no vocational training/university degree), medium

(vocational training), and high (university degree or equivalent). Additionally, we consider two occupational groups: occupations with low and high skill levels. In all graphs the remaining other controls apply. See the table notes for details.

Figure S.6 considers the probability of use of search channels with age groups. The pooled relationship depicted in Figure 2.a in the main text showed a weakly positive but not statistically significant relationship between the AKM rank of workers and the probability of using job postings. Figure S.6 shows that behind this weak correlation, young and middle aged workers exhibit a negative relationship between the AKM rank and the use of job postings, while for older workers this relation is positive. However, across all age groups we observe a negative correlation between the probability of using networks or the public employment agency and the AKM rank documented in the pooled relationships depicted in Figure 2.

Figure S.7 shows that the correlation between the probability of finding a job through each of the three search channels and the AKM rank of a worker for each age category follows the same patterns as the pooled relationships. Namely, positive for postings and negative for networks and the public employment agency.

Figures S.8 and S.9 present the relationship between the probability of use and success of each the three search channels and the AKM rank of workers within the three education categories described above. For the low educated group we find a weak positive relationship between the use of postings and the AKM rank, while for the other two education categories we observe a negative relation. For networks and the public employment agency we observe a negative correlation, consistent with the pooled relationships of Figure 2. In terms of probability of job finding through either of the three search channels, Figure S.9 shows positive relationships with the AKM rank when considering postings, but negative relationships when considering networks and the public employment agency, consistent with the pooled relationships of Figure 2.



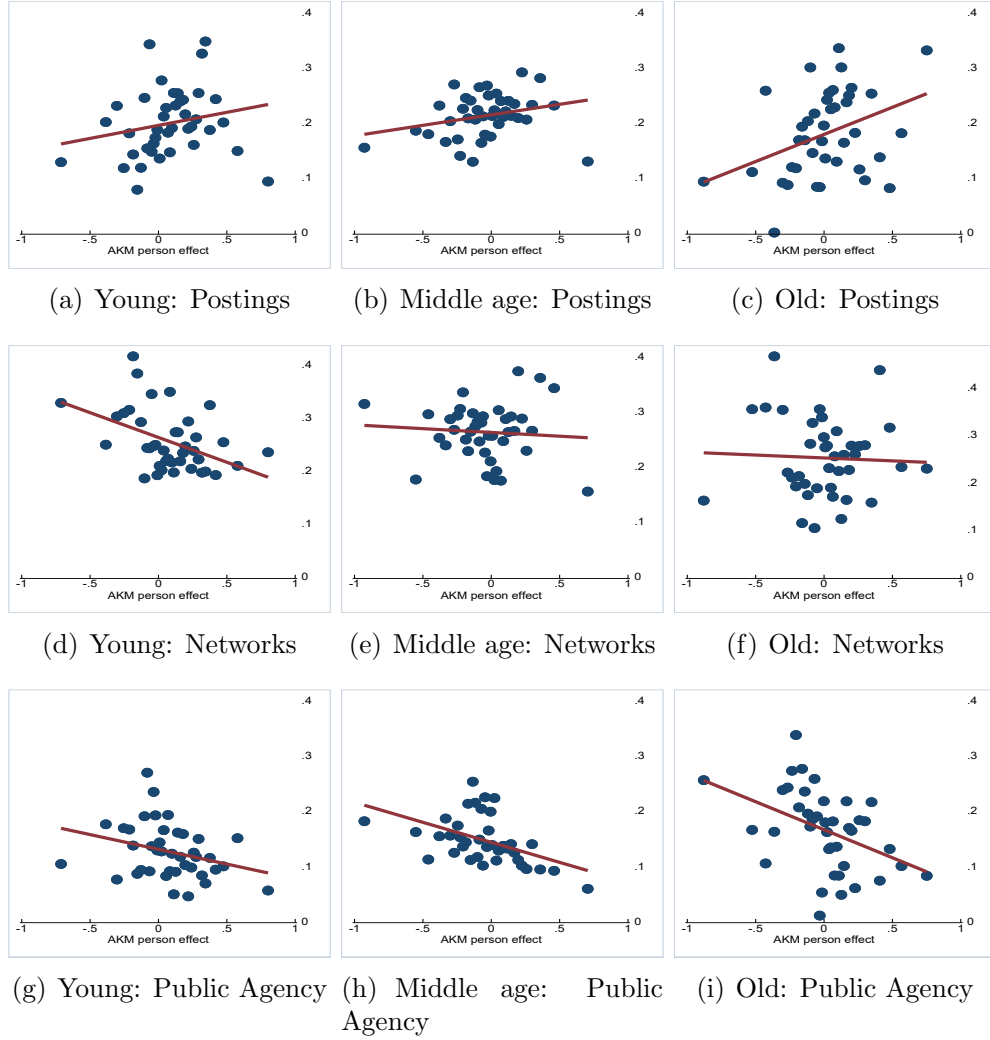


Figure S.7: Success of search channels by AKM worker fixed effect and worker age

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of succeeding through the channel. "Young" includes workers younger than 30, "middle age" includes workers aged 30-50, and "old" includes workers older than 50. Controls: gender, employment status (dep. employed, self-employed, unemployed, non-participation), one-digit occupation, and year dummies.

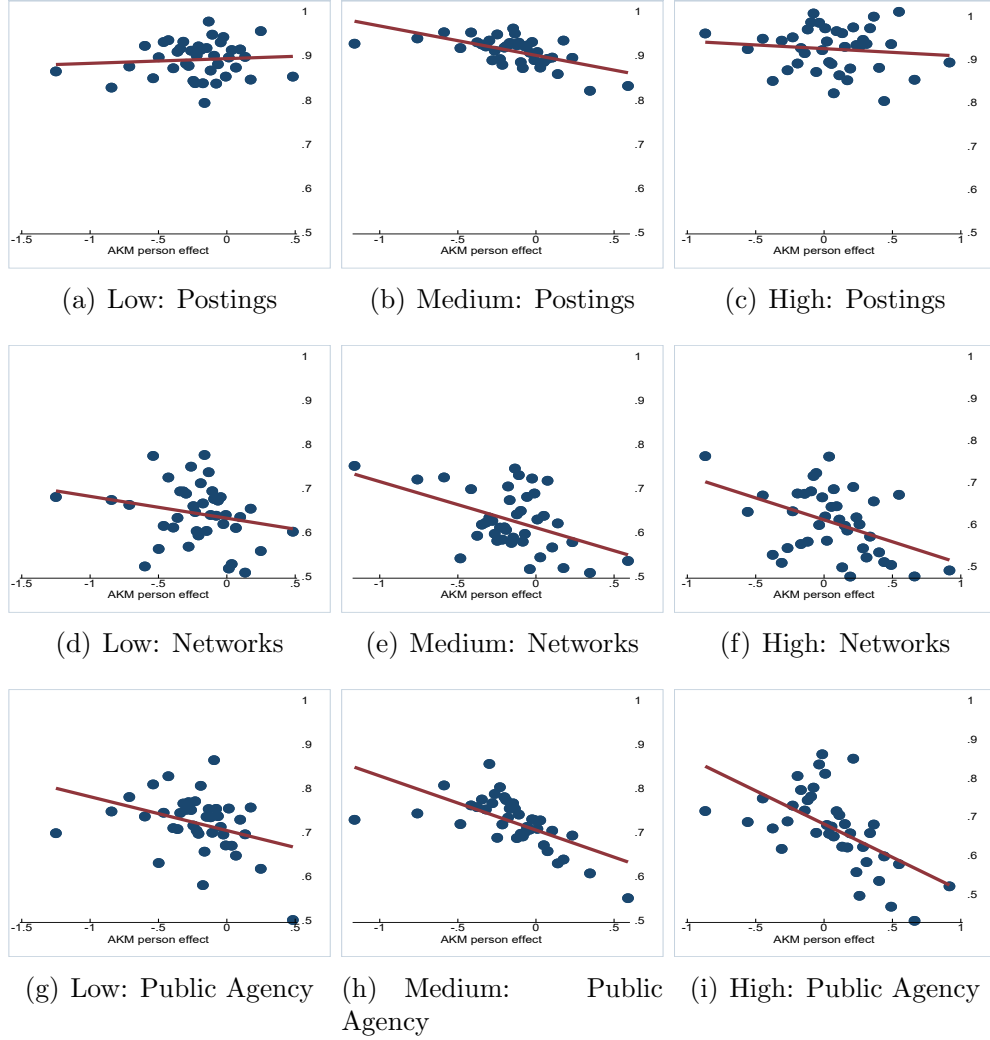


Figure S.8: Use of search channels by AKM worker fixed effect and worker education

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of using the channel. "Low" includes workers with no vocational training/ university degree, "medium" includes workers with vocational training, and "high" includes workers with a university degree or equivalent educational attainment. Controls: quadratic polynomial of worker age, gender, employment status (dep. employed, self-employed, unemployed, non-participation), one-digit occupation, and year dummies.

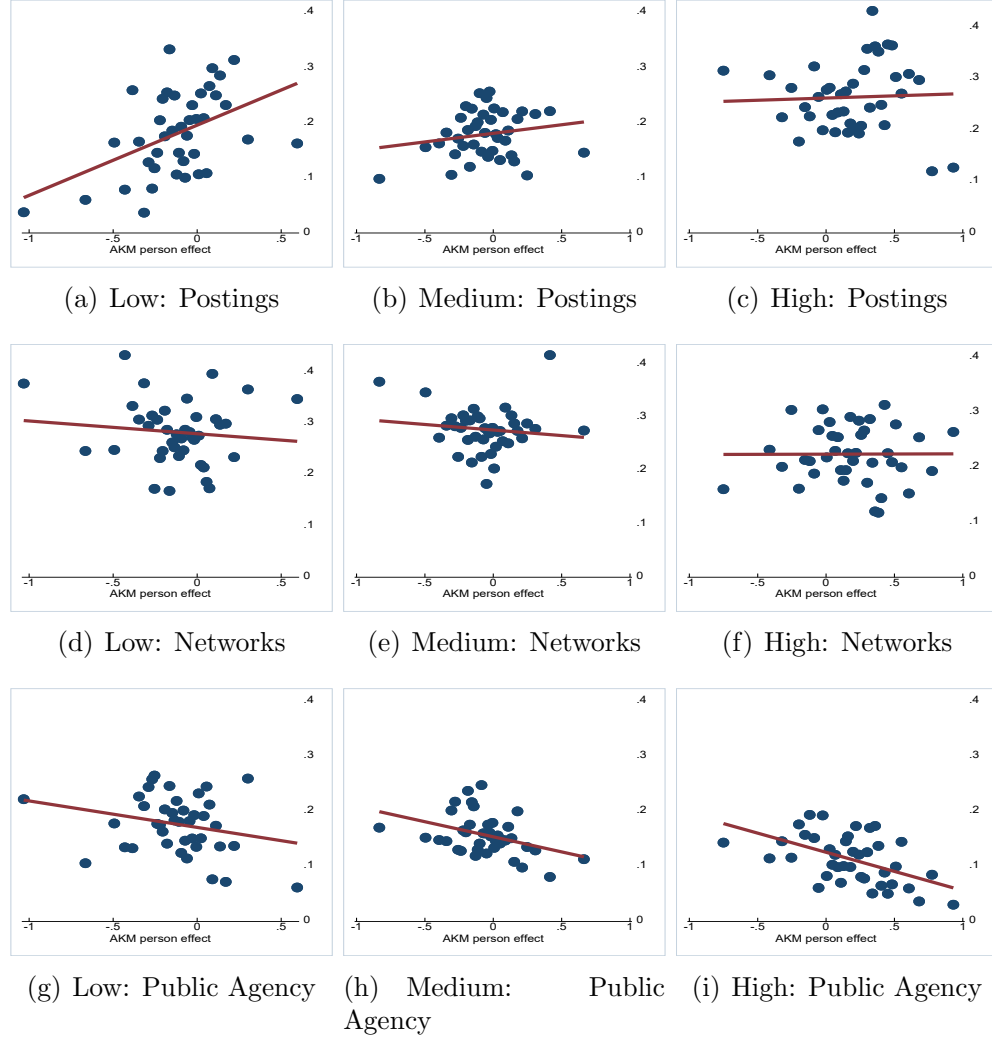


Figure S.9: Success of search channels by AKM worker fixed effect and worker education

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of succeeding to hire through the channel. "Low" includes workers with no vocational training/ university degree, "medium" includes workers with vocational training, and "high" includes workers with an university degree or equivalent educational attainment. Controls: quadratic polynomial of worker age, gender, employment status (dep. employed, self-employed, unemployed, non-participation), one-digit occupation, and year dummies.

Figure S.10 depicts the correlation between the likelihood of channel use and workers' AKM effects, conditioned on the skill level of the occupation a worker enters. The use pattern mirrors that of the main plot, with no clear relationship for job postings and a negative correlation for both networks and the public agency, regardless of the skill level of the occupation.

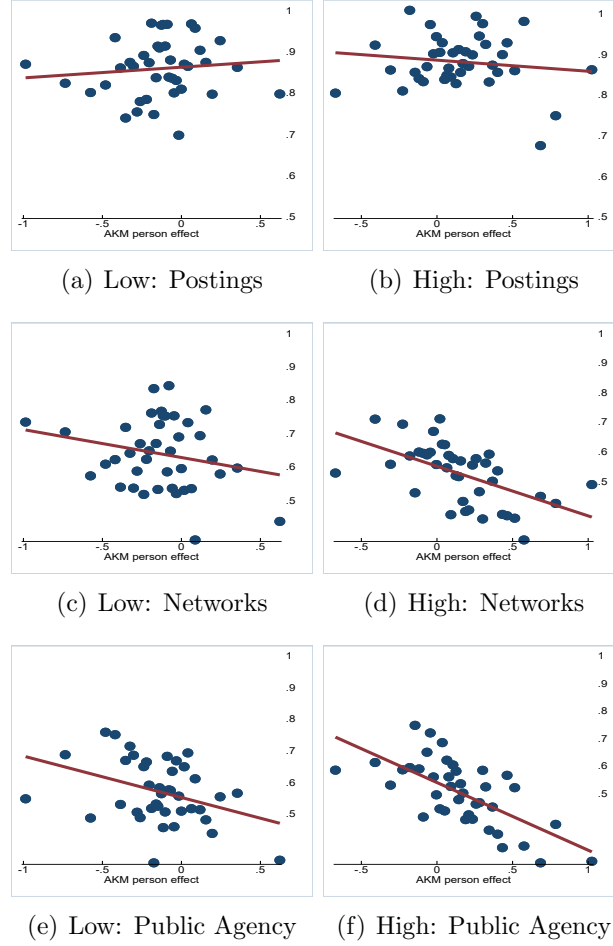


Figure S.10: Use of search channels by AKM worker fixed effect and skill level of target occupation

Notes: The figures show binscatter plots that relate the worker's AKM fixed effect to the probability of using the channel. "Low" refers to target occupations with low skill levels (isco-88 skill levels 1-2). "High" refers to target occupations with high skill levels (isco-88 skill levels 3-4). Controls: quadratic polynomial of worker age, gender, employment status (dep. employed, self-employed, unemployed, non-participation), and year dummies.

Figure S.11 illustrates the correlation between the likelihood of being hired through a channel and workers' AKM rank. The patterns align with those presented in the main text, although there is only a weak negative correlation between the probability of being hired

through networks and AKM ranks in occupations with high skill levels.

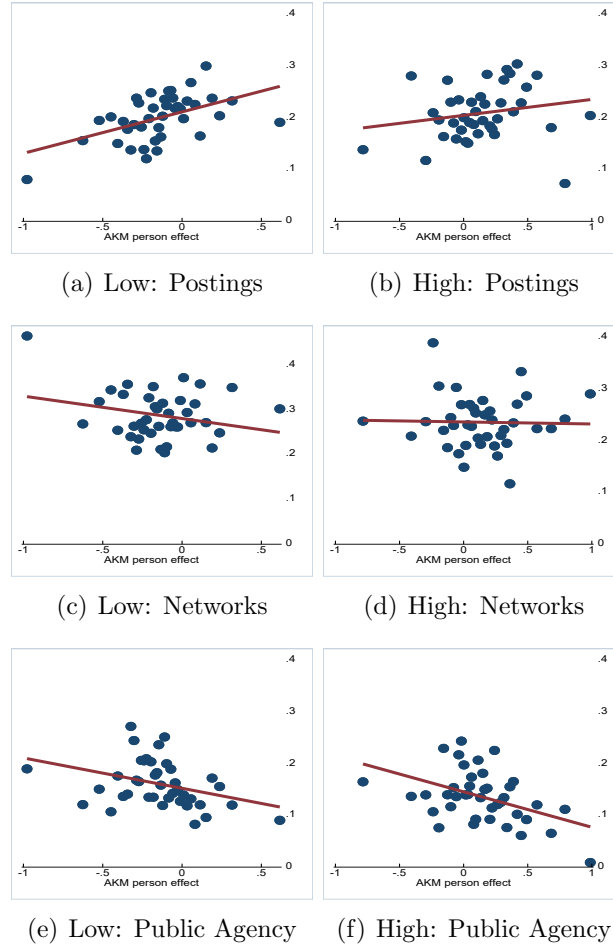


Figure S.11: Success of search channels by AKM worker fixed effect and skill level of target occupation

Notes: The figures show binscatter plots that relate the worker’s AKM fixed effect to the probability of using the channel. “Low” refers to target occupations with low skill levels (isco-88 skill levels 1-2). “High” refers to target occupations with high skill levels (isco-88 skill levels 3-4). Controls: quadratic polynomial of worker age, gender, employment status (dep. employed, self-employed, unemployed, non-participation), and year dummies.

### S.3 Alternative AKM Fixed Effects

Here we present the results from regressions using AKM firm and worker effects from a previous time period relative to our sample period. Specifically, we estimate the AKM model as outlined in the main text for the period 2003-2010, and then transfer the resulting fixed effects to the firms and workers in our sample period from 2010-2016. Tables S.1, S.2, S.3, S.4, and S.5 display these results, replicating earlier Tables B.1, B.3, B.4, B.5, and B.6.

The findings indicate that the conclusions drawn from using fixed effects from either the period 2010-2016 or 2003-2010 are highly similar.

In particular, Table S.1 reveals that high-ranked firms receive more applicants and a greater number of suitable applicants, but demonstrate greater selectivity compared to lower-ranked firms. Additionally, higher-ranked firms invest more time and resources in the recruitment process, although they utilize fewer search channels.

Table S.2 demonstrates that hiring through job postings or personal networks increases the likelihood of poaching. Conversely, hiring through personal networks and the public employment agency reduces the likelihood of poaching relative to hiring through job postings.

Furthermore, Table S.3 validates that hiring through job postings strengthens the positive correlation between the hired worker's AKM fixed effect and that of their employer more so than hiring through personal networks and the public employment agency.

Table S.1: Relationship between recruitment, firm types and job requirements

	(1) Sel. rate	(2) Suit. App.	(3) All App.	(4) Ad. costs	(5) Rec. Hours	(6) No. channels	(7) Vac. dur.
AKM firm effect (2003-2010)	-0.050*** (0.008)	0.954*** (0.108)	6.305*** (0.449)	633.365*** (131.088)	3.813*** (0.750)	-0.034* (0.018)	-0.617 (1.553)
Vocational training	-0.072*** (0.005)	0.354*** (0.065)	3.289*** (0.269)	354.834*** (77.668)	4.591*** (0.411)	0.079*** (0.012)	15.034*** (0.920)
University degree	-0.115*** (0.006)	0.935*** (0.079)	7.150*** (0.329)	1543.012*** (97.111)	12.119*** (0.526)	0.162*** (0.015)	32.989*** (1.114)
st.d. AKM firm effect (2003-2010)	0.206	0.206	0.206	0.210	0.207	0.222	0.207
No. Obs.	48164	49410	51607	6190	19083	75008	48534
Adj. $R^2$	0.041	0.095	0.088	0.101	0.054	0.375	0.049

Notes: All columns are OLS regressions with different dependent variables. Further controls: quadratic polynomial of firm age, six firm size categories (1-10 (reference), 11-25, 26-50, 51-100, 101-1000, and >1000 employees), one-digit industry codes, and financial, demand and workforce constraints. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.2: Search channels and poaching

	<b>Prob. hiring emp. worker</b>		
	Posting	Networks	Public agency
AKM firm effect (2003–2010)	0.081*** (0.011)	0.128*** (0.012)	0.089*** (0.011)
Successful search channel	0.127*** (0.004)	0.110*** (0.004)	-0.232*** (0.006)
Search channel $\times$ AKM firm effect	0.022 (0.021)	-0.077*** (0.020)	-0.070** (0.030)
Observations	63027	63027	63027
Adj. $R^2$	0.048	0.044	0.056

Notes: Linear probability regressions where the outcome is one if the hired worker was previously employed and zero otherwise. The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.3: Relationship between AKM worker and firm fixed effects and the successful channel

	<b>Hired worker AKM fixed effect</b>		
	Posting	Networks	Public agency
AKM firm effect (2003–2010)	0.169*** (0.021)	0.155*** (0.022)	0.175*** (0.019)
Successful search channel	0.008 (0.007)	0.016** (0.007)	-0.028*** (0.010)
Search channel $\times$ AKM firm effect	0.019 (0.036)	-0.027 (0.034)	-0.093* (0.048)
Observations	9977	9977	9977
Adj. $R^2$	0.150	0.150	0.151

Notes: The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Finally, Tables S.4 and S.5 shows that our conclusion that higher-ranked firms and workers are matched predominately through postings relative to personal networks and the public agency is unaffected from using firm or worker fixed effects from a previous time period.

Table S.4: Search channels and firm types

	Use of search channel			Successful channel		
	Postings	Networks	Public agency	Postings	Networks	Public agency
AKM firm effect (2003–2010)	0.073*** (0.010)	-0.063*** (0.010)	-0.172*** (0.010)	0.097*** (0.010)	-0.056*** (0.010)	-0.090*** (0.007)
Vocational training	0.089*** (0.006)	-0.090*** (0.006)	0.026*** (0.006)	0.094*** (0.006)	-0.086*** (0.006)	0.002 (0.004)
College degree	0.193*** (0.007)	-0.120*** (0.007)	-0.050*** (0.007)	0.192*** (0.007)	-0.122*** (0.007)	-0.041*** (0.005)
No. Obs.	61198	61198	61198	57290	57290	57290
Adj. $R^2$	0.106	0.056	0.052	0.075	0.071	0.017

Notes: All regressions are linear probability models where the outcome is one if the particular channel is used (left panel) or successful (right panel) and zero otherwise. The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.5: Search channels and worker types

	Use of search channel			Successful channel		
	Postings	Networks	Public agency	Postings	Networks	Public agency
AKM person effect	0.014* (0.008)	-0.034* (0.018)	-0.021* (0.013)	0.033*** (0.012)	-0.053*** (0.013)	-0.062*** (0.010)
dep.empl.=reference						
self-empl.	0.034* (0.021)	0.021 (0.034)	-0.008 (0.032)	-0.063*** (0.023)	0.020 (0.025)	-0.081*** (0.020)
unempl.	0.060*** (0.007)	0.057*** (0.013)	0.273*** (0.011)	0.016 (0.010)	0.011 (0.011)	0.072*** (0.009)
non-part.	0.026* (0.015)	0.042 (0.029)	0.046* (0.024)	-0.015 (0.020)	-0.056** (0.022)	-0.037** (0.018)
Observations	9963	9963	9963	8408	8408	8408
Adjusted $R^2$	0.012	0.003	0.075	0.002	0.005	0.018

Notes: All regressions are linear probability models where the outcome is one if the particular channel is used (left panel) or successful (right panel) and zero otherwise. The same controls as in Figure 2 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## S.4 Hiring Weights

In this section we further investigate the robustness of our results by using hiring weights as an alternative to firm weights or not using any weights in the JVS. Using alternative weights is important as those firms that have been successful in hiring at least part of their vacancies, and are the ones which provide information about the last case of a hire, tend to be larger firms. Tables S.6, S.7, S.8, and S.9 show, however, that the results presented in the main text are robust when using hiring weights.



Table S.6: Relationship between recruitment, firm types and job requirements

	(1) Sel. rate	(2) Suit. App.	(3) All App.	(4) Ad. costs	(5) Rec. Hours	(6) No. channels	(7) Vac. dur.
AKM firm effect	-0.1099*** (0.0091)	1.2218*** (0.1410)	9.3633*** (0.5440)	1479.1243*** (167.5835)	7.8431*** (0.8775)	-0.1480*** (0.0287)	15.0843*** (1.7303)
Vocational training	-0.0394*** (0.0041)	-0.4176*** (0.0634)	1.1801*** (0.2442)	302.9464*** (70.7053)	4.2156*** (0.3705)	0.0173 (0.0129)	20.2415*** (0.7698)
University degree	-0.0750*** (0.0054)	0.1370 (0.0846)	5.9690*** (0.3268)	1819.1182*** (98.1314)	11.7480*** (0.5124)	0.0955*** (0.0173)	39.4056*** (1.0179)
No. Obs.	46119	47278	49224	6114	19313	60095	46593
Adj. $R^2$	0.0454	0.0896	0.0919	0.1709	0.0555	0.1826	0.0631

Notes: All columns are OLS regressions with different dependent variables using the provided hiring weights. Further controls: quadratic polynomial of firm age, six firm size categories (1–10 (reference), 11–25, 26–50, 51–100, 101–1000, and >1000 employees), one-digit industry codes, and financial, demand and workforce constraints. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.7: Search channels and poaching

	<b>Prob. hiring emp. worker</b>		
	Posting	Networks	Public agency
AKM firm effect	0.184*** (0.014)	0.267*** (0.014)	0.193*** (0.013)
Successful search channel	0.098*** (0.004)	0.110*** (0.005)	-0.243*** (0.006)
Search channel $\times$ AKM firm effect	0.090*** (0.021)	-0.130*** (0.022)	-0.035 (0.031)
Observations	59297	59297	59297
Adj. $R^2$	0.069	0.070	0.085

Notes: Linear probability regressions with the provided hiring weights where the outcome is one if the hired worker was previously employed and zero otherwise. The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.8: Search channels and firm types

	<b>Use of search channel</b>			<b>Successful channel</b>		
	Postings	Networks	Public agency	Postings	Networks	Public agency
AKM firm effect	0.020* (0.010)	-0.098*** (0.012)	-0.290*** (0.012)	0.106*** (0.012)	-0.077*** (0.011)	-0.149*** (0.009)
Vocational training	0.077*** (0.005)	-0.124*** (0.005)	0.040*** (0.005)	0.098*** (0.005)	-0.111*** (0.005)	0.067*** (0.004)
College degree	0.148*** (0.006)	-0.116*** (0.007)	-0.074*** (0.007)	0.193*** (0.007)	-0.117*** (0.007)	-0.006 (0.005)
No. Obs.	57824	57824	57824	54473	54473	54473
Adj. $R^2$	0.128	0.055	0.100	0.066	0.076	0.032

Notes: All regressions are linear probability models with the provided hiring weights where the outcome is one if the particular channel is used (left panel) or successful (right panel) and zero otherwise. The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table S.9: Relationship between AKM worker and firm fixed effects and the successful channel

	Hired worker AKM fixed effect		
	Posting	Networks	Public agency
AKM firm effect	0.109*** (0.014)	0.210*** (0.014)	0.186*** (0.013)
Successful search channel	0.006*** (0.005)	0.114*** (0.005)	-0.035*** (0.006)
Search channel $\times$ AKM firm effect	0.202*** (0.021)	-0.108*** (0.022)	-0.139*** (0.032)
Observations	23192	23192	23192
Adj. $R^2$	0.232	0.230	0.230

Notes: OLS regressions with the provided hiring weights. The same controls as in Figure 1 are applied. Standard errors in parenthesis. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## S.5 Involuntary EE Transitions

In our observations of EE transitions in the data, it is important to note that we lack precise knowledge of the underlying reasons. While some transitions may align with the conventional interpretation of climbing the job ladder voluntarily, others could stem from involuntary factors such as layoffs. Consequently, individuals who move involuntarily may exhibit distinct patterns in the use and success of different channels compared to those who move voluntarily.

To take this possibility into account, we utilize information on advance layoff notice in the administrative data and clean our data from these *involuntary* transitions.<sup>45</sup> Table S.10 reproduces Table 2 from the main text, regressing the change in the AKM firm effect following an EE transition on the corresponding hiring channel and further controls. This analysis excludes hirings classified as involuntary.

Excluding involuntary EE transitions, as proxied by advance notice information, reveals that the association between hiring through job postings and steeper job ladders for workers remains largely robust.

<sup>45</sup>According to German legislation, workers are mandated to register with the federal employment agency as soon as they become aware of the termination of their employment.

Table S.10: Change in firm effect at an EE transition by search channel

	(1)	(2)
	$\Delta$ firm effect	$\Delta$ firm effect
	w/o controls	worker controls
Reference=Postings		
Networks	-0.0280*** (0.0045)	-0.0287*** (0.0049)
Public Agency	-0.0239*** (0.0072)	-0.0335*** (0.0078)
Constant	0.0563*** (0.0031)	0.3503*** (0.0281)
Observations	14,144	11,878
Adjusted $R^2$	0.0027	0.0205

Notes: EE means a direct employer-to-employer transition. Worker controls: dummy for change in occupation, dummy for change in hours, educational attainment (category), AKM person effect. Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## S.6 Other Search Channels

Figure S.12 replicates the relationships between a firm's wage rank and channel use and success for the other search channels besides job postings, networks and the public employment agency. Besides internal recruiting, which is positively associated with the firm AKM fixed effect, hiring through unsolicited applications, private agencies or other search methods is not systematically related to the wage rank of the firm.

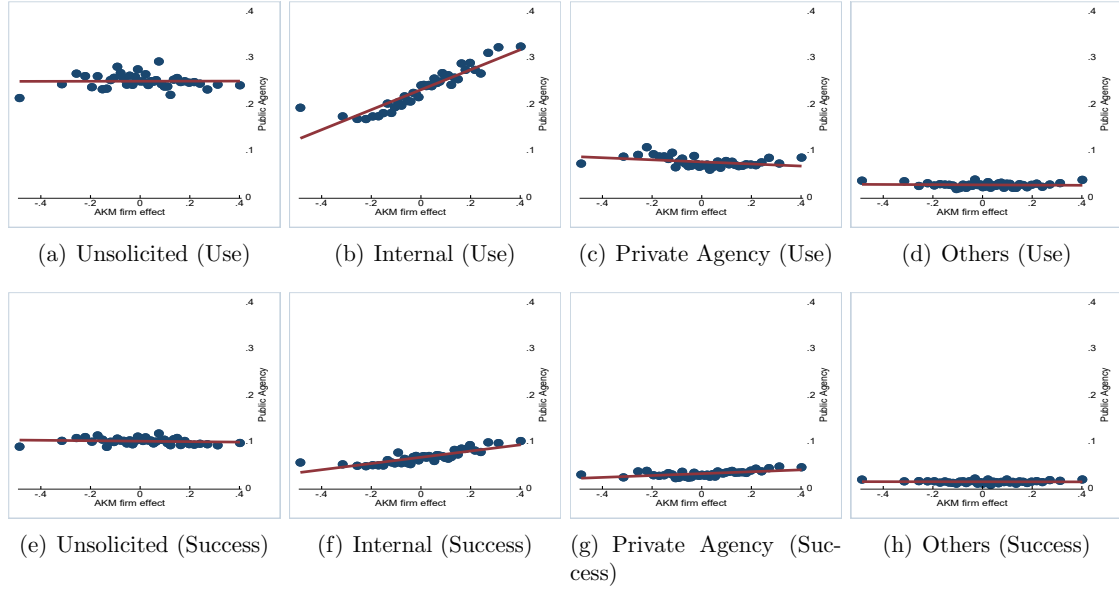


Figure S.12: Use and success of further search channels by AKM firm fixed effect

Notes: The figures show binscatter plots that relate the firm's AKM fixed effect to the probability of using (top) and succeeding (bottom) through the channel. Controls: educational requirements, quadratic polynomial of firm age, six firm size categories, one-digit industry codes, and financial, demand and workforce constraints.