

## **The Job Market for New Economists: A Market Design Perspective**

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**T**his paper, written by the members of the American Economic Association (AEA) Ad Hoc Committee on the Job Market, provides an overview of the market for new Ph.D. economists. It describes the role of the AEA in the market and focuses in particular on two mechanisms adopted in recent years at the suggestion of our Committee. First, job market applicants now have a signaling service to send an expression of special interest to up to two employers prior to interviews at the January Allied Social Science Associations (ASSA) meetings. Second, the AEA now invites candidates who are still on the market, and employers whose positions are still vacant, to participate in a web-based “scramble” to reduce search costs and thicken the late part of the job market. We present statistics on the activity in these market mechanisms and present survey evidence that both mechanisms have facilitated matches. The paper concludes by discussing the emergence of platforms for transmitting job market information and other design issues that may arise in the market for new economists.

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Around 1970, many departments of economics did not advertise assistant professor positions. Instead, jobs were filled by word of mouth and through letters of inquiry, and the market was relatively thin. More recently, the annual ASSA meetings, long organized by the AEA, have become a central venue for conducting interviews. Since 1974 the AEA has also helped make the market thicker by publishing Job Openings for Economists (JOE), initially as a hardcopy periodical and since 2002 exclusively online.

In January 2005, Dan McFadden, then AEA president, asked Al Roth to chair a new Ad Hoc Committee on the Job Market. The Committee took as its initial goal to assess whether the AEA could better promote a thick market for new Ph.D.s in economics, while reducing problems of congestion and coordination failure (Roth, 2008a).

U.S. institutions awarded 1,091 doctorates in economics in 2008 (Fiegener, 2009). For that year's job market, 1,910 unique new academic jobs (both junior and senior) and 1,004 unique new nonacademic jobs were posted on Job Openings for Economists (Siegfried, 2008). These numbers make a fairly thick market possible. However, recruitment and job search involves matching heterogeneous employers and candidates under incomplete information about both characteristics and preferences. In this situation, thick markets have to deal with the congestion caused by the many possibilities to be considered (Roth and Xing, 1997).

For candidates, the marginal cost of an additional application is very low, and candidates apply widely—to an average of 80 employers, according to surveys of job market candidates in the years 2006–2008, conducted by our Committee. As a result, many employers receive hundreds of applications, which can be very time-consuming to review carefully. The large number of applications sent by each candidate also implies that, for most employers, it would be a mistake to devote all their interview slots to the most accomplished applicants, because many of those candidates may be unattainable as they are likely to secure other jobs they prefer. Consequently, it may be optimal for some employers to decline to interview some of the candidates they like best and instead to interview at least some candidates who they think are more likely to accept an offer. As this process unfolds, there is a risk of coordination failure in which employers and candidates who would be well-suited do not match.

We begin with an overview of the job market for new economics Ph.D.s, and then focus on recent developments.

## **The Job Market for New Economists, Step by Step**

The annual job market for new economics Ph.D.s typically starts in September. Job openings for Ph.D. economists are listed in the monthly issues of Job Openings for Economists (JOE), and in a number of other places in recent years: for example, in the *Chronicle of Higher Education*; AcademicKeys.com; the *Economist* magazine; MRM Professional Announcement and Job Openings (a division of Social Science Electronic Publishing and Social Science Research Network); Economics Research

Network (ERN) Professional Announcements and Job Openings (automatically posted each week to all ERN subscribers); Inomics.com; walras.org (which aggregates job listings from a variety of sources including JOE); and EconJobMarkets.org.

Candidates submit applications and advisors submit letters of reference through a number of modalities, including mail, e-mail, university-specific web servers, and third-party web servers. Employers review applications throughout the fall and in December invite some applicants to interviews at the January ASSA meetings. The interview marketplace is divided into two parts: interviews in hotel rooms and suites, and interviews at one of many tables in a large ballroom. Academic institutions and those that participate more frequently in this market tend to interview in suites. The Illinois Department of Employment Security (IDES) has organized the ballroom interviewing since 1968.<sup>1</sup> About 600 interview suites and 150 interview tables have been booked at recent ASSA meetings.

In early December, immediately following publication of the December JOE, applicants have the option of sending no more than two signals of special interest to employers through the AEA signaling service. After interviews at the ASSA meetings, university employers invite some candidates for campus fly-outs, starting almost immediately after the meetings and continuing for several months. During this period, employers make job offers. Some are exploding offers that must be accepted or rejected quickly (often in one to two weeks), while some are extended for a much longer period. Typically only the most established and desirable employers, who can make multiple offers for a position, make offers without deadlines. (Anecdotal evidence suggests that owing to tight budgets in early 2010, many universities were constrained to make no more than one offer at a time and were more likely than in previous years to make offers with short deadlines.)

In March, applicants still looking for jobs and employers with unfilled jobs may indicate their continued availability on the AEA scramble website. Applicants who have not secured a position by late April may continue to explore the nonacademic job market; seek temporary academic employment as one-year visiting assistant professors, lecturers, and research associates (non-tenure-track, soft money positions); or may postpone graduation and re-enter the job market the following year. Most new Ph.D.s are awarded around June, and academic jobs typically begin at the start of the fall semester.

Each step of this process is worthy of attention from a market design standpoint. For example, consider the logistics of scheduling interviews at the ASSA meetings. These meetings help make the market thick, but thickness invites congestion. It can be nontrivial for employers even to inform interviewees of the location of the

<sup>1</sup> From 1968 until 2001, IDES provided a physical bulletin board that allowed employers to post openings and job applicants to post their availability. Each side of the market would hunt through postings by the other side. Much of the coordination between employers with open positions and job applicants occurred on-site, and interviews were arranged for the same or next day. In 2001, IDES began a computerized job listing and encouraged candidates to contact employers to schedule interviews in advance. Today, virtually all ballroom interviews are organized in advance of the ASSA meetings through this online system.

interview suite because interviewers only learn the room number when they check in to their hotel shortly before the interviews. In the 1950s and 1960s, candidates called hotels to ask for the room numbers of the people with whom they were to interview. In the 1970s, hotels, concerned about safety and privacy, adopted the policy of refusing to disclose room numbers. This forced candidates to wait until the interviewers had checked in, call the hotel, ask to be connected to the interviewer's room, and hope to catch the interviewer there. Hotel switchboards were overwhelmed by such calls just before the ASSA meetings began; interviewers felt constrained to stay in their rooms in case a candidate called; interviews were interrupted by calls; and candidates and interviewers were frustrated by the difficult, time-consuming system. In 2000, the AEA helped overcome this congestion by introducing disclosure codes: employers requested a disclosure code from the AEA and gave that code to interviewees in advance of the meetings. The employer, after learning the room number for the interview suite, would provide that information to the AEA, which would then publicly post room numbers next to disclosure codes. At first, this information was posted on a bulletin board in the conference hotel, but since fall 2008 it has been posted online. This allows candidates to easily learn the locations of their interviews while preserving confidentiality for interviewers. This example illustrates how thick markets can experience congestion and coordination failure but appropriately designed mechanisms can ameliorate these problems.

## Signaling

Since November 2006, the AEA signaling mechanism has offered candidates the opportunity to send signals of particular interest to up to two employers via an AEA website. The signals are meant to let candidates credibly express interest in employers, and to help employers identify candidates interested in their positions. What gives the signals credibility is that each applicant is limited to two, so there is an opportunity cost to sending a signal (Chakrabortya and Harbaugh, 2007). The Committee provided suggestions for how candidates might use and employers might interpret signals; this guide, "Signaling for Interviews in the Economics Job Market," is available at (<http://www.aeaweb.org/joe/signal/>) (AEA Ad Hoc Committee on the Job Market, 2010b).

Signals can serve as a coordination mechanism. For example, in breaking ties to fill interview slots, employers can place more weight on candidates who signaled.<sup>2</sup>

To see how signals can help coordinate matches and increase welfare even in the simple case in which match quality is unimportant, consider an example of two firms that each can offer one interview (for one job) and two workers, and assume that firms and workers are indifferent with whom they match. If the firms can do

<sup>2</sup> One recruiting chair confidentially admitted that in 2005 by the time the first half of the applications had been read, his committee found enough acceptable applicants to fill all the school's January interview slots. The remaining applications, of which there were several hundred, went unread.

no better than to play a symmetric mixed strategy, they randomly choose which worker to interview, and with probability one-half one worker will receive two interview offers, and the other will receive none. If each worker were allowed to first send one signal and sent it randomly, then half the time each firm would receive exactly one signal, which would solve the coordination problem. (When one firm receives two signals the coordination problem is the same as if no signals were sent.) Thus signals can reduce coordination failure by half in this simple example.<sup>3</sup>

One particular coordination problem in this market is that candidates can “fall through the cracks” because an employer that valued them highly guessed incorrectly that the candidate was “un-gettable.” The employer, even though it ranks the candidate highly, perceives that the candidate is unlikely to accept a job offer, so the employer declines to spend an interview or fly-out slot on the candidate.<sup>4</sup> This phenomenon may be widespread; in one survey conducted by our Committee, 83 percent of responding departments reported that their Ph.D. students were sometimes “declined interviews because employers viewed them as excessive long-shots (even though the department’s assessment suggested otherwise).”

A job candidate can try to avoid falling through the cracks by attempting to signal interest informally, but this may be seen as noncredible cheap talk: the candidate could be reaching out in this way to many departments. For candidates who have idiosyncratic preferences for schools that might otherwise presume them to be out of reach, signals can be a means of credibly expressing these preferences. Furthermore, in contrast to informal signaling (whose effectiveness often depends on the reputation and dedication of advisors) signals can transmit preference information equitably: each candidate has at most two signals.

Using data from the 2006–2009 job markets, we analyze how signals were used by candidates. We also provide a preliminary assessment of the effectiveness of signals in securing interviews with potential employers.

Table 1 displays statistics on use of the signaling mechanism from 2006 to 2009. The number of participating job candidates held steady at roughly 1,000 signalers per year. In a December 2008 survey of those appearing on departmental lists of job candidates, 66 percent of respondents reported signaling. Of the remaining 33 percent of respondents, 26 percent reported that they missed the deadline, 21 percent reported they didn’t know about the mechanism, 41 percent thought signaling wouldn’t help, and 5 percent thought signaling would hurt their chances of getting an interview. Almost all participating candidates sent two signals.

<sup>3</sup> For a theoretical exploration of the gains from signaling in a job matching context, useful starting points are Coles, Kushnir, and Niederle (2009), Stack (2007), Avery and Levin (forthcoming), and Haque (2009).

<sup>4</sup> When candidates fall through the cracks, the result is an unstable matching because after the fact the candidate and a potential employer would both prefer to be matched with each other than with their eventual partner (for background, see Gale and Shapley, 1962; Roth and Sotomayor, 1990). Note that the relevant matching models for interviews are many-to-many matching because both employers and candidates can participate in multiple interviews.

Table 1

**Number of Signal Senders, Signals Sent, and Signal Recipients, 2006–2009**

<i>Year</i>	<i># signalers</i>	<i># signals</i>	<i># employers signaled</i>	<i># JOE listings signaled</i>	<i># JOE listings (entire year)</i>	<i>Fraction of JOE listings signaled</i>
2006	971	1,890	519	674	2,643	25.5%
2007	1,022	2,010	489	672	2,914	23.1%
2008	979	1,926	461	687	2,881	23.8%
2009	978	1,922	449	666	2,285	29.1%

Roughly 25 percent of the listings in JOE (or between 450 and 500 employers) received at least one signal.

Our surveys also show that, among those sending signals in years 2006–2009, about two-thirds were current Ph.D. students. At 9 percent of the total, assistant professors were the second largest identified group. Despite the mechanism being open to anyone, 99 percent of signalers held (or are about to receive) Ph.D.s, 92 percent had economics as the primary field in their doctorate, and 85 percent received their degree from a U.S. institution.

We examined whether candidate participation in the signaling mechanism was correlated with the rank of their home institution. Specifically, we verified the participation of job candidates listed on web pages of the 100 highest-ranked economics departments, using ranking data from econphd.net.<sup>5</sup> Signaling rates were virtually flat across institution rank.

Figure 1 shows how number of signals received by employers is correlated with their rank. Given the widely-recognized imprecision in ranking and to protect confidentiality, we group employers into blocks of five. Thus, the first point on Figure 1 shows the total number of signals received by the top five ranked employers over the four years 2006–2009. Those five employers collectively received just over 180 signals in four years, an average of just over nine each per year. Generally, the remainder of the graph depicts that better-ranked departments received more signals, up until roughly the 100<sup>th</sup> ranked employer, after which there is a fairly even distribution of signals received by rank. “Spikes” in the graph in many cases correspond to employers in popular geographic areas. It is worth noting that signals

<sup>5</sup> These rankings are based on economics research productivity of institutions as weighted by journal quality: (<http://www.econphd.net>) (now available on the Internet archive at (<http://web.archive.org/web/20071217125412/www.econphd.net/rank/nrallec.htm>)). We used econphd.net’s “network rankings.” Strengths of the econphd.net rankings include that 1) they are deep, covering nearly 500 employers, and 2) they include nonacademic employers. A weakness of the rankings is that they rank institutions, not economics departments. For any analysis we do that involves rankings, we consider only signals to economics departments in ranked institutions and to nonacademic employers who are ranked. We do not examine signals to noneconomics departments in ranked institutions because we think that the rankings are less accurate for such departments than for either economics departments or nonacademic employers. Specifically, Figure 1 includes signals to economics departments and to nonacademic employers, while Table 2 looks at the subset of signals sent to economics departments only (including departments outside of the United States).

Figure 1  
**Signals Received by Employer Rank, 2006–2009**



Notes: Includes only signals to employers appearing in the rankings of econphd.net. Signals to noneconomics programs (for example, public policy, health) within institutions listed in the rankings are excluded. An additional 2,993 signals were received by “unranked” employers. Employers are ranked in blocks of five; 5 = employers ranked one through five, 10 = employers ranked six through ten, etc. Rankings are according to econphd.net.

are being sent to departments of all ranks, including those ranked 400–500. Given the difficulty that departments at that rank may have in identifying job candidates who wish to join their faculty, these signals may be improving coordination, one of the mechanism’s intended purposes.

Table 2 provides insight into signal flow, that is, how candidates trained in departments of a given rank allocate their signals to departments of a given rank. For this table, we consider only signals to economics departments, which we divide into tiers: tiers 1–4 are departments ranked 1–10, 11–50, 51–150, and 151–480, respectively. Economics departments not appearing in the rankings form a fifth, “unranked” category. There is a clear tendency for students from higher tiers to signal to departments in lower tiers. For example, from 2006–2009, 3,148 signals came from students in tiers 1 and 2 (see the top two rows of the far-right column), while just 1,426 signals went to those departments (see the first two columns of the bottom row). Unranked schools received many signals—2,346 over four years—while just 412 signals were sent by job candidates trained by unranked schools. Thus, while unranked schools do not produce many Ph.D. economists (who use the signaling mechanism), they are a relatively popular destination for signals.

The 21 employers (both academic and nonacademic) that received the most signals over the four-year period 2006–2009 received approximately one-sixth of all signals. (There was a tie for 20<sup>th</sup> place, which is why we used the top 21.) The composition of this group is suggestive of how candidates use signals. Perhaps the most notable feature of the top 21 signal recipients is their concentrated geography.



Table 2

**Flow of Signals by Rank of Economics Department, 2006–2009**

<i>Signals from...</i>	<i>Signals to...</i>					<i>Total</i>
	<i>Tier 1</i>	<i>Tier 2</i>	<i>Tier 3</i>	<i>Tier 4</i>	<i>Unranked</i>	
Tier 1	101	368	274	105	159	<b>1,007</b>
Tier 2	111	478	521	385	646	<b>2,141</b>
Tier 3	40	165	339	385	706	<b>1,635</b>
Tier 4	15	84	116	179	603	<b>997</b>
Unranked	13	51	54	62	232	<b>412</b>
<b>Total</b>	<b>280</b>	<b>1,146</b>	<b>1,304</b>	<b>1,116</b>	<b>2,346</b>	<b>6,192</b>

*Notes:* Includes signals to and from economics departments only. Tiers 1–4 are economics departments ranked 1–10, 11–50, 51–150, and 151–480, respectively.

Ten of these employers are in the Boston, New York, or the Washington, D.C., metropolitan areas. Three of the remaining employers are in California. Moreover, it appears that within this group, geography trumps employer rank. Of the 21 employers receiving the most signals, only seven are economics departments ranked 21 or better. Within popular geographic areas, we observe concentrations of signals to departments that are not the most highly ranked in that area. For example, Boston is home to two top-five economics departments but only one of these made the list of the 21 employers that received the most signals—and just barely. Meanwhile, three other Boston employers were among the top 21 signal recipients, and the average ranking of these economics departments was just over 60. This pattern of signals could arise because candidates want to live in these desirable locations, perhaps as a result of dual job searches focusing on big cities to try to find two nearby jobs. But the pattern of signaling to mid-ranked institutions also suggests that candidates are concerned not to waste signals on the most highly-selective employers, which are unlikely to take signals into account.

To measure the impact of sending a signal on the probability of getting an interview, we would ideally like to know both the probability of getting an interview if a signal had been sent and the probability of getting an interview if a signal had not been sent.<sup>6</sup> One way to measure the causal effect of the signal would be to conduct a randomized experiment. For example, we might have asked people to submit three signals, randomly deleted one, and then tracked the interview rates for both the sent and unsent signals.<sup>7</sup> Unsurprisingly, many colleagues found this kind of experimentation in an ongoing labor market inappropriate (Roth, 2007). Furthermore, randomly deleting some signals could compromise signal credibility;

<sup>6</sup> How signals affect the chances of receiving fly-outs or job offers is also of interest, but data for these outcomes are too sparse to draw conclusions.

<sup>7</sup> In a similar spirit, Lee, Niederle, Kim, and Kim (2009) performed an experiment on a Korean dating site in which participants were allowed different numbers of signals. They observed that participants allowed more signals were more successful in finding matches.



applicants might report to employers that they sent a signal, and employers would have no way of knowing whether the signal had indeed been randomly deleted.

Instead, sacrificing the control of a randomized experiment, in 2007 and 2008 we asked candidates the following question: “If you could have sent a third signal, where would you have sent it?” This was asked at the same time the candidate’s two signals were submitted. In 2008 we also surveyed candidates who did not use the signaling mechanism, asking them, “If you had used the signaling mechanism, where would you have sent your signals?” For these hypothetical signals, we followed up later by asking questions about outcomes, just as we did for the actual signals. (Descriptive statistics of survey respondents and nonrespondents suggest the two groups are similar.)<sup>8</sup>

During 2007 and 2008, 2,001 candidates sent 3,936 signals. Of these candidates, 785 responded to survey questions asking if they received interviews, fly-outs, or job offers from employers to whom they sent signals. Furthermore, 572 candidates reported a hypothetical third signal, of which 325 also responded to a follow-up survey about corresponding outcomes. An additional 54 students who did not use the signaling mechanism reported two hypothetical signals, along with outcomes for those applications.

These data were used to estimate a random-effects, ordinary least squares, linear probability model in which the unit of observation is a pairing of a candidate and an employer.<sup>9</sup> Only employers that were signaled or would have been signaled by the candidate (had the candidate sent any signal or had the candidate been able to send a third signal) are included in the sample. The dependent variable is an indicator variable for whether the candidate received an interview from the employer. (We assume that in each of these cases the candidate did apply for the job and thus was considered for an interview.) The regressor of interest is an indicator variable that equals one if the candidate signaled that employer, and zero if the candidate would have signaled the employer if either the candidate had had a third signal (if they sent two) or the candidate had sent any signals (if they sent none).

Thus, in all cases, the candidate was interested in the employer and presumably considered that employer to be a good match. For candidates who sent two signals, one can think of this model as exploiting something akin to a regression discontinuity: the third-choice employer was presumably about as good a match for the candidate as the first- and second-choice employers, but only the top two

<sup>8</sup> We investigated the possibility of nonresponse bias by comparing the characteristics of those who responded to our survey about job market outcomes to those of all signalers. These characteristics include indicator variables for current graduate student, economics as primary field, degree from a U.S. institution, tier of degree-granting institution (as defined in Table 2), and tier of employers signaled. Ratios for these variables in the survey sample and population were virtually identical.

<sup>9</sup> In the reported regression results, we use the applicant as the panel variable to address unobserved applicant quality. We also ran each regression using the employer as the panel variable and using a two-way clustered standard errors ordinary least squares model, finding similar results. Using applicant fixed effects instead of random effects, and logit specifications rather than ordinary least squares, again produces similar results.

Table 3

**The Association of Sending a Signal with Receiving an Interview**

	(A)	(B)	(C)	(D)	(E)
<i>Sample</i>	<i>Economics departments</i>	<i>Economics departments</i>	<i>Economics departments</i>	<i>Economics departments</i>	<i>All employers</i>
<i>Panel data grouping</i>	<i>Candidate</i>	<i>n/a</i>	<i>Candidate</i>	<i>Candidate</i>	<i>Candidate</i>
Signal	0.0680** (0.0287)	0.158*** (0.0443)	0.0321 (0.0328)	0.0580* (0.0317)	0.0634** (0.0271)
Is graduate student		0.176*** (0.0481)			
(Is graduate student) * Signal		-0.101* (0.0556)			
Applied to liberal arts school			-0.0482 (0.0587)		
(Applied to liberal arts school) * Signal			0.177*** (0.0675)		
Applied to international school				-0.0295 (0.0654)	
(Applied to international school) * Signal				0.0583 (0.0739)	
Applied to nonacademic employer					0.132* (0.0765)
(Applied to nonacademic employer) * Signal					-0.130 (0.0827)
Constant	0.247*** (0.0256)	0.114*** (0.0376)	0.259*** (0.0296)	0.252*** (0.0283)	0.254*** (0.0242)
$R^2$	0.003	0.012	0.015	0.004	0.003
Observations	1,529	1,520	1,529	1,529	1,868
Number of candidate groups	728	n/a	728	728	785

(continued on next page)

employers were sent signals. For candidates who did not send any signals, one can think of this model as exploiting something akin to a natural experiment: the treatment group sent their two signals, and the control group did not send their two signals (perhaps because they were unaware of the signaling mechanism, or because they missed the deadline). What makes this comparison meaningful is that in all cases job candidates thought themselves good matches with the employers, but in only a subset of cases were signals actually sent.

Table 3 displays the main results. In column A of Table 3, the intercept shows that applications to economics departments that were unaccompanied by signals resulted in interviews with a 24.7 percent success rate. (If this seems high, recall that every observation in this sample concerns a job that the candidate considered a sufficiently good match that the candidate ranked it in the top three for sending

Table 3 (continued)

	(F)	(G)	(H)	(I)	(J)
<i>Sample</i>	<i>U.S. economics departments</i>	<i>U.S. economics departments</i>	<i>Economics departments</i>	<i>Economics departments</i>	<i>Economics departments</i>
<i>Panel data grouping</i>	<i>Candidate</i>	<i>Candidate</i>	<i>Candidate</i>	<i>Candidate</i>	<i>Candidate</i>
Signal	0.0191 (0.0378)	-0.00325 (0.0395)	0.00712 (0.0370)	0.00122 (0.0373)	0.104*** (0.0345)
Town (pop. < 50,000)	-0.0665 (0.0593)	-0.0419 (0.0656)			
Town * Signal	0.133** (0.0661)	0.0601 (0.0735)			
Applied to liberal arts school		-0.0433 (0.0676)		-0.0314 (0.0669)	
(Applied to liberal arts school) * Signal		0.178** (0.0778)		0.115 (0.0767)	
Applied to unranked school			-0.0370 (0.0514)	-0.0221 (0.0588)	
(Applied to an unranked school) * Signal			0.152** (0.0591)	0.109 (0.0674)	
Received many signals (≥ than 7)					0.00227 (0.0307)
(Received many signals) * Signal					-0.0648* (0.0347)
Constant	0.271*** (0.0344)	0.278*** (0.0363)	0.265*** (0.0340)	0.266*** (0.0344)	0.246*** (0.0274)
$R^2$	0.015	0.015	0.012	0.015	0.006
Observations	1,266	1,266	1,529	1,529	1,529
Number of candidate groups	638	638	728	728	728

*Notes:* The data are from surveys conducted in 2007 and 2008. This table summarizes coefficients in a random-effects ordinary least squares linear probability model in which the unit of observation is a single application from a candidate to an employer. The dependent variable is an indicator variable for whether the candidate received an interview from the employer to which the application was sent. The regressor of interest is an indicator variable that equals one if the candidate signaled that employer and zero if the candidate would have signaled the employer if either the candidate had been allowed a third signal (if they sent two) or the candidate had sent any signals (if they sent none). In columns B–J, we include additional indicator variables for characteristics of the candidate or the employer, along with the interaction of these variables with the indicator variable for whether the candidate sent a signal. We use the candidate as the panel variable to address unobserved candidate quality (with the exception of the regression in column B, which measures the impact of a candidate-specific trait: being a graduate student). Robust standard errors are in parentheses.

\*\*\*, \*\*, and \* represent significance at 1 percent, 5 percent, and 10 percent levels respectively.

a signal.) The coefficient on the indicator variable for having sent a signal indicates that sending a signal (relative to not sending a signal but considering it a sufficiently good match that a signal would have been sent had the candidate participated in

the process or had one more signal) is associated with a 6.8 percentage point higher probability of receiving an interview; this difference is statistically significant at the 5 percent level. That is, applications accompanied by signals resulted in interviews with a 31.5 percent success rate.

This suggests (but given the study design, cannot prove) that signals are helpful in securing interviews. We next investigate whether the association of signaling with receiving an interview is higher for some groups than for others. In column B of Table 3, we compare the signaling outcomes of current graduate students to those for non-graduate students (like postdocs or assistant professors). This comparison requires two additional indicator variables: one for whether the applicant is a graduate student, and the other an interaction term for being a graduate student who signaled. Column B in Table 3 shows that for current graduate students, signals are associated with a 5.7 percentage point increase in the probability of receiving an interview (adding the coefficient of .158 on sending a signal to the coefficient of  $-.101$  on the interaction of sending a signal and graduate student status). Absent a signal, the probability of an interview for a graduate student is 29.0 percent (adding .114 and .176); with a signal, the probability is 34.7 percent. In contrast, for non-graduate students, signals are associated with a 15.8 percentage point increase in the probability of receiving an interview. A potential explanation for this difference is that non-graduate students might be more likely to be overlooked—for example, they are less likely to appear on department web-pages of job candidates—so signals are particularly helpful for attracting attention.

Liberal arts colleges may be particularly interested in signals because they often have different preferences than research universities regarding teaching. Liberal arts colleges might also be concerned that they are receiving applications from candidates who have strong preferences for a job in a research university but are applying widely. In 2009, we sent surveys to 50 economics departments in liberal arts colleges asking how they view signals. Of the 35 responding departments, 17 reported receiving signals. Of these, 12 reported offering interviews to candidates “in part because of the signals.” Of course, receiving a signal did not guarantee that an interview would be offered. However, no schools reported interpreting the signal negatively; in particular, no candidate was removed from the interview list for sending a signal. The data corroborate these survey findings. Column C in Table 3 indicates that a signal to an economics department in a liberal arts college was associated with a 20.9 percentage point higher probability of receiving an interview; in contrast, signals sent to economics departments not in liberal arts colleges were associated with a 3.2 percentage point higher probability of an interview (which is not statistically significant). Candidates who consider signaling a liberal arts college because of this finding should recognize this result is likely driven by selection—those who may have benefited from sending signals to liberal arts colleges were likely good matches for those colleges, while a randomly chosen candidate who signals a liberal arts college based on these regression results may not enjoy any increase in the probability of an interview.

Another group of employers we hypothesized might find signals particularly informative is economics departments outside the United States. They may also have to separate candidates with real interest from applicants who have strong preferences for a job in North America and those seeking all-expenses-paid international trips disguised as campus visits. We test this hypothesis in column D of Table 3. It is not possible to reject the null hypothesis that the association of signaling with probability of interview is the same for international as domestic U.S. employers.

Column E of Table 3 compares outcomes for signals sent to academic and to nonacademic positions. (For this model only, the sample is expanded from just economics departments to all employers.) There is no evidence that signaling a nonacademic employer is associated with a higher probability of receiving an interview, though applications to nonacademic employers are associated with higher interview rates regardless of signals.

Schools in small towns might face a similar informational challenge to liberal arts colleges: that is, distinguishing candidates with serious interest from those who are simply risk-averse and have applied everywhere. Column F in Table 3 displays outcomes for economics departments in towns with population under 50,000. Signals to these departments were associated with a 15.2 percentage point higher probability of an interview, compared to a 1.9 percentage point higher probability of an interview for signals sent to departments in larger cities. This difference is significant at the 1 percent level. When controlling for whether the school is a liberal arts college, as shown in column G of Table 3, there is still a 6.0 percentage point difference based on city size, but the result is no longer statistically significant. (Signaling a liberal arts college that is not in a small town is associated with a 17.8 percentage point increase in the probability of interview, which is statistically significant.)

The final employers we consider are departments that do not appear in econphd.net's rankings of economics departments. These 361 schools received 1,188 signals over the two-year period 2007–8, representing 37 percent of all signals to economics departments during that time. Column H in Table 3 shows that signals to unranked departments are associated with a 15 percentage point higher probability of interview relative to signals sent to ranked schools. When controlling for whether the institution is a liberal arts college (see Column I of Table 3), the difference drops to 10.9 percentage points, which is no longer statistically significant.

Column J in Table 3 examines the role of the total number of signals that an employer receives. We divide employers into two groups: those that received seven or more signals and those that received six or fewer.<sup>10</sup> A signal to an employer who

<sup>10</sup> In the sample used for these regressions, 10 percent of job postings received seven or more signals (and these accounted for 36 percent of signals in the sample). For comparison, within our entire dataset, 12 percent of postings in 2007 and 2008 received seven or more signals (accounting for 37 percent of signals).

received six or fewer signals was associated with a 10.4 percentage point higher probability of an interview. In contrast, sending a signal to an employer who received seven or more signals was associated with just a 3.9 percentage point increase in the probability of interview. Although we are cautious about interpreting these results as causal effects, it may be that signals are less effective when sent to schools that receive many of them.

In general, these results should be interpreted with care. Those who send signals may well have been better fits for the institutions they signaled than those who only designated the institution for a hypothetical signal. To some extent, that better fit may have been detectable to the employer even in the absence of the signal. The ability to send the signal may also mean that job candidates can make less effort along other dimensions to convey their personal interest in certain employers. Most concisely, these results should be interpreted as showing that signaling was associated with a higher probability of receiving an interview *for the particular candidates who signaled these particular employers*. Candidates deciding where to signal should choose employers appropriate for themselves.

A limitation of this analysis is that, while we have data on whether signals were sent, we lack data on whether they were received. In some cases, the AEA's e-mail containing the signals may have remained unopened or was not seen by the recruiting committee. To the extent this occurred, the results presented here, which are suggestive regarding the effect of sending a signal, understate the effect of a signal being received.

Employers may respond to an interesting signal by adding an interview slot, but it is also possible that a successful signal by one candidate displaces another candidate from the interview list. This represents a cost or at least a consequence of the signaling mechanism. Even if one supposes a "zero-sum" game in which no employer adds slots upon receiving signals, to the extent that matches generated by signals are higher value than those crowded out, the signals can nevertheless increase allocative efficiency.

## **The Scramble**

As candidates are hired and positions filled, the market becomes thinner, and information obtained from fall applications and advertisements and from January interviews becomes dated. To reduce search costs in this thin, late stage of the market, in 2006, the AEA formalized a secondary market scramble. The initial announcement stated:

Occasionally prospective employers of new Ph.D. economists exhaust their candidates before hiring someone during the winter/spring "job market" period. Similarly, new economics Ph.D.s seeking a job sometimes find that all of the prospective employers interested in them have hired someone else before they have secured an appointment.

Table 4

**Basic Descriptives of the Job Market Scramble**

	2006	2007	2008	2009	2010
Employers registered	70	67	100	78	67
Total positions	70	75	103	87	71
Job applicants registered	518	535	361	395	374

*Note:* Prior to the 2008 scramble, it was emphasized that the scramble was primarily for new Ph.D.s, which accounts for much of the decline in applicants registered.

To address these problems, the AEA will establish a “Job Market Scramble” website to facilitate communication between employers and job seekers in late spring. Between March 15 and March 20, 2006, employers that continue to have an available position advertised in *Job Openings for Economists (JOE)* prior to January 1, 2006 may post a short notice of its availability (with a link to the *JOE* listing). Similarly, new or recent economics Ph.D. job seekers still looking for a position may post a short announcement of their continued availability at that time, with a link to their application materials (cv, papers, references). The website will open for viewing at noon on Wednesday, March 21, 2006 Eastern time.<sup>11</sup>

Table 4 provides some descriptive statistics for the scramble from 2006 to 2010. The number of employers has ranged from 67 to 100; employers typically advertise one position each; the number of job applicants has ranged from 361 to 535.

From 2006–2009, we surveyed participants to gauge the results of the scramble. The response rates have been modest: about 30–40 percent of employers and 20–30 percent of job candidates. The survey results suggest that about half of employers initiate an interview as a result of the scramble. The survey results also allow us to identify some of the jobs that have been filled, and confirm that at least 10 percent of the jobs listed in the scramble have been filled through the contacts it facilitated. In the 2008 follow-up survey, 17 of the 22 responding employers who contacted applicants in the scramble were academic economics departments, as were 8 of the 10 responding employers who reported hiring through the scramble.

In 2009, the scramble underwent a noteworthy change. Some employers complained that they were inundated with e-mails and calls from candidates in the scramble, and expressed reluctance to participate again unless they

<sup>11</sup> The AEA description continues: “The scramble webpage will not be updated to include new listings. The committee does not want the website to become a pernicious waste of time for job market candidates; if new listings could be posted, candidates might be tempted to log on to the site frequently in search of new jobs. To avoid this, the only information that will ever be contained on the webpage is that which is on it the first minute it goes online.” See (<http://www.aeaweb.org/joe/scramble/guide.pdf>) (AEA Ad Hoc Committee on the Job Market, 2010a).



could remain invisible to job applicants while still viewing which job candidates remained available. The committee, wanting the market to be thick, agreed, somewhat reluctantly. In 2009, 17 of the 87 positions were not made visible even to registered applicants; these were openings with employers who preferred to lurk—that is, to observe available applicants but not to be observed by them. The Committee was unable to detect a pattern in which employers chose to remain visible and which chose to be invisible.<sup>12</sup>

## **Transmission of Job Market Materials**

There is presently a good deal of coordination in certain aspects of the American job market for Ph.D.s, such as the dissemination of information about available positions through Job Openings for Economists, and the synchronization of initial interviews at the ASSA meetings. However other aspects of the job market are uncoordinated, such as how job market materials and reference letters are transmitted. Until recently, these were all sent by mail, but the Internet has made possible submission by e-mail or web application. In the last several years, job seekers and their references have had to use multiple channels, which may be more costly in time and effort than if all information were transmitted the same way.

Two kinds of web applications have a presence in the market. Some departments are in institutions that use a university-wide platform, usually purchased commercially and then operated by the human resources department. Such university-specific systems impose high costs on applicants and references because they require individual uploading for each application and letter of reference.

Other employers use third-party services such as EconJobMarket.org, AcademicJobsOnline.org (run by Duke's Math Department, offering services to all sorts of departments), and others such as Academic Careers Online at (<http://www.academiccareers-job.com/>), Economist Jobs at (<http://www.econ-jobs.com/>), EconCareers at (<http://www.econcareers.com/>), and LiberalArtsFacultyJobs.com. The job listing aggregator walras.org has also explored offering such a service. The website of EconJobMarket.org (accessed March 1, 2010) indicates some consolidation: their service has been merged with that of the European Economic Association and has been endorsed by other economics organizations.

The setup costs for job applicants and references would be reduced if there were fewer services transmitting data to employers. Universities with unique

<sup>12</sup> The visible employers in 2009 consisted of 20 universities with graduate programs, 18 four-year colleges, 10 consulting or research firms, seven federal government agencies, four banking or finance firms, and two "other." The employers who chose to remain invisible consisted of eight universities with graduate programs, three four-year colleges, three federal government agencies, two consulting or research firms, and one banking or finance firm.

websites for job applicants could urge their software providers to make it easy for candidates and references to upload materials to other sites.<sup>13</sup>

For comparison, the American Mathematical Society (AMA), like the AEA, publishes job openings and facilitates an “Employment Center” at its annual meeting. But in addition, since August 2000, the AMA sponsors an automated job application system, MathJobs.Org, that both lists jobs and transmits job packets and letters of reference. MathJobs.Org reported in February 2010 that in the previous year 307 employers used the site and 5,552 applicants submitted an average of 22.7 applications each.

In contrast, the web-based services that offer to serve as a clearinghouse for job packets and letters of recommendation haven’t gained as much traction among economists. AcademicJobsOnline.org (launched in 2006 and offering services to disciplines other than mathematics) had 155 participating employers (including a small number of economics departments) using the site in the 12 months prior to February 2010, in which 8,285 applicants submitted an average of 3.7 applications each. EconJobMarket.org reports that 262 employers had signed up by the end of 2009 and that the average number of applications per job candidate was 13 (personal communication, John Rust, 2/28/10).<sup>14</sup>

Should the AEA play some role in operating, endorsing, or collaborating with one or more services for transmitting job market information? Our committee has been presented with several such proposals, but so far has not recommended that the AEA select one or more to support. It seems likely that there will be further consolidation in the coming years, which may affect how vacant positions are announced and advertised. If many competing providers persist, candidates and letter writers may continue to face high transaction costs. But if one independent site becomes dominant, it could raise prices or expand or limit its scope in ways that might adversely affect the economics profession. These developments deserve continued attention.

## **Concluding Remarks**

Members of the Ad Hoc Committee on the Job Market have been asked why the market for economists does not move toward computer matching based on preference rankings. Precedents for this include the American market for medical residents, in which about 20,000 graduating physicians are centrally matched with residency programs based on rankings filled out by both applicants and programs (Roth, 1984; Roth and Peranson, 1999). Other examples include many other

<sup>13</sup> However, university-specific application protocols may partly serve to impose a small cost on applicants who may be deterred from making the most marginal applications.

<sup>14</sup> John Rust writes: “[Y]ou can get a sense of the rate of growth from the date the account applications were approved: 39 by end of 2007 (EJM’s first year of operation), 139 by end of 2008, and 172 as of today [Sept. 23, 2009]” (personal communication). He further writes (2/28/10): “EJM is starting to see increasing “secondary market trading” for tenured professorships and other positions that are not connected with the North American new Ph.D. hiring cycle.”

medical and healthcare labor markets (Roth, 2008b), and several public school systems, including about 90,000 students each year in New York City who are centrally matched to high schools based on their listed preferences and other rules (Abdulkadiroğlu, Pathak, and Roth, 2005, 2009; Abdulkadiroğlu, Pathak, Roth, and Sönmez, 2005).

Decentralized markets that adopted centralized clearinghouses were most often experiencing such costly and pervasive market failure that there was widespread interest in a radical change (Niederle and Roth, 2003, 2009a, b). We do not detect such interest in economics, so it is unlikely that such a change is presently feasible, even if we were sure it would be desirable.

Investigating the desirability of a clearinghouse would involve exploring ways in which the market for economics Ph.D.s might differ from markets that have adopted clearinghouses. These might involve, among other things, the large costs that employers willingly incur simply determining their preferences over potential hires, costs that involve reading papers, interviewing, one-on-one meetings, and job market seminars that convene a substantial part of a department's faculty. In the decentralized market, departments may be able to contain these costs by flying out the most likely candidates first.

Practical market design is often a response to particular problems. The choice of mechanisms will be guided by theory and experience, but often, practical questions are addressed before firm theoretical foundations are established (Roth, 2002). This is one reason why new market institutions should be monitored and why a new market design will often lead the way to developing new knowledge.

In just this way, a number of questions arose when we considered signaling. For example, how many signals should be allowed? We settled on two, in part because if signals were more plentiful, then employers might view negatively candidates who did not send them a signal. Should job candidates be allowed to announce publicly that they were not sending any signals? We decided against facilitating such announcements, again to avoid bad equilibria in which signals were interpreted negatively (perhaps as signs of candidates who were not confident they could otherwise effectively indicate interest to employers) with the potential result that no signals are sent. At what point or points in the job market might signaling do the most good? If signaling before interviews reduces congestion, why not also allow candidates, after the ASSA interviews, to signal their interest in a fly-out? As we learn more about the role that signaling plays for interviews, this may be a future direction. The theory of signaling and matching in decentralized markets is being pushed forward by such questions (see for example, Coles, Kushnir, and Niederle, 2009; Niederle and Yariv, 2009).

Market design is different from some parts of theoretical mechanism design in that it is not committed only to mechanisms for which all equilibria have certain properties; instead, it is more pragmatic—it would be satisfactory to implement a mechanism with one desirable equilibrium as long as that equilibrium is achieved. This is why we also give advice, as in the advice to signalers on the AEA webpage. If

the goal is to reach a good equilibrium, advice that accompanies the introduction of a new mechanism can be viewed as part of the mechanism itself.

Well-functioning markets do not always spring up spontaneously. As economists, we are well-positioned to monitor and modify the market through which new members enter our profession.

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