Landing the First Job:

The Value of Intermediaries in Online Hiring*

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Abstract

Online markets for trade in offshore remote labor allow workers and firms to contract directly with each other, but, in the largest online markets, small, third-party intermediary organizations have become widespread. This paper studies why intermediaries have arisen in these markets by empirically determining the intermediation roles that they perform. The main conclusion is that intermediaries exist primarily to provide information about affiliated workers' productivity, rather than to increase worker productivity directly. The information provided is most valuable at the start of affiliated workers' online careers, before individual reputations are built in the market place. The presence of intermediaries improves the allocation of inexperienced workers to jobs, increasing market efficiency. Nonetheless, organizational constraints on the growth of the intermediaries that are currently observed suggest that these intermediaries cannot fully mitigate the trade frictions arising from incomplete information about workers' productivity in offshore labor services markets.

Keywords: Labor market intermediation, offshoring, incomplete information.

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1 Introduction

Trade is governed by the institutional environment in which buyers and sellers interact. A growing literature studies how market transactions can be organized to overcome the limitations of a formal institutional environment that is unable to support fully-specified contractual arrangements. This paper studies the organizations and institutions governing the growing trade in offshore labor services. Advances in communications technology have made trade in offshore labor services possible to an unprecedented extent.[1] Several large online platforms provide institutional frameworks that mitigate potential barriers to this type of trade. These platforms reduce search costs by bringing potential employers and employees together; they provide tools to allow for remote monitoring in exchange for payment guarantees to workers; and they provide effective reputation systems for market participants.

These marketplaces were designed in part to allow employers with complex technical projects to contract with workers directly, bypassing the need to send work abroad through large specialist IT services firms. Surprisingly, however, small, independent intermediary organizations are prominent participants within many online platforms. On oDesk, the largest platform and the source of data for this paper, almost 30 percent of the site's non-US workers are affiliated with one of many small independent intermediary organizations operating within the marketplace. In oDesk's terminology, these intermediary organizations are called "outsourcing agencies" or "agencies".

Agency-affiliated workers are a subset of any cohort of new workers signing up on the platform but are strikingly more successful than independent non-affiliates. Over their careers, they earn, on average, over six times as much as new non-affiliated workers, and over three quarters of this earnings gap is unexplained by differences in observable worker characteristics, including reported technical skills, test results measuring technical skills, years of education, English language ability, prior labor market experience, and host country.

This paper asks two related questions. First, why have independent intermediaries arisen within electronic online platforms for trade in labor services? And second, why are the workers affiliated with these intermediaries so much more successful than otherwise similar non-affiliates? Addressing these questions sheds light on the potential barriers to trade in offshore labor services and the extent to which these barriers can be overcome (Spulber, 1999).

The paper assesses the relative importance of several candidate theories explaining intermediation in offshore labor services trade. The first theory of intermediation considered is that intermediary organiza-

[1] Blinder (2006) asserts that the ability to employ workers located anywhere in the world is arguably bringing about the next industrial revolution. Blinder and Krueger (2009) estimate that around 25 percent of U.S. jobs are potentially "offshorable", often made possible by electronic product delivery.

tions reduce incomplete information about trading partners' types or actions. This theory is the subject of a long literature which includes some recent studies of international trade in goods markets. Feenstra and Hanson (2004) view wholesalers as certification intermediaries that arise because of incomplete information about product quality. The dynamics of bilateral trading relationships have been shown to reflect the fact that partner types are initially unknown (Antras and Foley, 2011; Araujo et al., 2012). Formal or informal institutional arrangements may also mitigate trade frictions by reducing trading-partners' incentives to engage in opportunistic behavior (Milgrom et al., 1990; Greif, 1993).

A second candidate theory of intermediation is that intermediaries provide inputs to production that are complementary to labor services.[2] In online labor markets, intermediaries might undertake management activity related to coordination across work teams of specialized workers (Becker and Murphy, 1992). Alternatively, they might provide productivity-enhancing services such as translation, training, or capital equipment, similar to the traditional staffing agencies described in Autor (2001b).[3]

The results of the analysis in the paper show that intermediaries mainly perform a certification role, revealing information about worker quality. The data also imply that there are organizational constraints on the extent to which agencies fully mitigate incomplete information in the market. The findings, hence, suggest that incomplete information about worker type is a barrier to trade in online markets, even with the large amounts of information and other tools made available to employers by the online platforms.

An outline of the oDesk transaction process is a necessary background to the empirical approach taken to investigate the various intermediation roles. With over 600 thousand workers enrolled around the world as of July 22, 2010, oDesk is one of the largest online global labor markets. Over 80 percent of transactions span country borders, and, in doing so, constitute international services trade. A firm that wants to hire a remote worker can create an account on the site, post a project description, and view the profiles of job applicants. Employers observe a large amount of information about each job applicant in a detailed profile. Figure 1 provides an example of a worker profile, showing the information employers observe when first evaluating a job applicant. The worker in the example, Evgeny M., is located in Omsk, Russia and is a programming specialist. On the bottom right-hand side of Evgeny's profile, employers can observe that he is affiliated with an intermediary called *qcode*. The employer selects which applicant, if any, to hire, and contracts with the employee rather than through the agency. The work takes place, and then payments

[2] Autor (2001a) sets out reasons why online labor markets might require intermediation that both reduces incomplete information and that increases productivity on the job.

[3] A separate large literature suggests that intermediaries exist in international trade to reduce the fixed costs associated with market entry or searching for trading partners (Ahn et al., others). In the largest online labor market platforms, these activities are performed by the platform itself, and employers contract directly with both agency-affiliated and non-agency-affiliated workers. In this respect, they differ from the temporary staffing agencies described in Autor (2001b), and in Bidwell and Fernandez-Mateo (2010), which also provide a matching function. This role, hence, cannot explain the prominence of agencies on oDesk, for example.

are made. After a completed job, employers are asked to leave feedback for the worker, which is publicly available from then on.

There are three main findings in the empirical analysis of comprehensive administrative data from oDesk that lead to the inference that agencies exist to act as labor market information brokers, and each is related to the feedback mechanism.[4] The first finding is that employers appear to incorporate the information from the agency affiliation brand when forming initial beliefs about worker productivity. When neither affiliates nor non-affiliates have public feedback scores—that is, among all inexperienced workers—affiliates are significantly more likely to be hired than non-affiliates, and affiliates earn higher wages on their first jobs. Oaxaca-Blinder decompositions (Oaxaca 1973; Blinder, 1973; Fortin et al., 2011) imply that affiliates are twice as likely to be employed and, conditional on being employed, earn hourly wages that are 15 percent higher than otherwise observably similar non-affiliates.[5]

The second finding is that employers' assessment of worker productivity, as measured by willingness to pay, is more responsive to favorable new information (contained in feedback scores) for non-affiliated than for affiliated workers. On average, employers choose to employ only experienced workers who have received favorable feedback scores in the past. The hourly wage rates for re-employed non-affiliates are also more responsive to the feedback scores received. The hourly wage rates of the non-affiliates that are re-employed grow faster than the hourly wage rates of re-employed affiliates, so that wage rates converge among experienced workers. This suggests that affiliation provides information that substitutes for the information contained in employed workers' feedback scores, meaning that a worker's quality becomes public information before the first job for affiliates but only after the first job for non-affiliates.[6]

The third finding is a consequence of the first two findings. After the first few jobs, by the time that all previously inexperienced workers have public feedback scores, there is no ongoing agency affiliation premium. The worst non-affiliates have been selected out of the market, and agency affiliates and the remaining non-affiliates have similar wages and employment outcomes for the remainder of their careers.

These findings are consistent with agency affiliation credibly signaling that inexperienced affiliates are higher quality than inexperienced non-affiliates, an inference which has implications for the efficiency of

[4] As in eBay and Amazon.com, a feedback score is included as part of a seller's (worker's) online profile. It is the revenue-weighted average of past employer feedback, and is scored out of five. This feedback mechanism is referred to here as the reputation system. The top right corner of Figure 1 shows that Evgeny has excellent feedback from past jobs—scoring 5 out of 5.

[5] The premium attributed to affiliation is the fraction of the average gap between affiliates and non-affiliates that cannot be attributed to differences in other observed worker-level characteristics. 30 percent of all agency affiliates find at least one job compared to only 9 percent of all non-affiliates. The gap in hourly wages is 48 percent of the non-affiliates average wage.

[6] This result is consistent with the idea that employers' prior beliefs about inexperienced worker productivity differ based on a workers' affiliation status. The logic follows directly from the literature on statistical discrimination and employer learning (Farber and Gibbons, 1996; Altonji and Pierret, 2001; Lange, 2007). If employers either have a less precise signal about non-affiliate productivity or if employers expect affiliated workers to receive good feedback because they are more productive, then employers' posterior beliefs change most in response to good feedback for non-affiliates.

this online labor market. Before looking for any evidence that agencies perform other intermediation roles, it is useful to briefly describe the efficiency implications of the information-provision role. On-the-job talent discovery, when combined with short-term labor contracts and an inexperienced workforce that cannot "buy their jobs," is shown in Tervio (2009) to result in inefficiency because firms ignore the option value of hiring workers of unknown quality. Hiring firms do not capture the full benefit of their investment in talent discovery, and so inefficiently few inexperienced workers are hired. Pallais (2011) uses experimental evidence to show that this inefficiency exists among non-affiliated data entry workers in the oDesk marketplace.[7]

Intermediation provides an endogenous organizational response to this inefficiency. The empirical results in the paper show that the presence of agencies increases the efficiency of the allocation of workers to job openings, since it increases the share of jobs that are staffed by higher quality inexperienced workers. The findings are consistent with the equilibrium predictions of a simple version of Tervio's model, extended to allow for an agency that credibly signals that a subset of inexperienced workers are high quality. In the equilibrium of the model, agencies also reduce inefficiency by increasing the firm's expected payoff from hiring inexperienced workers and, hence, increasing the supply of known high-quality workers in the market.

It is unlikely that affiliation is randomly assigned among all inexperienced workers, and the results are consistent with affiliates being a selected high-quality group. Turning now to alternative intermediation roles: Can the three main empirical findings be explained by a direct agency treatment effect that increases worker productivity on the job? The fact that the agency earnings premium is confined to the first few jobs suggests that, if a direct treatment effect causes the findings, the treatment has to either be limited to the beginning of all affiliates' careers or have a persistent effect for only the lowest productivity affiliates. As examples of how this could arise, agencies' provision of complementary inputs to production—such as translation services, capital equipment, or management—might be offered only to inexperienced workers, or to only the subset of agency affiliates that would benefit most from the treatment.

There are few discontinuities in the environment that allow this possible agency role to be separately identified from the agency role of selecting only high quality workers into affiliation. Instead, the analysis presented about individual worker's careers provides several pieces of evidence that, when taken together, appear inconsistent with the presence of an agency treatment effect that would meet either of the necessary criteria. The first piece of evidence comes from the study of job application and wage-offer behavior of the 15 percent of affiliates who joined an agency after their first job application on the site. For workers

[7] Revealing worker quality in this setting is analagous to providing employees with general and, hence, transferable skills (Becker, 1962).

that switch into agency affiliation, there is a significant increase in their hourly wage offer at the time of affiliation, which suggests that any treatment effect directly increasing their productivity would have to be instantaneous.[8]

The second fact that casts doubt on the agency treatment effect hypothesis is the limited evidence of any heterogeneous agency affiliation premium among affiliates with very different backgrounds. If agencies were providing a treatment effect that increased individual productivity on the first job, then the benefit is likely to be greatest for new affiliates with relatively low skill levels. There is very little evidence of a heterogeneous agency effect based on a worker's observable skills or prior labor market experience. This implies that, for a treatment effect to explain the main findings, the activities undertaken by the agency during the first few jobs of an affiliate's career must have a similar effect on the productivity of an affiliate with low levels of observable skills and a very skilled affiliate coming in to the workforce. This is somewhat unlikely since the most plausible treatment effects include providing translation services or other inputs that substitute for observable skills.

One characteristic of individual jobs that does appear to be related to affiliates' relative performance on the first job is whether or not the worker is staffed on a team-based project.[9] On average, inexperienced workers staffed on teams for their first jobs are less likely to be re-employed on the site, but affiliates staffed on teams with members of the same agency do not experience this negative effect. This offers some evidence that agencies may help to coordinate teams. However, this role cannot explain the three main findings in the paper. A large affiliation premium in first-job success remains after including controls for any team work and for same-agency team work. Moreover, the relative responsiveness of re-employed non-affiliates' wages to feedback increases once controls for teamwork and the interactions of teamwork with affiliation status are included.

Given that it appears intermediation in online markets exists in response to incomplete information, it is useful to understand whether intermediaries can grow to fully solve the inefficiencies arising from incomplete information about inexperienced workers. This requires some insight into how agencies are organized and how they function internally. In particular, one key question is how agencies can determine worker quality when employers cannot. Administrative data on same-agency worker characteristics suggests that agencies can screen worker quality, allowing them to offer affiliation only to high-quality workers, through their shared offline social ties. Across all agencies in the data, 75 percent of affiliates are in the modal city for their respective agency. Among agency affiliates who report their school, 65 percent attended the modal

[8] This result also suggests that employers are not able to observe an omitted characteristic about workers that is correlated with agency affiliation; the agency brand itself appears to cause the change in workers' wage offers.

[9] Teamwork is defined as being employed by an employer who has hired another oDesk worker within a 30-day window of hiring the worker in question.

school for their agency. Members of the same agency also tend to work in the same narrowly-defined job category, with over 80 percent of experienced agency members having had at least one job in the modal job category for their agency.[10]

Agencies are able to overcome the labor market inefficiency demonstrated by Tervio (2009) because oDesk enables long-term contracting between agencies and individual workers. An oDesk worker that wants to leave an agency will lose his or her individual feedback history in doing so. This allows the agency to capture the benefits of allowing high-quality inexperienced workers to affiliate under the agency brand. The heads of outsourcing agencies appear to be local specialists with the ability to tap into their own networks to identify qualified new affiliates[11].

The fact that affiliates of the same agency appear to know each other offline also suggests that the size of any one agency is limited by the boundaries of existing social networks. Furthermore, the reason that agencies are prevalent in the market—inefficiently low levels of hiring of inexperienced workers due to incomplete information about quality—also implies that there are barriers to the entry of new agencies. To start a successful agency on oDesk, a high-quality unaffiliated worker has to be fortunate enough to be hired for at least one job to have his quality revealed. Only then can he share his reputation among the high-quality members of his offline network when they join the new agency.[12]

This study of the role played by these intermediaries provides some of the first empirical evidence that incomplete information about quality constitutes a barrier to efficient trade in offshoring market in online services. The findings also imply that other mechanisms that reduce incomplete information are likely to increase transactions' value and, thereby, increase efficiency in these markets. While online intermediaries provide employers with information about worker quality that facilitates hiring, their organizational structure indicates that there are constraints on the extent to which agencies can grow to accommodate employer demand. Incomplete information about worker quality is, hence, likely to limit the rate at which the jobs that are technically offshorable are actually moved offshore.

The paper proceeds as follows: Section 2 outlines a theoretical framework that guides the empirical analysis. Section 3 describes the data used in the study. Section 4 investigates differences between affiliates

[10] As an illustration, almost all workers affiliated with the agency *qcode* are located in the same city, most workers attended the same local university, and, as the agency name suggests, all specialize in web programming.

[11] While affiliates of the same agency share social ties, it is unlikely that the first order effect of agencies is to reduce moral hazard by increasing the social costs of shirking. Employed workers face strong individual reputational incentives within the oDesk market to refrain from shirking, since feedback scores are the single most important factor associated with ongoing employment and earings in the market. The role of social ties among members of these organizations, hence, appears to differ from the role played by social ties in the rotating savings and credit associations (Roscas) studied in Besley et al. (1993).

[12] The barriers to new agency entry created by requirements of a good oDesk reputation and an offline network of potential agency affiliates suggest that agency heads enjoy significant market power. They gain a share of all the revenues earned by all agency members throughout the duration of their careers. The share of revenue collected by the agency head is not contained in the data that oDesk collects, but oDesk's management reports that agency heads typically take between three and six percent of affiliated workers' wages.

and non-affiliates at the start of their oDesk careers. Section 5 studies workers' subsequent success on the site and infers that the agency premium is consistent with an information provision role. Section 6 explores an alternative explanation of the premium—a treatment effect that is limited to the start of affiliates' careers. Section 7 discusses how agencies' organizational structure can allow them to screen inexperienced worker quality. Section 8 concludes.

2 A Framework to Motivate the Empirical Analysis

The feedback mechanism on oDesk, and common to other online product and labor markets, relies on revelation of worker quality on the job. Tervio (2009) shows that in environments with on the job talent discovery, short-term labor contracts, and an inexperienced workforce that cannot "buy their jobs," firms do not internalize the option value of hiring workers of unknown quality. Since hiring firms do not capture the full benefit of their investment in talent discovery, inefficiently few inexperienced workers are hired. The inefficiency he describes arises because of the key assumption that talent is revealed only on-the-job itself.

Because the empirical results in this paper ultimately suggest that intermediaries signal information about worker quality rather than increase worker quality directly, it is helpful to formalize this role in a simplified version of Tervio's model. An intermediary is introduced into a stylized version of Tervio (2009), and this intermediary is able to determine the quality of a subset of the workers in the market. In equilibrium, only high-quality workers that the intermediary can assess are offered agency affiliation. The empirical approach to assessing the information role of intermediation involves an examination of whether the data about workers' career outcomes are consistent with the equilibrium predictions of this theoretical framework. The data on workers' careers match a large number of the equilibrium predictions.

The theoretical framework has the following structure: It is a discrete time game where a large number of new workers enter the market in each period and can work for a maximum of two periods. N identical employers can hire a single worker in each period. Worker quality (productivity) is given by θ, which, for inexperienced workers, is unknown to both workers and firms. With probability h, a new worker is high-quality, $\theta \quad H$, and with probability $\quad - h$, a new worker is low-quality, $\theta \quad L$, where $H > L$.[13] Each worker's quality is publicly revealed after the first employment spell, and workers have a per-period outside wage normalized to .There is an intermediary in the market, called an agency, that observes worker type for a subset of the workers arriving in the market in each period. The agency chooses whether to offer affiliation to each inexperienced worker. Workers offered agency affiliation choose whether to

[13] The equilibrium predictions from the model are robust to assuming that there is a distribution of worker qualities.

accept the offer or to join the pool of non-affiliated new workers. Agency affiliation lasts throughout the worker's career.[14] The agency collects an endogenously determined fraction of each agency affiliate's lifetime earnings, and the agency's objective is to maximize profits.

The timing of the game in each period is: (1) N firms post a job opening. (2) E new workers, each with a per-period outside option w_0, enter the marketplace. The agency can determine θ for S of these new workers, and the agency offers affiliation to a subset of workers under an endogenous revenue-sharing agreement.[15] (3) Workers offered agency affiliation choose whether to affiliate. (4) The N firms in the market hire one of: an experienced worker in the second period of his working life, known to be of either high or low quality; a new agency-affiliated worker; or a worker from the pool of inexperienced unaffiliated workers (in equilibrium, inexperienced workers who were not hired in the first period of their lives will not participate in the market). There is a perfect Bayesian equilibrium of this game where the agency offers affiliation to high-quality, screened, inexperienced workers workers and does not offer affiliation to unscreened workers or screened low-quality workers. In this equilibrium, agency affiliation communicates to employers that inexperienced affiliated workers are high-quality. Screenable workers who are not offered agency affiliation drop out of the market.[16] There are three equilibrium empirical predictions consistent with this information-provision intermediation role that are evaluated using data from workers' careers on oDesk.

First, in this equilibrium, employers believe, correctly, that affiliates are high quality, and thus inexperienced affiliates receive high-type wages. Non-affiliated inexperienced workers compete for job offers, so that their equilibrium wage in that period is equal to the rate that sets their lifetime expected earnings (given that they are unaware of their type) equal to their outside option. The model, hence, predicts that inexperienced affiliates are more likely to be hired, and, conditional on being hired, are paid higher wages, than inexperienced non-affiliates.

The second equilibrium prediction arising from this framework relates to outcomes on subsequent jobs. Among workers who are hired in the first period of their careers, affiliates are, on average, more likely to go on to be hired in the second period. This is because, while all affiliates are high quality in this equilibrium,

[14] This corresponds to the oDesk environment. Agency affiliates leaving an agency have their personal work histories removed from their profile.

[15] S is assumed to be exogenous since the boundaries of an agency are often determined by offline networks and, hence, rely on pre-existing ties. Offline interaction confers the ability to screen. The number of new workers in each period is assumed to be large enough, and the number of these workers whose quality can be observed by the agency small enough, that the number of affiliates and known high-quality experienced workers available for hire in each period exceeds the number of firms.

[16] The information structure assumes symmetric ignorance of θ by workers and employers. Since workers know whether their θ is observed by the agency, those whose type is observed but who do not receive an offer to join the agency learn that they are low quality. They drop out of the market because the lifetime earnings of a low-quality worker are less than their outside option. The equilibrium wage for a non-affiliated, inexperienced worker (whose quality is unobserved by employers for all such workers) in the first period is below w_0.

a fraction $-h$ of the non-affiliates that are hired in the first period will be revealed on-the-job to be low-quality, and are not hired a second time.[17]

A key implication of this framework is that quality is discovered on the job for non-affiliates but not for affiliates. That is, worker performance on the first job is more informative about worker quality for non-affiliates, allowing for selection on quality into re-employment after the first period for these workers. Those non-affiliates who are revealed to be high quality after the first job are perfect substitutes for affiliates at the start of the second period of their careers. Employers are willing to pay all known high-quality workers the same wage. The final prediction, then, is that non-affiliates who are hired for a job in the second period experience larger wage growth between jobs than affiliates.

3 Data and Summary Statistics

During the sample period between August 1, 2008 and December 28, 2009, over 125,000 workers created a profile and applied for at least one job on oDesk.com. The information that oDesk collected about these workers, both before and after their first job on the site, make up the primary data used in this paper.[18] Twelve percent, or 15,285, of new workers arriving in the market were affiliated with an outsourcing agency. Table 1, Panel A presents summary information about the prevalence of agency affiliation among these workers: overall; within four of the largest worker countries; and then within the two most frequently observed job categories.

Affiliation is relatively prevalent among oDesk workers in India and Russia compared to among workers in the Philippines and is even more rare among workers located in the United States. Thirty-four percent of all new oDesk workers are located in the United States, but only 12 percent of affiliates are located there.

Job postings on the site are categorized into several groups according to the worker skills required. Some categories require specialized skills while others are relatively routine. As an illustration, Web Development, the most prevalent job category, accounts for around one third of the job postings on oDesk and requires specialized programming and design skills; many of the projects in Web Development appear to belong to a production process where output is only realized after a substantial lag. Around 30 percent of new workers in this job category are agency affiliates. In contrast, Administrative Support, the second

[17] A firm would prefer to hire an inexperienced worker of unknown quality at the equilibrium wage rate for these workers than hire a known low quality worker.

[18] Earlier data is not incorporated because of changes to the database that records agency affiliation. A separate database query contains the subsequent employment histories, up to 9/8/2010, for all the workers that entered the platform between 8/1/2008 and 12/28/2009. Some of the analysis in later sections uses data collected about all workers who apply for jobs during the time period studied, this sample includes the workers that signed up after 8/1/2008 and those workers who were applying for jobs after this date, but signed up on the site at an earlier date.

largest job category, accounts for around one fifth of the job postings on oDesk and requires only basic computer and data entry skills; output quality in administrative support can be continually observed. Only 10 percent of new workers in this job category are agency affiliates.[19]

The focus of this paper is on labor contracts that span international borders—that is, offshored work. Because the majority of employers on oDesk were located in the U.S. during the time of the study, the analysis concentrates on the 83,029 new workers located outside of the U.S.[20] Columns 5 to 8 of Table 1, Panel A show that agency affiliates make up 16 percent of these workers, and affiliation remains relatively prevalent among workers in India, Pakistan, Russia and the Ukraine, and in Web Development.

Agency affiliates are more successful on the site. Table 2, Panel A compares the career earnings for affiliates and non-affiliates. The 69,610 workers that were not affiliated with an agency earned an average of $303 between the date they first applied for a job and August 10, 2010. The 13,419 agency affiliates earned an average of $1,944 in the same period, over six times as much as the average earnings of non-affiliates.

A share of this earnings gap can be attributed to the fact that agency affiliates tend to have observable characteristics that are valuable to potential employers, as also shown in Table 2, Panel A. For example, a significantly larger share of affiliates have good English skills, have some tertiary educational qualification, and have taken at least one oDesk-administered skills test.[21]

Decomposing this gap in "lifetime" earnings between affiliates and non-affiliates reveals, however, that over three-quarters of the gap can be attributed to the difference in agency affiliation rather than in any other observable characteristic. The Oaxaca-Blinder decomposition approach that yields this result follows well-known methods in the literature.[22] In this analysis, the cross-sectional outcome (at this point, lifetime earnings for worker i) for a non-affiliate is given by $y_i \quad X_i\beta_N \quad t \quad \varepsilon_i$ and the cross-sectional outcome for an affiliate is given by $y_i \quad X_i\beta_A \quad t \quad \varepsilon_i$, where the subscripts N and A indicate that the coefficients correspond to non-affiliates and affiliates, respectively. The vector X_i contains a constant term and a large number of individual worker characteristics, including country and job category fixed effects. A month fixed effect, t, captures mean differences across cohorts and time-varying market characteristics.[23] Estimates of

[19] Administrative Support postings typically attract more applicants than Web Development jobs. This explains why a larger share of new workers apply for Administrative Support jobs than for Web Development jobs even though the largest share of posted jobs are in the Web Development job category.

[20] The main results are generally unchanged if workers from the United States are included in the analysis.

[21] oDesk has established a battery of skills tests in a variety of subject areas that workers can choose to take. Workers' disclosure of test scores is also voluntary and employers do not have the ability to determine the number of times, if any, that a worker has attempted a test.

[22] The outcome variable that is decomposed in Table 2 is lifetime earnings. Later analysis decomposes different outcome variables: the probability of being hired, hourly wages, job duration, the probability of employer-reported job success, and worker feedback score. In each case, the gap in the mean value of the outcome variable for affiliates and for non-affiliates is decomposed into the share of the gap that can be attributed to affiliation and the share that can be explained by mean differences in other observable characteristics between groups.

[23] Other characteristics included in X_i are all measurable resume characteristics that can be easily quantified, including dummies for levels of educational attainment, prior years of work experience, prior programming experience, the oDesk test

the coefficients β_N and β_A are obtained from separate regressions for each group.

The gap in average outcomes between affiliates and non-affiliates due to differences in observable characteristics is measured as $\left(X_A - X_N\right)\beta_N$, where X_A and X_N are the mean characteristics for each group.[24] The remaining difference in outcomes, $\beta_A - \beta_N \ X_A$, captures the fact that employers appear to value the same characteristics differently in affiliates and non-affiliates. This component can be attributed to agency affiliation or to other factors correlated with agency affiliation but excluded from X_i. The presence of a constant term in X_i captures the mean difference in the outcome across groups, but the specification does not restrict differences in outcomes due to agency affiliation to be captured in difference in the estimated constant term. For example, an employer may weigh education or any other characteristic differently for an affiliate versus a non-affiliate if affiliation makes disclosure of these characteristics seem more credible.

Columns 1 and 2 of Table 2, Panel A show that 78 percent of the $1,641 average earnings difference between affiliates and non-affiliates—a dollar value of 1,278—can be attributed to affiliation. This is equivalent to an agency earnings premium of over 400 percent of the non-affiliate average wage of $303. Columns 3 and 4, and 5 and 6 present the same analysis for new workers applying for Administrative Support and Web Development jobs, respectively. Of the earnings gap in each of these job categories, $715 and $1431 can be attributed to a workers' affiliation status rather than differences in observable characteristics, corresponding to an agency earnings premium of 360 percent in Administrative Support and 280 percent in Web Development.

The earnings premium that is attributed to affiliation could arise because of two reasons: affiliation causes the premium, or affiliation is correlated with an unobserved variable that is also correlated with the premium. The remaining analysis in this paper analyzes the oDesk career-stages of these new workers to determine when and where the earnings premium develops. In doing so, it offers evidence about whether the premium can be attributed to an agency "selection effect"—in that affiliated workers share an unobserved characteristic (such as high quality)—or to a "treatment effect," in that affiliation has a direct effect on career outcomes. The former explanation is consistent with an agency-as-information broker role, and the latter with an intermediation role where agency affiliation leads directly to increased worker productivity on the job.

scores that are observed in workers' profiles, and any work history from prior fixed-price jobs. Job category and worker country fixed effects are also included when the sample includes more than one group of each variable. Where appropriate, some specifications contain characteristics about the job opening in X_i,including the expected duration of the job and the number of characters in the employer's job description.

[24] This decomposition provides results relative to a baseline group. The most straightforward baseline for evaluating the impact of observable characteristics on affiliates' wages is to hold affiliates' characteristics constant, but to "weight" those characteristics as if they were evaluated for non-affiliates, by using the estimated coefficients β_N. This is the approach taken throughout the paper.

4 Empirical Analysis at the Beginning of Workers' Careers

4.1 The probability of being hired for at least one job

The first striking difference between affiliates and non-affiliates is in the probability of being hired for a first job. For all inexperienced workers located outside the U.S., 10,103 of the 83,029 applicants—twelve percent—are hired in the time period studied in the paper (Table 1, Panel B; Table 2, Panels A and B). Table 3, Panel A reveals that inexperienced non-affiliates are much less likely than affiliates to find work. Overall, and in both the Administrative Support and Web Development job categories, around 30 percent of affiliates are hired at least once compared to only around 9 percent of non-affiliates.

The panel also presents a decomposition of the difference in the probability of a first hire for affiliates and non-affiliates into the share of the difference that can be attributed to agency affiliation and the share that can be explained by other observed characteristics. The results show that, while other observed characteristics are correlated with which non-affiliates get hired, they cannot explain much of the large mean gap in the probability of employment between affiliates and non-affiliates. Overall, 78 percent of the mean difference in the probability of finding a job between affiliates and non-affiliates cannot be explained by the fact that non-affiliates applying for work have inferior observed skills. The final row of Table 3, Panel A, showing the agency affiliation premium, suggests that affiliates are around twice as likely to be hired as otherwise observably similar non-affiliates.

The difference in the probability of finding work explains a large share of the lifetime earnings agency premium. While around 70 percent of affiliates do not find work and, hence, have zero earnings, this is true for over 90 percent of non-affiliates. Table 2, Panel B examines differences in lifetime earnings for those workers that are hired for at least one job.[25] The share of the lifetime earnings gap between affiliates and non-affiliates for the workers hired at least once is $2,796, and the decomposition of this gap shows that 61 percent of the gap, across all job categories, can be attributed to agency affiliation. This corresponds to an affiliation premium of 55 percent of the average earnings of these non-affiliates—a large reduction from the agency earnings premium of over 400 percent for all workers shown in Panel A of the same table.

Turning to the same decomposition by job category, the difference between affiliates' and non-affiliates' earnings among workers whose first bids were in once of the two main job categories and who were hired at least once is $883 in Administrative Support and $1833 in Web Development. Given the share of this

[25] Table 2 Panel B, Columns 3, 4, 5 and 6 present the subset of workers who find work out of the workers in the same columns in Panel A. These are the inexperienced workers who first bids are for jobs in Administrative Support (Columns 3 and 4) and Web Development (Columns 5 and 6). The analysis in Tables 3 onwards examines the source of agency-affiliation premium among the workers whose first hire, rather than first bid, is in either Administrative Support or Web Development. Hence, there is some discrepancy betwene the number of workers in Table 2, Panel B and Tables 3 onwards. The overall number of workers is consistent, where comparable, across tables.

difference that can be attributed to agency affiliation, the premium due to affiliation is 52 percent in Administrative Support and 27 percent in Web Development. Again, the affiliation premium for workers who are hired is much reduced from the results shown in Panel A for the premium among all workers who make at least one bid.

4.2 Wages for workers on the first job

Although the difference in the probability of finding employment explains a large share of the affiliation earnings premium, Table 2, Panel B shows that there is a remaining earnings gap between the subset of inexperienced workers who are employed at least once. Employed affiliates earn significantly more than non-affiliates despite the fact that, as shown in the same panel, non-affiliates that are hired for at least one job have, on average, higher levels of observed skills than hired affiliates. Table 3, Panels B and C ask whether differences in the total wages earned on the first job can explain part of the earnings premium that remains among workers that find employment. Panel B shows that affiliates have higher hourly wage rates on the first job, both overall and for workers in Administrative Support and Web Development, where affiliates' wage rates are 6 percent and 18 percent higher, respectively. Panel C shows that affiliates' first jobs are also longer in duration—the hours worked by affiliates on their first jobs in Administrative Support are 32 percent and 45 percent greater, respectively.

Table 3, Panels B and C go on to decompose these gaps in mean log wage rates and hours, and show that a large share of each can be attributed to agency affiliation. In Administrative Support and Web Programming, respectively, inexperienced affiliates have an hourly wage rate premium of 34 percent and 8 percent of the average hourly wage rate earned by otherwise similar non-affiliates.[26] The first jobs of affiliates in Administrative Support are 11 percent longer than the first jobs of otherwise similar non-affiliates, and the first jobs of affiliates in Web Development are 8 percent longer.

The decompositions reveal that a large share of the initial hourly wage rate gap can be attributed to affiliation, or some unobserved factor correlated with affiliation. There is, though, also the possibility that affiliation is correlated with a worker-level characteristic other than worker quality that is unobserved in the data but is, however, observed by employers. While the decompositions of wages cannot estimate affiliates' wage rates under the counterfactual of non-affiliation, the fact that the data contain bid rates for around 1700 affiliates whose initial bids were made as non-affiliates can offer a within-worker estimate

[26] The large difference in first log hourly wage in Column 1 is due to the mix of job categories in the overall sample. A large share of affiliates are in Web Development, and all workers in Web Development earn higher hourly wages than workers in other job categories. Since job categories are included in the decomposition as an observed characteristic, this is controlled for in the measure of the share of the hourly wage rate gap that can be attributed to affiliation.

of the affiliation treatment effect for these workers.[27] Workers bid for many jobs, often over a short time interval, allowing for identification of a within-worker treatment effect in a small time interval around the switch from non-affiliation to affiliation.[28]

Table 4 present the results of this analysis, using a 4-day window before and after the switch to affiliation.[29] The baseline estimate, contained in Column 1, shows that the agency brand causes the worker to increase his or her bid by about 4.7%. Column 2 contains a falsification test using this same sample. A randomly generated placebo agency switching date was generated for each worker in the pre-switch period and was included as a "false indicator" that the worker switched into the agency after this time. If agency switchers had upward trending wage-offer profiles for reasons that were correlated with agency affiliation and observed by employers, then the placebo date should capture this effect. The estimated coefficient on the placebo is small, negative, and not statistically significant. The specification in Column 3 includes both the placebo switching indicator and the indicator as of the actual agency switch. The estimate of the agency effect, even including the placebo switching date, is almost identical to the estimate in Column 1.[30]

Overall, these results suggest that the effect of agency affiliation on bidding is nearly instantaneous. The effect is detectable within a 2-day window of the worker switching into the agency, and a placebo test suggests that the effect is not due to something happening in workers' bidding histories prior to switching into the agency. These workers' appear to be bidding as if they understand the increased probability of employment, even at higher wage-offer rates, as affiliates.

Under a reasonable assumptions, it is possible to use the results in Table 4 to recover a "clean" estimate of the agency treatment effect on the hourly wage rate during the first job. The assumption is that the proportional deviation between the "true" agency treatment effect and the estimated agency treatment effect from the Oaxaca-Blinder procedure is constant regardless of whether the dependent variable is $Bids$ or $Wages$ on the first job. Then, the ratio of the estimate in Table 4 to an estimate of

[27] Most agency affiliates are brought onto oDesk by the agency head and do not bid for jobs without the agency affiliation in their profiles.

[28] The estimated equation is:

$$\log Bid_{it} = \alpha_i + \beta_1 1\left(AgencyAffiliate_{it}\right) + \beta_2 BidNumber_{it} + \beta_3 f\left(TimeFromFirstApplication_{it}\right) + \varepsilon_{it}$$

where β_1 measures the effect of joining an agency on workers' bidding behavior. The function $f\left(TimeFromFirstApplication_{it}\right)$ is a cubic polynomial capturing the elapsed time since a worker first began applying for jobs and $BidNumber$ captures the intensity of application behavior over this period. In this setting, both the bid number and the time since the first job application can be considered running variables. All workers' bid rates tend to decline over the course of their job search prior to the first hire.

[29] With 14,765 applications during this window, there are about 8.3 observations per worker, enough to separately identify a worker's fixed effect and pre-period bidding behavior from the agency treatment effect.

[30] These findings are robust to also including job-category fixed effects (Columns 4 and 5), and using a 3-day rather than a 4-day window (Column 6). Column 7 includes job-category fixed effects and a 2-day window. The estimated agency effect is 3.8%, similar to the other specifications with job-category fixed effects.

the Oaxaca-Blinder agency premium on *Bids* provides an estimate of the general agency treatment effect, controlling for any omitted variables observed by employers and correlated with agency affiliation.[31]

The first step is to use the Oaxaca-Blinder procedure to estimate the agency premium for workers' bids. The mean difference in log bids between affiliates and non-affiliates is 0.204, of which 26.7 percent of the gap is attributable to agency affiliation. This means that the estimated agency bid premium from the Oaxaca-Blinder decomposition is around 5.5 percent for all workers applying for jobs. Because the set of workers who switch into an agency may differ from the other non-affiliates, the estimated coefficients from the Oaxaca-Blinder equations are used to calculate an implied agency bid premium of 6.5 percent for the switchers when using the characteristics of agency switchers in their non-affiliate period. Using the smallest and largest estimates from Table 4, the agency brand itself is responsible for between (.0383/.065) = 59 percent to (.0525/.065) = 81 percent of the bid gap from the decompositions.

As a back of the envelope comparison, from Table 3, Panel B, Column 1, the estimated wage premium on the first job due to agency affiliation is 11.2 percent. If the agency brand itself is responsible for between 59 and 81 percent of the premium estimated from the decompositions, then the hourly wage premium on the first job due to agency affiliation can be estimated to be between 6.6 percent and 9.0 percent.

4.3 Job outcomes for workers on the first job

If agencies are effectively communicating that inexperienced affiliates are relatively high quality, then this should be reflected in measures of productivity on the job. The specification in Table 3, Panel C includes dummy variables for the expected job duration, which means that the outcome variable of the log number of hours worked on a job can be viewed as a measure of performance, since the estimation captures employers' option value to terminate the contract at any point. The fact that affiliates' jobs last longer suggests that affiliates' productivity is higher than non-affiliates' productivity.

Panel D of the same table provides further evidence that affiliates deliver output that is more valued by employers. Once a job is completed, employers are asked whether or not it has been a success. 62 percent of affiliates' first projects are considered successful, compared to 57 percent of non-affiliates' first projects. In Administrative Support, and Web Development, affiliates first jobs are on average 6 percentage points more likely to be successful. In each column in Panel D, over 100 percent of the difference in the probability of success between affiliates and non-affiliates can be attributed to affiliation rather than other observable characteristics.

[31] This estimate is not the average treatment effect of affiliation, since the switchers into agency are not a randomly chosen group of inexperienced workers. This treatment effect can be interpreted as the effect of agency affiliation for a group of workers that were selected into being offered affiliation.

The final panel in Table 3 presents the feedback scores received by affiliates and non-affiliates on their first jobs for those workers who had jobs where the employer subsequently reported whether or not the job was successful and left a feedback score for the worker. Overall, and in Administrative Support and Web Development, affiliates receive slightly higher feedback than non-affiliates. The gap in the feedback score is relatively small compared to the difference in the reported success rates for affiliates and non-affiliates, and the feedback premium that can be associated with affiliation is two to four percent of the average non-affiliates' score. Since the decomposition in Panel E does not control for the differences in average hourly wage rates, this offers some indication that feedback reflects employers' overall sense of value for money.

This analysis of outcomes on the first job is consistent with the hypothesis that inexperienced affiliates are higher quality than inexperienced non-affiliates and also that the inexperienced affiliates who are hired are correctly viewed as more productive than inexperienced non-affiliates. Accordingly, employers are willing to offer inexperienced affiliates higher hourly wages on their first job, and their jobs are more likely to be successful than otherwise similar inexperienced non-affiliates.

5 Empirical Analysis of Workers' Subsequent Careers

The fact that affiliates earn more per hour and work for more hours on the first job explains a large share of the agency earnings premium seen for employed workers in Table 2, Panel B. In fact, first job outcomes are responsible for the bulk of the overall lifetime earnings agency premium. Some evidence of this can be seen in Table 2, Panel C, which concerns the subset of these workers that go on to be hired again in the data—that is, workers who are hired at least twice in the sample. The earnings decomposition for these workers reveals that the ongoing premium among the workers selected into at least two jobs is much reduced compared to the premium seen among all workers (Panel A) and the workers employed for at least one job (Panel B). The earnings gap for re-employed workers has decreased to $1,825 overall, and to $721 and $927 for workers in Administrative Support and Web Development, respectively. This means that, after only the first job, the ongoing agency earnings premium has fallen to 31 percent overall, 43 percent in Administrative Support and to only 17 percent in Web Development.[32]

Table 5 provides further additional evidence confirming that the ongoing agency affiliation earnings premium diminishes for workers who are hired repeatedly. This table studies all oDesk workers located

[32] The lifetime earnings for affiliates in Web Development hired for at least two jobs and excluding the first job (Panel C) are actually lower on average than those who are hired for at least one job when the earnings on the first job are included (Panel B). This is consistent with the evidence that a large majority of affiliates in this job category go on to be hired for at least two jobs, consistent with their succesful average performance on the first job.

outside of the U.S., who apply for hourly jobs between August 1, 2008 and December 28, 2009, and who have been hired for at least three previous jobs. The sample consists of 4,594 non-affiliates and 1,777 affiliates.[33] Among these workers, non-affiliates actually earn higher hourly wages than affiliates overall and in Administrative Support and Web Development. In addition, non-affiliates have had a larger number of prior jobs, on average. Investigating why there is no affiliation premium among experienced workers sheds light on why agencies exist.

5.1 The probability of being hired for subsequent jobs

It is informative, first, to turn to the question of which workers go on to be hired for subsequent jobs. The probability that workers employed for a first job are hired for a second job is analyzed in Table 6. 65 percent of non-affiliates hired for one job are hired for a subsequent job, and 75 percent of affiliates are rehired. Panel A presents the results of a linear probability model where the dependent variable is an indicator of whether a worker was hired for a second job. Controls for many worker-level characteristics, including country and job category fixed effects, are included. The coefficient on the agency affiliation indicator shows that affiliates are significantly more likely to be hired for a second job than similar non-affiliates.[34] The fact that the probability of finding a second job is higher for affiliates than for non-affiliates among workers hired for a first job is consistent with the results in the last three panels of Table 3 that suggest that, for workers that have completed one job, by the end of that job, affiliates are viewed as higher quality than non-affiliates.

By the end of the first job, employers have more information about the quality of all workers, based on the demonstrated quality of the output from that job. The data offer some direct evidence on how this information is related to the subset of affiliates and the subset of non-affiliates that are selected into subsequent jobs.

Table 6, Panel B includes in the regression workers' first job feedback scores and the interaction of these scores with a worker's affiliation status.[35] The feedback score is positively and significantly associated with re-hire. However, the most interesting estimate is the coefficient on the interaction of feedback score with affiliation status. For non-affiliates who received a feedback score, a score that is one point higher increases

[33] There is a larger number of workers in this analysis because it includes workers who applied for their first job before August 1, 2008, not just the inexperienced workers who made their first bid after this date.

[34] Affiliates are an average of 11.4 percentage points more likely than non-affiliates to be re-employed, and affiliates in Administrative Support and Web Development are 16.3 percentage points and 8.2 percentage points more likely to be re-employed, respectively.

[35] Also included in this regression are an indicator variable for whether the feedback score is missing and this variable interacted with affiliation status. This means that the coefficient on the feedback measure can be interpreted as the marginal effect on the probability of re-hire of a one-point higher feedback score (out of a possible 5) among those workers who received a feedback score.

the mean probability of finding a second job by between 10 and 12 percentage points. For affiliates, the increase in the probability of re-hire associated with a one point-higher feedback score is significantly smaller—between 3 and 5 percentage points lower.

These results suggest that employers are more responsive to the feedback score received by non-affiliates when deciding which experienced workers to hire. That is, the feedback score helps employers select good-quality non-affiliates into re-employment, but is less useful in distinguishing between affiliates. This finding is consistent with the hypothesis that the feedback on the first job provides employers with more information for non-affiliates than for affiliates.

5.2 Wage growth between jobs and wage responsiveness to feedback

Table 6, Panel B showed that, among the non-affiliates hired for a first job, only those with relatively good feedback are selected into re-employment. Table 7 studies the hourly wage increases between jobs for the subset of non-affiliates who are hired for at least two, three and four jobs. Column 1 shows that the average hourly wage on the second job for non-affiliates that find at least two jobs is 10 percent higher than on their first job. For non-affiliates hired for at least three jobs, the average hourly wage on the third job is 19 percent higher than on their first job. For those hired for at least four jobs, the average non-affiliate wage by job four is 26 percent higher than on their first job. It is important to note that these hourly wage changes compare the wages earned on the first and fourth jobs by those workers that are hired for later jobs. That is, it excludes the hourly rates earned on the first job by workers that do not go on to the second, third and fourth jobs, respectively. This shows that, on average, the hourly wages of surviving non-affiliates (those that received good feedback scores) are increasing from job to job.

Comparing Columns 1 and 2 shows that the non-affiliates that survive to be hired for four jobs have hourly wage growth between the first and fourth jobs that is significantly larger than the wage growth of surviving affiliates. For affiliates that go on to be hired for at least four jobs, the wage growth between jobs one and four is 18 percent—significantly lower than the increase in wages for non-affiliates that survive to a fourth job. While there is no significant difference in hourly rate changes for non-affiliates and affiliates in Administrative Support, non-affiliates surviving to a fourth job in Web Development have significantly higher wage increases than affiliates. Non-affiliates' wages increase by 20 percent in Web Development between jobs one and four, but wages for affiliates increase by only 11 percent. Faster wage growth for non-affiliates, on average, overall and in Web Development, explains the absence of any agency affiliation wage gap among the experienced workers that have been hired for at least three jobs seen in Table 5.

Table 8 examines the relationship between feedback scores and wage growth controlling for unobserved

worker characteristics by including worker fixed effects. This analysis includes all workers hired during the data period who have completed at least two jobs, resulting in over 42 thousand observations in total, nearly 11 thousand in Administrative Support, and over 14 thousand in Web Development.[36] As shown in each column, an increase in feedback is associated with a positive and significant increase in the hourly wage.

However, as in the case of the relative probability of being re-hired, affiliates' wages are less responsive than non-affiliates' wages to an increase in feedback. As seen in Column 1 of Panel A, an increase of one point in the feedback score is associated with an hourly wage increase of 4.5 percent for non-affiliates overall, but of only 2.2 percent for affiliates overall.[37] In the Web Development job category, shown in Column 3, a one-point increase in feedback is associated with a 2.9 percent increase in hourly wages for non-affiliates, but only a 1.1 percent increase for affiliates. These results offer further evidence consistent with the hypothesis that the feedback score is more informative about non-affiliates' quality than it is about affiliates' quality. Having earned good feedback, a non-affiliate is both able to be re-hired and also earns an hourly rate that is higher than the rate he earned when the information that was public about him suggested he was lower quality. For affiliates, a public signal that he or she is higher quality is not associated with as large an increase in the probability of re-hire or with as large a wage increase.

6 Alternative Intermediation Functions

6.1 There is little evidence of a treatment effect

The analysis in the previous section shows that affiliation correctly signals that inexperienced affiliates will perform better on the first job. After the first job, the feedback score received allows employers to distinguish between non-affiliates: Those with high feedback are more likely to be hired than non-affiliates receiving low scores, and those that go on to find a second job see significantly higher wage growth between jobs than do re-employed affiliates. These findings are consistent with the agency-as-information broker role of intermediation. Could these results also be explained by a direct benefit from agency affiliation that causes affiliates to be more productive than similar non-affiliates?

To investigate this possibility, the analysis asks whether affiliates' career outcomes after the first job are differentially related to worker attributes and/or job characteristics. The benefit of any agency treatment effect is likely to be greatest for workers' with lower levels of observable skills. Similarly, even if an agency

[36] This sample includes those workers with at least two jobs who signed up on oDesk before 8/1/2008, in addition to the non-US workers described in Table 1.

[37] The 2.2 percent increase is the sum of the estimated coefficient for feedback and the estimated coefficient for the interaction between feedback (0.045) and the affiliation indicator variable (-0.023).

treatment effect is uniform across all agency affiliates, the cumulative effect of agency treatment may depend on the duration of the first job if the agency treatment is transmitted from time on the job.

Table 9 presents the results of this investigation. The dependent variable in this analysis is the probability that a worker employed for one job is re-hired during the time period spanned by the data. The first four regressions investigate whether the higher likelihood of re-hire for affiliates varies with workers' educational background, having taken skills tests, or prior work experience outside oDesk. An agency treatment effect might be more salient among workers with relatively little education or experience. However, the results show that the increased probability of re-hire associated with agency affiliation is unrelated to worker experience and education. While, as also seen in Table 6, affiliates are significantly more likely to be hired for a subsequent job, the coefficient on the interaction term of affiliation status and education or experience is insignificantly different from zero, and is often of different signs across columns.[38]

The fifth regression in Table 9 examines the relationship between affiliate success in being re-hired and the initial hourly wage. If a first-job agency treatment effect for inexperienced affiliates is correctly anticipated by employers, it is likely that they would be willing to offer higher wages to those affiliates who will benefit most from the treatment effect, compared to the wages they would offer to otherwise similar non-affiliates. The sixth regression examines whether the duration of the first job is related to variation in the agency premium in the likelihood of future success. If an agency treatment effect arose from on-the-job training or coaching, longer jobs would provide more opportunity for such a treatment effect to occur. In both these regressions, however, the coefficients on the interaction terms are insignificantly different from zero. This suggests that affiliates are as likely to be more successful on the site than non-affiliates whose first jobs are similar in hourly rate and in length, whether the jobs are high- or low-paid, or are short or long in duration.

6.2 Agencies may facilitate team work, but this does not explain the agency earnings premium.

The final regression in Table 9 investigates whether there is a difference in the agency affiliation success premium for workers employed on teams on their first jobs. Working in a team is defined as being employed by an employer who has hired another oDesk worker within a 30 day window of hiring the worker. An inexperienced affiliate who is employed by an employer who has hired a member of the same agency in the same 30 day window is defined as working on an agency team. The estimates show that affiliates employed

[38] The one exception is that overall, the affiliation premium appears to be greater for affiliates who have not taken skills tests. However, for affiliates in Web Development, there is no heterogeneous effect erlated to whether affiliates have taken skills tests.

on an agency team are significantly more likely to be re-hired for a second job, with point estimates ranging from 3.5 and 5.3 percentage points. However, offsetting this positive effect on the probability of re-hire for these workers is the fact that working in any team on the first job has a negative effect on the likelihood of re-hire. This negative effect is significant for workers in Web Development.

Taken together, the results in the final regression in Table 9 raise the possibility that an affiliation premium exists because agencies facilitate team work. For projects that are staffed by teams, workers on teams that are not made up of affiliates of the same agency are less likely to go on to future success on the site. However, agency team-members are not less likely than other agency workers to go on to be re-employed. If, at the same time, non-affiliates and affiliates were similarly likely to work on teams on the first job, then this difference could explain the higher average success rate of agency affiliates.

Table 10, Panel A re-estimates the worker fixed effects analysis of the relationship between wage growth and feedback, controlling for the relationship between teamwork and feedback. Specifically, it includes variables that allow the relationship between feedback and log wages to differ depending on whether a worker was employed on a team and whether the worker was employed on an agency team. Including these controls does not substantively change the finding that non-affiliates wages are significantly more responsive to feedback than the wages of similar affiliates receiving the same feedback.

Teamwork effects are also unable to explain the difference in first job outcomes between affiliates and non-affiliates that were first examined in Table 3. Panels B to E of Table 10 repeat the analysis in the equivalent Panels of Table 3 but also include variables that measure whether workers were employed on teams and on agency teams during their first job. Including these variables in the Oaxaca-Blinder decomposition does not change the conclusions from Table 3 that a large share of the gap in outcomes for affiliates and non-affiliates can be attributed to affiliation rather than any other observable characteristic, including variation in team work.

The results in Table 10 suggest that while agencies may be able to coordinate team work among workers employed by the same employer, this activity is not the main reason for the early-career differences in worker outcomes that are the source of the lifetime earnings agency premium.[39]

[39]It is also possible that factors correlated with agency affiliation enable better worker coordination among teams, rather than the direct effect of agency intermediation. As discussed in more detail in the following subsection, members of the same agency are more likely to have similar skills, live in the same town, and know each other. Even if not members of the same agency, it is quite feasible that they would work together well.

7 Discussion

The data suggest that inexperienced affiliates are, on average, better quality workers than otherwise similar inexperienced non-affiliates. This raises the question of how agencies can screen for quality whereas employers require the certification provided by affiliation to apply the same screening process. The data on worker characteristics available from the administrative data collected by oDesk offer some insight about how agencies are able to do this. Affiliates of the same agency are frequently located in the same city and have similar skills, often having attended classes together at the same educational institutions. This suggests that agencies are able to screen worker quality and offer affiliation only to high-quality workers using the shared offline social ties that pre-date workers' oDesk registration. In doing so, agencies are performing a role that is similar to that played by the experts described in Biglaiser (1993), the certification intermediaries in Lizzeri (1999) and the temporary help supply firms discussed in Autor (2001b), but without incurring additional screening costs.[40]

It is worth note that the type of social ties that are known to play a role in traditional labor markets, such as referral systems through "Old Boy Networks" (Saloner, 1985), also play a role in this setting, conferring an ability to screen for quality based on existing knowledge. In this way, rather than being rendered obsolete by recent developments in communication technology, offline social ties are complementary to online interactions in this setting.

The fact that affiliates of the same agency appear to know each other offline also suggests that the size of any one agency is limited by the boundaries of existing social networks. Furthermore, the reason that agencies are prevalent in the market—inefficiently low levels of hiring of inexperienced workers due to incomplete information about quality—also implies that here are barriers to the entry of new agencies. To start a new agency on oDesk, a high-quality unaffiliated worker has to be fortunate enough to be hired for at least one job in order to have his quality revealed. Only then can he share his reputation among the high-quality members of his offline network when they join the new agency.

8 Conclusion

This paper presents evidence that organizations have sprung as part of the institutional environment in online labor markets to intermediate between employers and workers by providing information about worker quality. Affiliation with one of the many small independent outsourcing agencies on oDesk.com is strongly

[40] In addition, the structure of these intermediaries does not require costly self-selection in order for the signal that they are high-quality to be credible, unlike in Spence (1973). The ability of the agency to screen a given worker appears to depend on the worker being a pre-existing network. A worker chooses to join an agency and pay a fraction of his wages to the agency because it increases the probability of being hired.

positively correlated with success on the site—affiliates lifetime earnings are around four times higher than the earnings of non-affiliates with similar observable skills and characteristics.

This agency-affiliation premium is consistent with an information-provision role because it originates at the start of workers' careers, when information about worker quality is particularly incomplete. Among experienced workers, there is no ongoing agency-affiliation premium. Feedback received on early jobs for workers who are employed appears to substitute for the information contained in agency affiliation. Non-affiliates' likelihood of being re-employed, and their subsequent hourly wages, are more responsive to the feedback scores received on the job than for affiliates, implying that more information is contained in these scores for non-affiliated workers.

One important implication of the findings shown here is that agencies have a large positive impact on both transactions' volume and value by increasing the number of known high-quality workers in the market.[41] By demonstrating how intermediaries have arisen to perform this role, the findings suggest that incomplete information hinders efficient trade in labor-offshoring markets, despite the large amount of digital information that is available to trading partners.[42]

This study complements the large empirical literature on incomplete information in online consumer-product markets, in which the product being sold is analogous to the labor services provided by an oDesk worker.[43] Several other recent related papers study the role of social networks in providing information about online investment quality. Agrawal et al. (2011) suggest that investors sharing personal connections to unsigned music artists are less responsive to others' investment decisions because they have informational advantages about the artist's quality. In their study of the loan market Prosper.com, Freedman and Jin (2010) find that borrower affiliation with a social network is not associated with borrower quality. They propose that this is due to characteristics of the market design, which limit incentives for group founders to grant membership only to good-quality borrowers.[44]

[41] Agencies increase output in two related ways: They increase the expected quality of workers hired on the first job (on the intensive margin). They also increase the number of known high-quality workers, who are more likely to be re-hired for subsequent jobs (on the extensive margin).

[42] According to oDesk.com's senior management, the infrastructure built to accommodate agencies within the oDesk market was not designed to fulfill a quality-signaling role. Rather, the aim was to increase the number of workers on the site by creating incentives for existing workers to encourage new workers to sign up.

[43] Lewis (2011) examines the role of voluntary information disclosure in defining explicit contracts between buyers and sellers regarding the quality of used cars sold on eBay Motors. Luca (2010) shows that restaurant revenues respond more strongly to online restaurant reviews that are more informative. Resnick and Zeckhauser (2002) and Bajari and Hortacsu (2004) discuss the economics of internet auctions and summarize the empirical evidence on the relationship between the information contained in seller feedback and price. Other studies of online labor markets discuss different methods by which information is credibly shared; see Horton (2010) for a discussion of the features of online labor markets. Bagues and Labini (2009) show how mandatory disclosure of quality-relevant worker information affects worker outcomes such as unemployment duration, wages, and job satisfaction.

[44] In the oDesk setting, an agency head has a strong incentive to maintain the average feedback score (and, because of this, affiliate quality) within the agency since he collects a fraction of the revenues earned by all other agency affiliates over their entire oDesk careers.

A further possible implication of the results here, and, specifically, the finding that agencies' primary role is not in providing complementary inputs to increase worker productivity on the job, is that once the employer hires a high-quality worker, tasks can be completed successfully without requiring additional intermediation to increase worker productivity. That is, for the selected jobs posted on the site, the employer and worker do not appear to need any additional inputs from a third-party organization to either coordinate tasks across workers or to increase worker output directly.[45] Even in tasks that are likely to require coordination, such as those tasks performed by teams of Web Programmers, the oDesk marketplace appears to successfully disintermediate managers.

Two factors constrain agencies' growth and, in doing so, agencies' ability to fully resolve trade frictions arising from incomplete information about inexperienced workers. Members of the same agency tend to share many observable characteristics and appear to know each other offline. This suggests that offline social ties among groups of remote workers enable quality screening.[46] The size of any one agency is thereby restricted by the size of each agency head's personal offline network. The mechanisms outlined in the paper also indicate that there are limits to the number of potential new agencies. Since affiliation is fixed throughout a worker's career, new agencies can be formed only by the relatively small number of good-quality non-affiliates who are fortunate enough to be hired and, as a result, have their quality revealed.[47] Therefore, outsourcing agencies' growth may be outpaced by both the growing demand for offshore services and the corresponding demand for information about service providers' quality.

[45] While recent work has established that local services that are complementary to internet use and labor skills increase the wage gains from internet adoption across the U.S. (Forman et al., 2012), providing complementary services that increase on-the-job productivity is not the primary role of the intermediaries studied here. This is likely due to the fact that the oDesk institutional framework, itself, provides many tools to allow this.

[46] Montgomery (1991) describes how referrals from current employees connected to a social network lead to subsequent hiring from the same network. Casella and Hanaki (2006, 2008) show how costly signaling of worker quality can substitute for finding employment through a personal connection. Our data mirror the assumption made in Saloner (1985) that "Old Boy Networks" have pre-existing information about worker quality. These social ties enable quality signaling.

[47] Over the time period studied, the number of hires made on oDesk grew at an average of 10 percent per month. However, the share of jobs for which inexperienced workers were hired fell by an average of 0.2 percent per month.

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Appendix 1: A framework illustrating the role of agencies

This appendix presents a model to illustrate the empirical predictions stated in the text. The following subsections describe the game and characterize a steady-state perfect Bayesian equilibrium from which empirical relationships are derived.

A.1 Game Structure

There are three types of players: workers, employer firms, and an agency.[48]

Workers. Worker quality (productivity) is given by θ, which is unknown to both workers and firms when they enter the market. With probability h, a new worker is high-quality, θ H, and with probability $-h$, a new worker is low-quality, θ L, where $H > L$. Quality θ is publicly revealed after the first employment spell. An exogenous number, S, of the E arriving workers is connected to the agency. Each worker has a per-period outside option w_0, which is normalized to . Each worker can be employed for a maximum of two periods, and the worker's objective is to maximize lifetime earnings.

Firms. There are N identical employers (firms) that hire a single worker in each period. Each employer combines labor input with other inputs to produce an output valued at the worker's quality level, θ. Firms' profits in each period are π θ $\theta - c - w_\theta$, where w_θ is the endogenously determined wage of the worker hired, and $c >$ are production costs. Long-term contracts between firms and workers are not enforceable.

Agency. The agency owns a screening technology that can determine the quality of S inexperienced workers arriving in the market, where S is small enough that the total number of (experienced and inexperienced) agency-affiliated workers in the market in each period is less than the number of firms.[49] The agency chooses whether to offer affiliation to each inexperienced worker. Workers offered agency affiliation choose whether to accept the offer or to join the pool of non-affiliated new workers. Agency affiliation lasts throughout the worker's career.[50] The agency collects an endogenously determined fraction $-\beta$ of each agency affiliate's lifetime earnings, and the agency's objective is to maximize profits.

The timing of the game in each period is as follows: (1) N firms post a job opening. (2) E new workers, each with a per-period outside option w_0, enter the marketplace: S of these new workers are screened by the agency, which offers agency affiliation to a subset of workers under the revenue-sharing agreement defined by the contract β. (3) Workers offered agency affiliation choose whether to affiliate. In

[48] Including only one agency mirrors the hypothesis that any one agency has a local monopoly, in that it is able to screen workers that are unconnected to any other agency.

[49] S is assumed to be exogenous since the boundaries of an agency are often determined by offline networks and, hence, rely on pre-existing ties. Offline interaction confers the ability to screen.

[50] This corresponds to the oDesk environment. Agency affiliates leaving an agency have their personal work histories removed from their profile.

equilibrium, because workers observe S but not θ, it will be the case that θ L workers who are screenable can determine their type. (4) The N firms in the market hire one of: an experienced worker in the second period of his working life, known to be of either high or low quality; a new agency-affiliated worker; or a worker from the pool of inexperienced unaffiliated workers. The wages offered are: w_H, w_L, w_A, and $w_{\overline{\theta}}$, respectively. Each worker offered a job decides whether or not to accept it. The probability that an unaffiliated and inexperienced worker is employed in the first period of his life is given by p. (5) Production takes place; wages are paid to employed workers; the agency collects its revenues; and the quality of all newly-employed workers is revealed.

A.2 A Perfect Bayesian Equilibrium

There is a perfect Bayesian equilibrium of this game where agencies offer affiliation to high-quality screened workers. Thus, agency affiliation signals to firms that inexperienced affiliated workers are high-quality.[51,52]

Equilibrium Strategies and Beliefs

Workers. For each of the $E - S$ inexperienced and unscreened workers entering the market, employment in the first period of reveals their type and, if they are high-quality, results in a wage of w_H in period two. $w_{\overline{\theta}}$, the wage for inexperienced non-affiliates, is set by these workers' participation constraints by the lifetime zero-rent condition $p\ w_{\overline{\theta}}$ hw_H $- p\ w_0$ w_0 . This means the wages of inexperienced non-affiliates is below the per-period reservation wage $w_{\overline{\theta}} < w_0$.[53]

Screened workers that are offered agency affiliation learn that they are high-quality. By offering to work at a wage of $\left(w_{\overline{\theta}} - \varepsilon\right)$ in the first period, these workers could signal to firms that they are high-quality, guaranteeing employment in both periods of their working lives and a wage of w_H in the second period. Hence, a screened worker offered affiliation has a lifetime payoff of $\left(w_{\overline{\theta}} - \varepsilon \quad w_H\right)$ if he does not affiliate with the agency. A firm is willing to pay w_H for an agency affiliate in each period in this equilibrium, so a worker's lifetime earnings on joining the agency are βw_H. The agency sets β so that these workers are indifferent between affiliating and signalling their quality with a low wage bid in the first period: βw_H $w_{\overline{\theta}} - \varepsilon$ w_H. It is assumed that indifferent workers offered affiliation choose to affiliate with the agency.

[51] There are three indifference conditions that hold in this equilibrium: (1) Workers unconnected to the agency are indifferent between entering oDesk and working off the platform; (2) firms are indifferent between hiring a worker known to be high-quality, hiring an inexperienced agency affiliate, and drawing from the pool of workers of unknown quality; and (3) high-quality screened workers are indifferent between affiliating with the agency and remaining independent.

[52] The variables w_H, $w_{\overline{\theta}}$, w_A, β, D, and $\overline{\theta}$ are functions of the model parameters, and the endogenous values of p and E can take any values in a bounded set. It is assumed that $H - \frac{(1-h)}{(1+h)}(H - L) > c$, $E > \frac{N-2hS}{1+h}$, and $N > h + 2hS$.

[53] In this equilibrium, wages adjust so that $w_{\overline{\theta}} + hw_H = 0$, whatever the number of workers in the pool and, hence, the probability a given worker in the pool is employed, p. This means p and, hence E, are not determined.

Since the equilibrium wage for workers drawn from the pool is $w_{\overline{\theta}} < w_0$, inexperienced unscreened workers who remain unaware of their type and are not offered employment in the first period drop out of the market. They have only one more chance to be employed, and their lifetime earnings would, thus, be negative. Similarly, inexperienced screened workers who learn that they are low-quality when they are not offered agency affiliation drop out of the market. Because no screenable workers join the pool, the expected quality of a worker drawn from the pool mirrors the overall workforce, $\overline{\theta}$ $- h\ L$ hH.

Firms. Each firm believes that an affiliated worker is high-quality with probability , and is willing to offer the wage w_A w_H to inexperienced affiliates. If a firm ever observes a low-quality affiliate, it believes that all agency workers are high-quality with probability zero. Each of the N firms would prefer to employ known high-quality workers and new agency affiliates. N is assumed to exceed the number of known high-quality workers in the market, including new affiliates, so the equilibrium wage for each of these workers is such that firms are indifferent between hiring these workers at the wage w_H and drawing from the pool at the wage $w_{\overline{\theta}}$. The size of the inexperienced-worker pool is sufficiently large such that $w_{\overline{\theta}}$ is makes an inexperienced worker in the labor pool is indifferent between taking the job offer and remaining unemployed in the first period of his life. The firm is assumed to make non-negative profits in expectation when drawing from the pool.[54] This means that the wage of known high-quality workers, w_H, such that π_H $\pi_{\overline{\theta}}$; that is, $H - c - w_H$ $\overline{\theta} - c - w_{\overline{\theta}}$.

Agency. The agency believes that as long as all affiliates in the past have been high-quality, then w_A w_H for each employed affiliate. The agency screens S new workers and, given that it has a sufficiently high discount rate, offers affiliation only to the hS workers who are high-quality under a contract where the agency collects $- \beta$ of affiliates' wages.

Payoffs

Workers. New agency affiliates are hired with probability in each period. They receive positive lifetime payoffs equal to βw_A βw_H. The expected payoffs are $p\ w_{\overline{\theta}}$ w_H $>$ for a high-quality unaffiliated worker and $p\ w_{\overline{\theta}}$ $<$ for a low-quality unaffiliated worker.

Firms. The condition that firms are indifferent between hiring from the pool and a known high-quality worker or new affiliate, together with the zero expected lifetime payoff of unscreened workers, gives: w_H $\frac{(1-h)}{(1+h)}\ H - L$, and $w_{\overline{\theta}}$ $-h\frac{(1-h)}{(1+h)}\ H - L$. That is, w_A $w_H > w_{\overline{\theta}}$, since $H > L$; equilibrium wages are positively correlated with expected worker productivity. The expected payoff for each firm is: π $H - c - \frac{(1-h)}{(1+h)}\ H - L$.

[54] This assumption reflects the fact that some buyers do hire inexperienced workers in the data.

Agency. Since there are hS affiliates employed in the market, agency revenues in each period are $hS \quad -\beta \ w_H > \ .$[55] The agency's screening technology allows it to earn positive profits.

Efficiency Implications due to the Agency

The net output in the economy in each period is total production less total fixed costs, where the production of each firm depends on the quality of the hired worker.[56] A fraction of firms employ known high-quality workers or new agency affiliates; the remaining D firms draw workers from the pool of unscreened workers. That is, the number of workers hired from the pool in each period, D, is equal to the number of firms, N, less the number of known high-quality workers remaining in the labor force from the previous period, and less the number of new agency affiliates. When $N > \ hS \quad hD$, D is determined by the equation $N - \ hS - hD \quad D$. This gives $D \quad \frac{N-2hS}{1+h}$. Of the draws from the pool, $\quad -h \ $ are expected to be low-quality. Hence, net output in each period is:

$$Y \quad NH - \left(\frac{-h}{h}\right) \ N - \ hS \quad H - L \ - Nc. \tag{3}$$

Setting $S \quad$ in equation (3) denotes net output in an economy with no agency. Comparative statics with respect to S provide efficiency implications. The first derivative of equation (3) with respect to S, the number of screenable workers, is positive since $h \in \quad ,$ $\quad$ and $H > L$. Relative to a market outcome with no agency, the presence of an agency in this equilibrium increases allocative efficiency in the economy by reducing incomplete information about worker quality, ensuring that more jobs are taken by high-quality workers.[57]

Empirical Predictions

This equilibrium provides a theoretical motivation for the worker histories observed in the data. The first set of equilibrium predictions relates to the first job. Since employers expect that agency affiliates are higher-quality than unscreened workers on average, affiliates are predicted to receive higher initial wages than non-affiliates (shown empirically in Section 4.2). Agency affiliates' first projects are also more likely to be successful (shown in Section 4.3). In addition, agency affiliates are predicted to be hired immediately,

[55] Solving this gives $Revenue = 2hS\,(1-\beta)\,w_H = 2hS\left(1 - \frac{(1-h)}{2} + \epsilon\right)\left(\frac{(1-h)}{(1+h)}\,(H-L)\right)$, where $\epsilon = \frac{\varepsilon}{2w_H}$.

[56] It is assumed that there are no additional fixed costs associated with agency screening. This is reasonable in this setting since the ability to screen appears to be associated with pre-existing social connections.

[57] In the case that $H - \frac{(1-h)}{(1+h)}\,(H-L) < c$, the presence of the agency prevents complete market unravelling as long as $H - c > 0$. The relevant indifference condition for the firm in this case would be that $\pi_H = 0$ and, in each period, all of the $2hS$ agency members would be employed at a wage $w_A = w_H = H - c$. Hence, $(N - 2hS)$ firms would choose not to produce and no unaffiliated workers would be employed. In this case, the increase in output created by the agency presence in the market is $2hS\,(H-c) > 0$.

whereas non-agency affiliates experience unemployment with a non-zero probability (affiliates are shown to be more likely to be hired in Section 4.1).

The second set of predictions relates to outcomes on subsequent jobs. Agency affiliates are more likely to find a second job (Section 5.1). This is because a fraction of the workers who are unscreened by the agency and do find a first job are revealed to be low-quality and are, thus, not hired a second time. Only the fraction of unscreened workers who are high-quality are hired in the second period of their lives. Since all agency affiliates are high-quality in equilibrium, all are rehired. Finally, agency affiliates are predicted to experience no wage growth, but those non-affiliated workers who are rehired experience wage growth of $w_H - w_{\overline{\theta}} >$ between their first and second job (Section 5.2). This is due to a selection effect and an employer learning effect. The L type non-affiliates leave the market, whereas the H type non-affiliates catch up to the agency-affiliated workers in their cohort. Each of these predictions is borne out in the data.

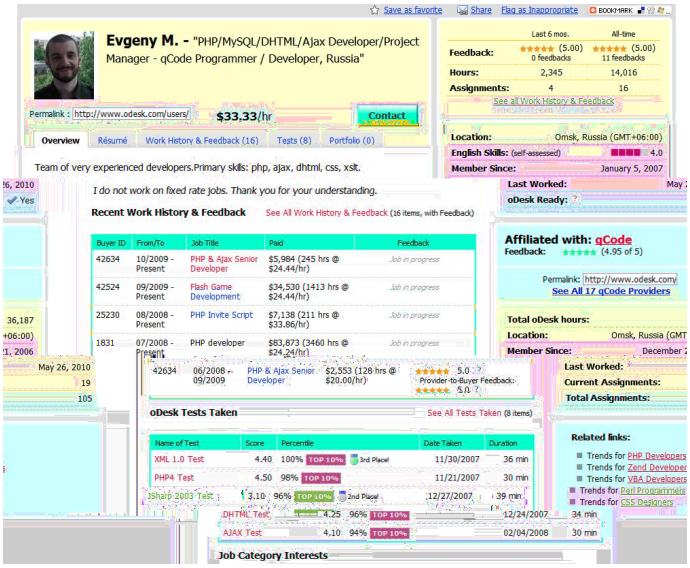

Figure 1: A sample worker profile. The feedback score is in the top right corner, and the agency brand appears as "qcode." The work history on recent jobs is visible in the middle of the screen.

Table 1: Summary Statistics

	All Workers	Non-affiliates	Affiliates	Sig. Diff. : (2) and (3)	All Workers	Non-affiliates	Affiliates	Sig. Diff. : (6) and (7)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: Workers applying for at least one job				
						Non-US workers		
Number of workers applying for at least one hourly job	125,219	109,934	15,285		83,029	69,610	13,419	
Number of workers in the United States	42,190	40,324	1,866	***	0	0	0	
Number of workers in India/Pakistan	25,084	18,220	6,864	***	25,084	18,220	6,864	***
Number of workers in Russia/Ukraine	3,332	2,310	1,022	***	3,332	2,310	1,022	***
Number of workers in The Philippines	26,433	24,488	1,945	***	26,433	24,488	1,945	***
Number of workers in Administrative Support	40,657	37,703	2,954	***	25,221	22,645	2,576	***
Number of workers in Web Development	24,799	18,365	6,434	***	20,584	14,667	5,917	***
				Panel B: Workers hired for at least one job				
						Non-US workers		
Number of workers hired for at least one hourly job	12,766	8,418	4,348		10,103	6,023	4,080	
Number of workers in the United States	2,663	2,395	268	***	0	0	0	
Number of workers in India/Pakistan	3,470	1,411	2,059	***	3,470	1,411	2,059	***
Number of workers in Russia/Ukraine	851	385	466	***	851	385	466	***
Number of workers in The Philippines	2,962	2,319	643	***	2,962	2,319	643	***
Number of workers in Administrative Support	3,854	2,952	902	***	2,946	2,117	829	***
Number of workers in Web Development	3,575	1,581	1,994	***	3,210	1,293	1,917	***

Notes: The sample consists of unique workers whose first job applications occurred between 8/1/2008 and 12/28/2009. Workers are assigned to job categories based on the job category of their first hourly job application. Triple asterisks indicate that two-sample t-tests with unequal variances reject equality of the means for the non-affiliates' and affiliates' at the 1% level. The proportion of affiliates joining oDesk over time is relatively constant, so these measures are not affected by large initial cohorts of affiliates or changing cohort composition over time. Columns 1 to 4 summarize all new oDesk workers applying for (Panel A) and being hired for (Panel B) their first hourly job in the sample window. Columns 5 to 8 summarize the subset of all new workers applying for and being hired for their first job who are located outside the United States.

Table 2: Career Wages By Affiliation Status, Workers Outside of the US

	Non-affiliates	Affiliates		Non-affiliates	Affiliates		Non-affiliates	Affiliates	
	All Job Categories			Administrative Support			Web Development		
	(1)	(2)		(3)	(4)		(5)	(6)	
Panel A: Career earnings for all job applicants									
Observations	69,610	13,419		22,645	2,576		14,667	5,917	
Total career earnings through 8/14/2010	303	1944	***	198	1010	***	510	2426	***
Good english skills, indicator	0.53	0.79	***	0.55	0.80	***	0.50	0.79	***
Bachelors degree or higher, indicator	0.24	0.32	***	0.27	0.35	***	0.22	0.32	***
Skills tests taken, indicator	0.38	0.42	***	0.39	0.42	***	0.40	0.45	***
Earnings gap		1641			811			1916	
Percentage of earnings gap attributed to affiliation from Oaxaca-Blinder decomposition		78%			88%			75%	
Affiliation Earnings Premium		422%			360%			280%	
Panel B: Career earnings for workers who are hired at least once									
Observations	6,023	4,080		2,117	829		1,293	1,917	
Total career earnings through 8/14/2010	3081	5877	***	1922	2805	***	5090	6924	***
Good english skills, indicator	0.86	0.82	***	0.90	0.89		0.79	0.79	
Bachelors degree or higher, indicator	0.42	0.36	***	0.48	0.42	***	0.35	0.33	
Skills tests taken, indicator	0.71	0.55	***	0.74	0.60	***	0.67	0.53	***
Earnings gap		2796			883			1833	
Percentage of earnings gap attributed to affiliation from Oaxaca-Blinder decomposition		61%			113%			75%	
Affiliation Earnings Premium		55%			52%			27%	
Panel C: Career earnings for workers who are hired at least twice									
Observations	3518	2768		1300	648		726	1250	
Total career earnings net of earnings on the first and sec	3265	5090	***	2211	2932	***	5374	6301	*
Good english skills, indicator	0.93	0.88	***	0.95	0.93	**	0.87	0.86	
Bachelors degree or higher, indicator	0.44	0.39	***	0.50	0.44	**	0.38	0.36	
Skills tests taken, indicator	0.79	0.63	***	0.80	0.64	***	0.77	0.62	***
Earnings gap		1825			721			927	
Percentage of earnings gap attributed to affiliation from Oaxaca-Blinder decomposition		56%			132%			100%	
Affiliation Earnings Premium		31%			43%			17%	

Notes: The sample consists of unique workers whose first job applications occurred between 8/1/2008 and 12/28/2009. Workers are assigned to job categories and agency affiliation status based on the job category of their first hourly job application. Asterisks (double asterisks) [triple asterisks] indicate that two-sample t-tests with unequal variances reject equality of the means for the non-affiliates' and affiliates' at the 10% (5%) [1%] level. Earnings measures are calculated between the time of initial job application and August 14, 2010. The proportion of affiliates joining oDesk over time is relatively constant, so these measures are not affected by large initial cohorts of affiliates or a changing composition of affiilates and non-affiliates. The earnings affiliation premium is calculated as the share of the earnings gap that can be attributed to agency affiliation divided by the average earnings for non-affiliates.

Table 3: The Affiliation Wage Premium and Productivity Differences on the First Job

	All Job Categories (1)	Administrative Support (2)	Web Development (3)
Panel A: Dependent Variable is Probability of Being Hired for At Least One Job (Sample is Job Applicants)			
Data:			
Number of Non-Affiliates	69,610	22,645	14,667
Number of Affiliates	13,419	2,576	5,917
Mean Probability of First Hire: Non-Affiliates	0.087	0.093	0.088
Mean Probability of First Hire: Affiliates	0.304	0.322	0.324
Mean Difference in Probability of First Hire	0.218	0.228	0.236
Decomposition Results:			
% Due to Agency Affiliation, Unexplained by Characteristics	78.0%	83.6%	74.4%
Agency Affiliation Premium	195.4%	205.0%	199.5%
Panel B: Dependent Variable is Log Wage on the First Job (Sample is Workers who are Hired)			
Data:			
Number of Non-Affiliates	6,023	1,779	1,374
Number of Affiliates	4,080	693	1,989
Mean Log Hourly Wage: Non-Affiliates	1.387	0.491	2.144
Mean Log Hourly Wage: Affiliates	1.863	0.558	2.325
Mean Difference in Log Hourly Wage between Affiliates and Non-affiliates	0.475	0.067	0.181
Decomposition Results:			
% Due to Agency Affiliation, Unexplained by Characteristics	32.6%	246.9%	92.0%
Agency Affiliation Premium	15.5%	16.5%	16.7%
Panel C: Dependent Variable is Log Hours on the First Job (Sample is Workers who are Hired)			
Data:			
Number of Non-Affiliates	6,023	1,600	1,192
Number of Affiliates	4,080	632	1,740
Mean Log Hours on First Job: Non-Affiliates	3.118	3.169	3.123
Mean Log Hours on First Job: Affiliates	3.659	3.492	3.571
Mean Difference in Log Hours between Affiliates and Non-Affiliates	0.541	0.323	0.447
Decomposition Results:			
% Due to Agency Affiliation, Unexplained by Characteristics	62.1%	111.1%	54.7%
Agency Affiliation Premium	33.6%	35.9%	24.5%
Panel D: Dependent Variable is Success Reported on the First Job (Sample is Workers who are Hired)			
Data:			
Number of Non-Affiliates	5,265	1,600	1,192
Number of Affiliates	3,603	632	1,740
Mean Frequency of Reporting Successful Project: Non-Affiliates	0.574	0.527	0.587
Mean Frequency of Employer Reporting Successful Project: Affiliates	0.618	0.584	0.643
Mean Difference in Success Frequency between Affiliates and Non-Affiliates	0.044	0.057	0.055
Decomposition Results:			
% Due to Agency Affiliation, Unexplained by Characteristics	136.8%	116.0%	198.6%
Agency Affiliation Premium	10.5%	12.5%	18.6%
Panel E: Dependent Variable is Feedback Received on the First Job (Sample is Workers who are Hired)			
Data:			
Number of Non-Affiliates	4,477	1,324	1,041
Number of Affiliates	3,092	539	1,491
Mean Feedback Score: Non-Affiliates	4.380	4.372	4.368
Mean Feedback Score: Affiliates	4.382	4.412	4.377
Mean Difference in Feedback Score between Affiliates and Non-Affiliates	0.003	0.040	0.009
Decomposition Results:			
% Due to Agency Affiliation, Unexplained by Characteristics	2600.8%	386.9%	1133.0%
Agency Affiliation Premium	1.8%	3.5%	2.3%

Notes: An observation in Panel A is a unique worker who applies for at least one hourly job between 8/1/2008 and 12/28/2009. The dependent variable in Panel A is an indicator for whether the worker is hired for at least one job. An observation in Panels B through E is a unique worker on the first job, for those whose first job occurs between 8/1/2008 and 12/28/2009. The dependent variable in Panel B is the log of the hourly wage on the first job. In Panel C, the dependent variable is the log of the number of hours worked on the first job. The dependent variable in Panel D indicates whether the employer reports the project is successful on an internal survey collected after the job ends. The dependent variable in Panel E is the feedback score received by the worker on the first job. Differing numbers of observations between the panels reflect jobs that are ongoing without a recorded success or feedback measure. For models with a binary dependent variable (Panels A and D), the decompositions are computed from the "pooled model" because this baseline has better properties for discrete dependent variables. The decompositions in other panels use the non-affiliate "coefficients" as the base case. All specifications contain controls for job characteristics, including a full set of project duration and weekly expected hours interactions and the number of alpha-numeric characters in the job opening description. The set of worker characteristics includes dummy variables for education levels, a dummy for good english skills, years of pre-oDesk experience, a dummy for programming experience, scores on various oDesk skills tests, revenues from fixed-price contracts before the first hourly job, and the number of hires on fixed-price jobs. Month dummies account for differences in cohorts, including right-censoring propensities for ongoing jobs where relevant. All specifications contain fixed effects for each country, and Column 1 contains job category fixed effects. The agency affiliation premium is calculated in two different ways, depending on whether the dependent variable is in logarithms. For dependent variables in logarithms, the agency affiliation premium is just the estimated

Table 4: The Effect of Agency Affiliation on Log Hourly Wage Offers for Agency Switchers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post-Affiliation	0.0468**		0.0456**	0.0391*	0.0386*	0.0525**	0.0383*
	(0.021)		(0.021)	(0.020)	(0.020)	(0.023)	(0.023)
Placebo Date in Job Application History		-0.0193	-0.0149		-0.0073		
		(0.022)	(0.022)		(0.021)		
Window in Days Before and After Affiliation Switch	4	4	4	4	4	3	2
Worker Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Job Category Fixed Effects	No	No	No	Yes	Yes	No	Yes
Number of workers	1770	1770	1770	1770	1770	1737	1697
Observations	14,765	14,765	14,765	14,765	14,765	12,722	10,423
R-squared	0.858	0.858	0.858	0.865	0.865	0.865	0.879
Oaxaca-BlinderWage Offer Premium for Switchers	0.0651	0.0651	0.0651	0.0651	0.0651	0.065	0.0638

Notes: Robust standard errors clustered by worker in parentheses, *** p<0.01, ** p<0.05, * p<0.1. The sample is workers who join oDesk as non-affiliates who switch their affiliation status by joining an agency prior to their first date of employment. Columns 1 to 5 use a four-day window around the date that the worker changes affiliation status. Columns 6 and 7 use three and two day windows, respectively. All specifications include controls for the job application number and a cubic polynomial measuring the elapsed time since the worker's first job application. The variable Post-Affiliation is an indicator that the worker has switched into an agency, meaning that the worker's profile as an affiliate identification. The placebo date in the bidding history is generated via a uniform random as a false Post-Affiliation indicator set equal to 1 between 24 and 60 hours prior to the actual switch time-stamp. The Oaxaca-Blinder wage offer premium for switchers is calculated by recovering the coefficients of the Oaxaca-Blinder decomposition using the log of the wage offer as the dependent variable. With these coefficients, the premium for agency switchers is calculated using the characteristics of the set of switchers in the sample. The overall gap in log wage offers is 0.204, of which 26.7 percent is unexplained, for an overall wage offer premium in the entire sample of 0.545.

Table 5: Summary Statistics for Experienced Workers

	Non-Affiliates	Affiliates		Non-Affilliates	Affiliates		Non-Affilliates	Affiliates	
	All Job Categories			Administrative Support			Web Development		
Log Hourly Rate	2.055	1.922	***	1.08	0.923	***	2.43	2.27	***
	(0.866)	(0.895)		(0.743)	(0.893)		(0.621)	(0.645)	
Good English Skills Dummy	0.945	0.935		0.971	0.966		0.939	0.930	
	(0.228)	(0.247)		(0.167)	(0.181)		(0.240)	(0.255)	
BA Degree or Higher	0.375	0.455	***	0.474	0.50		0.325	0.452	***
	(0.484)	(0.498)		(0.500)	(0.501)		(0.469)	(0.498)	
Number of Total Hires	11.242	7.615	***	10.25	8.80	***	13.37	7.926	***
	(11.662)	(5.806)		(9.941)	(7.098)		(14.225)	(6.338)	
Feedback Score	4.487	4.535	**	4.517	4.549		4.447	4.529	***
	(0.659)	(0.685)		(0.654)	(0.695)		(0.665)	(0.690)	
Number of Workers	4594	1777		1216	473		2624	1133	

Notes: The sample is experienced workers with three or more total hires and non-zero feedback who are hired for their third or more job before 12/28/2009. Standard deviations in parentheses below. Triple (double) asterisks indicate that two-sample t-tests with unequal variances reject equality of the means for the non-affiliates' and affiliates' at the 1% (5%) level.

Table 6: The Probability of Finding a Second Job

	All Categories (1)	Admin Spport (2)	Web Development (3)
Observations	10103	2472	3363
Mean of Dependent Variable: Non-Affiliates	0.647	0.674	0.634
Mean of Dependent Variable: Affiliates	0.750	0.838	0.73
Panel A. Estimates without first-job feedback measures			
Agency Affiliate Indicator	0.114***	0.163***	0.082***
	(0.010)	(0.014)	(0.021)
R-squared	0.130	0.18	0.15
Panel B. Estimates including first-job feedback measures			
Agency Affiliate Indicator	0.231***	0.370***	0.252***
	(0.054)	(0.010)	(0.070)
Feedback on First Job	0.102***	0.113***	0.124***
	(0.00)	(0.008)	(0.011)
Agency Affiliate x Feedback on First Job	-0.028***	-0.050***	-0.042**
	(0.01)	(0.018)	(0.019)
R-squared	0.162	0.220	0.1936

Notes: Panels A and B present the results of an ordinary least squared regression. Robust standard errors clustered by country in parentheses, and *** p<0.01, ** p<0.05, * p<0.1. An observation is a unique worker on his or her first hourly job. The sample includes all workers whose first job occurs between 8/1/2008 and 12/28/2009. The dependent variable is a dummy variable set equal to 1 if a second hourly job is observed prior to August 14, 2010. All specifications are linear probability models and contain controls identical to those entering the Oaxaca-Blinder decomposition of Table 3, Panel B. Panel B also includes an indicator for missing feedback and the interaction of this indicator with affiliate status.

Table 7: Summary Statistics on Wage Changes Between Jobs

	Non-Affiliates	Affiliates		Non-Affilliates	Affiliates		Non-Affilliates	Affiliates	
	All Job Categories			Administrative Support			Web Development		
Mean Percentage Wage Change Between Jobs 1 and 2	0.096	0.071		0.222	0.192		0.027	0.040	
	(0.720)	(0.013)		(0.021)	(0.032)		(0.024)	(0.019)	
Number of workers	4349	3128		1330	575		1043	1522	
Mean Percentage Wage Change Between Jobs 1 and 3	0.194	0.151	**	0.314	0.292		0.122	0.093	
	(0.013)	(0.173)		(0.026)	(0.042)		(0.027)	(0.027)	
Number of workers	2992	2209		970	458		671	1048	
Mean Percentage Wage Change Between Jobs 1 and 4	0.261	0.181	***	0.377	0.351		0.197	0.113	**
	(0.015)	(0.021)		(0.030)	(0.050)		(0.022)	(0.033)	
Number of workers	2163	1681		736	373		488	770	

Notes: Summary statistics on the change in log wage between jobs 1 and 2 for workers hired for at least two hourly jobs in the data, then the equivalent figure for the the change in log wage between jobs 1 and 3, and jobs 1 and 4 for workers hired for 3 and 4 jobs, respectively. Standard deviations are in parentheses below each mean. Asterisks (double asterisks) [triple asterisks] indicate that two-sample t-tests with unequal variances reject equality of the means for the non-affiliates' and affiliates' at the 10% (5%) [1%] level.

Table 8: Agency Affiliates' Wages are Less Responsive to Feedback

	All Job Categories	Administrative Support	Web Development
	(1)	(2)	(3)
Dependent Variable is Log Wage			
Feedback	0.045***	0.050***	0.029***
	(0.003)	(0.005)	(0.006)
Affiliate x Feedback	-0.023***	-0.007	-0.018**
	(0.005)	(0.010)	(0.008)
Worker Fixed Effects	Yes	Yes	Yes
R-squared	0.7983	0.6657	0.7031
Observations	42715	10846	14254

Notes: Robust standard errors clustered by worker in parentheses, and *** p<0.01, ** p<0.05, * p<0.1. The sample is worker-job pairs for those workers in the sample from Table 3 with 2 or more jobs prior to 12/28/2009, and an observation is a worker-job pair commencing prior to 12/18/2009. The dependent variable is the log of the hourly wage. All specifications include individual worker and monthly time fixed effects.

Table 9: Individual and First-Job Characteristics and the Probability of Being Rehired

	All Job Categories (1)	Administrative Support (2)	Web Development (3)
Affiliate	0.119***	0.182***	0.0757***
	(0.0116)	(0.0252)	(0.0222)
Has BA or higher degree	-0.0212**	0.0202	0.00368
	(0.0105)	(0.0174)	(0.0270)
Affiliate x Has BA or higher degree	-0.00739	-0.0441	0.0258
	(0.0125)	(0.0333)	(0.0232)
Affiliate	0.120***	0.176***	0.0796***
	(0.0111)	(0.0199)	(0.0257)
Has Prior Experience	0.00435	0.0282	-0.0572
	(0.0215)	(0.0413)	(0.0490)
Affiliate x Has Prior Experience	-0.0166	-0.0485	0.0288
	(0.0129)	(0.0432)	(0.0366)
Affiliate	0.152***	0.239***	0.121*
	(0.036)	(0.038)	(0.063)
Has Good English Skills	0.229***	0.009	0.202***
	(0.021)	(0.011)	(0.023)
Affiliate x Has Good English Skills	-0.043	-0.086**	-0.046
	(0.033)	(0.037)	(0.056)
Affiliate	0.1571***	0.2042***	0.1253***
	(0.0186)	(0.0245)	(0.057)
Has Taken Skills Tests	0.089***	0.0013	0.0633*
	(0.0135)	(0.0416)	(0.0341)
Affiliate x Has Taken Skills Tests	-0.0636***	-0.0631	-0.0638
	(0.0184)	(0.0277)	(0.0482)
Affiliate	0.151***	0.178***	0.0822**
	(0.0108)	(0.0236)	(0.0340)
Initial Log Hourly Wage	-0.0189***	-0.0231**	-0.0313**
	(0.00642)	(0.00902)	(0.0128)
Affiliate x Initial Log Hourly Wage	-2.14e-05	-0.0224	0.00334
	(3.22e-05)	(0.0219)	(0.0161)
Affiliate	0.126***	0.159***	0.0868***
	(0.00859)	(0.0120)	(0.0135)
Hours worked on First Job	2.48e-06	4.76e-05***	-7.21e-05
	(2.99e-05)	(1.37e-05)	(4.69e-05)
Affiliate x Hours worked on First Job	-6.49e-05***	1.87e-05	-1.12e-05
	(1.99e-05)	(5.91e-05)	(8.10e-05)
Affiliate	0.102***	0.136***	0.0720***
	(0.00857)	(0.0127)	(0.0243)
Affiliate on an Agency Team on First Job	0.0353**	0.0526*	0.0398**
	(0.0142)	(0.0315)	(0.0191)
Worker on Any Team on First Job	-0.0179	0.0102	-0.0340*
	(0.0133)	(0.0148)	(0.0182)
Observations	10,103	2,472	3,363

Notes: Robust standard errors clustered by country in parentheses, and *** p<0.01, ** p<0.05, * p<0.1. An observation is a unique worker on his or her first hourly job. The sample includes all workers whose first job occurs between 8/1/2008 and 12/28/2009. The dependent variable is a dummy variable set equal to 1 if a second hourly job is observed prior to August 14, 2010. All specifications are linear probability models and contain controls identical to those entering the Oaxaca-Blinder decomposition of Table 3, Panel B. See text for the definition of the interaction terms.

Table 10: Including Teamwork as a Control Variable

	All Job Categories (1)	Administrative Support (2)	Web Development (3)
Panel A: Dependent Variable is Log Wage, Includes Worker Fixed Effects			
Feedback	0.038***	0.059***	0.018**
	(0.004)	(0.009)	(0.007)
Affiliate x Feedback	-0.027***	-0.013	-0.020**
	(0.005)	(0.013)	(0.009)
Agency Team	-0.081***	-0.097	-0.065
	(0.031)	(0.066)	(0.057)
Agency Team x Feedback	0.008	0.005	0.004
	(0.008)	(0.017)	(0.014)
Any Team	-0.091***	-0.041	-0.100***
	(0.015)	(0.032)	(0.034)
Any Team x Feedback	0.0100***	-0.008	0.015*
	(0.004)	(0.008)	(0.008)
Worker Fixed Effects	Yes	Yes	Yes
R-Squared	0.8397	0.7314	0.7571
Observations	48189	11970	16101
Panel B: Dependent Variable is the Log of Hourly Wage on the First Job			
Data from Table 3:			
Mean Difference in Log Hourly Wage between Affiliates and Non-affiliates	0.475	0.067	0.181
Decomposition Results when First-Job Teamwork-related variables excluded (as in Table 3)			
% Due to Agency Affiliation	32.6%	246.9%	92.0%
Agency Affiliation Premium	15.5%	16.5%	16.7%
Decomposition Results when First-Job Teamwork-related variables are included.			
% Due to Agency Affiliation	32.6%	229.0%	90.9%
Agency Affiliation Premium	15.5%	15.3%	16.5%
Panel C: Dependent Variable is Log Hours on the First Job			
Data from Table 3:			
Mean Difference in Log Hours between Affiliates and Non-Affiliates	0.541	0.323	0.447
Decomposition Results when First-Job Teamwork-related variables excluded (as in Table 3)			
% Due to Agency Affiliation	62.1%	111.1%	54.7%
Agency Affiliation Premium	33.6%	35.9%	24.5%
Decomposition Results when First-Job Teamwork-related variables are included.			
% Due to Agency Affiliation	72.5%	139.2%	63.6%
Agency Affiliation Premium	39.2%	45.0%	28.4%
Panel D: Dependent Variable is Success Reported on the First Job			
Data from Table 3:			
Mean Difference in Success Frequency between Affiliates and Non-Affiliates	0.044	0.057	0.055
Decomposition Results when First-Job Teamwork-related variables excluded (as in Table 3)			
% Due to Agency Affiliation, Unexplained by Characteristics	136.8%	116.0%	198.6%
Agency Affiliation Premium	10.5%	12.5%	18.6%
Decomposition Results when First-Job Teamwork-related variables are included.			
% Due to Agency Affiliation	119.9%	95.2%	179.8%
Agency Affiliation Premium	5.3%	5.4%	9.9%
Panel E: Dependent Variable is Feedback Received on the First Job			
Data:			
Mean Difference in Feedback Score between Affiliates and Non-Affiliates	0.003	0.040	0.009
Decomposition Results when First-Job Teamwork-related variables excluded (as in Table 3)			
% Due to Agency Affiliation, Unexplained by Characteristics	2600.8%	386.9%	1133.0%
Agency Affiliation Premium	1.8%	3.5%	2.3%
Decomposition Results when First-Job Teamwork-related variables are included.			
% Due to Agency Affiliation	2415.1%	325.5%	954.1%
Agency Affiliation Premium	7.2%	13.0%	8.6%

Notes: Panel A replicates the results in Table 8 with extended interactions for team work. Panels B through E reproduce the results in Table 3, but now include indicators for a teamwork and agency-based teamwork.