Hiring and Learning in Online Global Labor Markets

Evidence from freelancer.com

Roy Mill

NET Institute Conference, April 2012

– WORK IN PROGRESS –
Trading Labor Services Globally

Labor matching websites and the law of one price

- Labor matching websites enable *global* search for services
  - {Freelancer, oDesk, Elance, rent-a-coder, 99designs, …}.com
- Services that are tradable should abide the law of one price:
  - Assuming they are homogenous, or of equal quality
  - Prices should equalize on and off the website

Overarching question:
Why do wage gaps in tradable services still persist?

- Alternatively, what stops employers from offshoring to poor countries?
Some reasons for North not to hire from South

- **Tradability**: Can the service be provided remotely?
  1. How costly is distance for providing the service?
  2. How much complementarity to other services?
    - Data entry tradable / child care not tradable / programming … ?

- **Quality and capacity**:
  - Employees of high quality scarcer in developing economies
    - Generally: if higher ed and technical training worse
    - On the website: if high-skilled prefer to work offline

- **Asymmetric information**:
  - Screening for quality and monitoring are harder when done remotely, in less familiar countries
Some reasons for North not to hire from South

- **Tradability**: Can the service be provided remotely?
  1. How costly is distance for providing the service?
  2. How much complementarity to other services?
    - Data entry tradable / child care not tradable / programming …?

- **Quality and capacity**: 
  - Employees of high quality scarcer in developing economies
    - Generally: if higher ed and technical training worse
    - On the website: if high-skilled prefer to work offline

- **Asymmetric information**: 
  - Screening for quality and monitoring are harder when done remotely, in less familiar countries
How does freelancer.com work?

How it works:

1. Post Project
2. Received Bids
3. Compare Quotes
4. Select Bidder
5. Milestone Payment
6. Work Starts
7. Release Payment
How does freelancer.com work?

How it works:

- Post Project
- Received Bids
- Compare Quotes
- Select Bidder
- Milestone Payment
- Work Starts
- Release Payment

5890 Freelance Jobs Found

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Bids</th>
<th>Avg (USD)</th>
<th>Job Type</th>
<th>Started</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Website Construction</td>
<td>29</td>
<td>$1645</td>
<td>PHP, Website Design</td>
<td>Today</td>
<td>4d 15h</td>
</tr>
<tr>
<td>Wordpress Project Development</td>
<td>1</td>
<td>$950</td>
<td>CSS, MySQL, PHP, Script Install, Wordpress</td>
<td>Today</td>
<td>15h 54m</td>
</tr>
<tr>
<td>iPhone app - Add 2-3 features and solve bugs</td>
<td>3</td>
<td>$177</td>
<td>iPhone, Objective C</td>
<td>Today</td>
<td>15h 54m</td>
</tr>
<tr>
<td>Html Expert need, Urgent</td>
<td>2</td>
<td>$30</td>
<td>CSS, HTML, Javascript, PHP, Script Install</td>
<td>Today</td>
<td>15h 53m</td>
</tr>
<tr>
<td>Simple After Effects Changes</td>
<td>11</td>
<td>$73</td>
<td>After Effects</td>
<td>Today</td>
<td>4d 15h</td>
</tr>
<tr>
<td>30 articles needed related to furniture</td>
<td>2</td>
<td>$30</td>
<td>Copywriting</td>
<td>Today</td>
<td>4d 15h</td>
</tr>
<tr>
<td>Send 5 million emails for us</td>
<td>1</td>
<td>$200</td>
<td>Internet Marketing, Link Building, SEO</td>
<td>Today</td>
<td>59d 15h</td>
</tr>
<tr>
<td>Content Writing</td>
<td>2</td>
<td>$63</td>
<td>Product Descriptions, Publishing, Report Writing,</td>
<td>Today</td>
<td>59d 15h</td>
</tr>
<tr>
<td>iphone art sales application design</td>
<td>1</td>
<td>$800</td>
<td>iPhone, Mobile Phone</td>
<td>Today</td>
<td>16d 15h</td>
</tr>
</tbody>
</table>
Receiving bids on a freelancer.com project

**Status:** Open  
**Selected Providers:** -  
**Budget:** $30-$250 USD  
**Created:** 11/05/2010 at 11:34 PDT  
**Bid Count:** 10  
**Average Bid:** $114 USD  
**Ends:** 01/04/2011 at 11:34 PST (51d 13h left)  
**Project Creator:** sm840817  
**Last Login:** 11/10/2010 at 15:17 PST  
**Employer Rating:** ★★★★★★★★★★ (4 reviews)

**Description**

Hi,

I would need a script to generate reports on the merchants selling on ebay.

For example:

If I enter a keyword for a search, it should pull out list of merchants selling that product on ebay.

and for each merchant, the report should be generated such as how many items listed, feedbacks, location, etc. (many additional fields)

<table>
<thead>
<tr>
<th>Service Providers</th>
<th>Bid</th>
<th>Milestone %</th>
<th>In</th>
<th>Time of Bid</th>
<th>Provider Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>wildlily980</td>
<td>$150 USD</td>
<td>20% ($30)</td>
<td>5 days</td>
<td>Sat, Nov 6</td>
<td>★★★★★★★★★★ (14 reviews)</td>
</tr>
<tr>
<td>arnab0143</td>
<td>$140 USD</td>
<td>40% ($56)</td>
<td>3 days</td>
<td>Fri, Nov 5</td>
<td>★★★★★★★★★★ (7 reviews)</td>
</tr>
<tr>
<td>shreeshotech</td>
<td>$200 USD</td>
<td>50% ($100)</td>
<td>4 days</td>
<td>7 days ago</td>
<td>★★★★★★★★★★ (6 reviews)</td>
</tr>
<tr>
<td>Terry101</td>
<td>$100 USD</td>
<td>-</td>
<td>1 day</td>
<td>Fri, Nov 5</td>
<td>(No Feedback Yet)</td>
</tr>
<tr>
<td>stepdais</td>
<td>$200 USD</td>
<td>10% ($20)</td>
<td>0 days</td>
<td>Fri, Nov 5</td>
<td>(No Feedback Yet)</td>
</tr>
</tbody>
</table>
 Tradable, “bulky,” types of projects more popular

Number of new projects, monthly

<table>
<thead>
<tr>
<th>Websites, IT &amp; Software</th>
<th>Writing &amp; Content</th>
<th>Design, Media &amp; Architecture</th>
<th>Data Entry &amp; Admin</th>
<th>Sales &amp; Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Job</strong></td>
<td><strong>Projects</strong></td>
<td><strong>Job</strong></td>
<td><strong>Projects</strong></td>
<td><strong>Job</strong></td>
</tr>
<tr>
<td>PHP</td>
<td>198,864</td>
<td>Copywriting</td>
<td>81,515</td>
<td>Web Design</td>
</tr>
<tr>
<td>SEO</td>
<td>74,711</td>
<td>Articles</td>
<td>39,623</td>
<td>Data Entry</td>
</tr>
<tr>
<td>Javascript</td>
<td>41,161</td>
<td>Research</td>
<td>25,322</td>
<td>Data Processing</td>
</tr>
<tr>
<td>Link Building</td>
<td>39,975</td>
<td>Proofreading</td>
<td>20,225</td>
<td>Excel</td>
</tr>
<tr>
<td>.NET</td>
<td>38,415</td>
<td>Article Rewriting</td>
<td>19,768</td>
<td>Virtual Assistant</td>
</tr>
</tbody>
</table>

Total projects

- Websites, IT & Software: 39%
- Design, Media & Architecture: 26%
- Writing & Content: 14%
- Data Entry & Admin: 8%
- Sales & Marketing: 8%
- Other: 1%
- Product Sourcing & Manufacturing: 0%
- Engineering & Science: 1%
- Other: 1%

*Note: The chart shows the number of new projects and the percentage of different types of projects on Freelancer.com.*
Services flow mainly from developing to developed countries

Yet not exclusively: Significant freelancing in developed countries

* Each curve connects two cities
* Each curve changes color from red to green
* Payments flow from red to green in exchange for services flowing from green to red.
Hiring gaps between countries and asymmetric information

- Freelancers’ countries affect chances of being hired
- Part of the gap disappears for better-rated freelancers
- Employers learn country’s quality from experience with freelancers they hired from that country
A country’s reputation and a freelancer’s reputation

- Information on an individual > information on their country
  - Can tell if a specific freelancer is good even if most are bad
- Freelancers and employers review and rate each other (0-10 scale)
  - Only if both sides rated each other rating and review become public
  - For now, using only public ratings
    - Public ratings are almost perfect on average
    - Thus number of ratings is the meaningful signal

Hypotheses:

1. Employers prefer freelancers from some countries over others
2. As individual ratings get better, country effect gets smaller
   - Otherwise country matters not (only) as a signal
Country and individual reputation results: graphically

Country effects and country-specific ratings effects mostly in right directions

Regression table
Learning to infer expected quality from a country

- Experience in the market improves screening
- Data can shed light on the process: in each project, employers …
  1. **Choose bid**: observed directly
  2. **Assess match**: observed through ratings, disputes, cancellations
  3. **Update beliefs**: unobserved, but should affect choices in future

- Approach: show that past assessments affect future choices of similar freelancers
  - Similar freelancers = freelancers from same country
Learning to infer expected quality from a country

- Experience in the market improves screening
- Data can shed light on the process: in each project, employers …
  1. Choose bid: observed directly
  2. Assess match: observed through ratings, disputes, cancellations
  3. Update beliefs: unobserved, but should affect choices in future

- Approach: show that past assessments affect future choices of similar freelancers
  - Similar freelancers = freelancers from same country

- Planned: take a structural approach to:
  - Decompose hiring gaps to statistical and “taste”-based
  - Measure impact of subsidies for hiring from unfamiliar countries
  - Translate observed choices back to employers’ priors on countries
  - Incorporate other signals and improve identification
Reduced form analysis

1. Classify each match outcome as good or bad (or unknown)
   - Good: rating = 10
   - Bad: rating < 5, employer opened dispute / canceled project

2. Count employer’s past good and bad outcomes with each country

3. Assign past-outcomes counts to current bids accordingly

4. Run the following linear probability model:

\[
\text{won}_{bp} = \phi + \beta_{g} \cdot \text{good}_{bp} + \beta_{g2} \cdot (\text{good}_{bp})^2 + \beta_{b} \cdot \text{bad}_{bp} + \beta_{b2} \cdot (\text{bad}_{bp})^2 + \delta \cdot \text{X}_{bp} + u_{bp}
\]

- Hypotheses:
  1. Bad (good) experience reduces (increases) hiring of future freelancers from same country ($\beta_{b} < 0 < \beta_{g}$)
  2. Marginal effect of each experience is diminishing ($\beta_{g2} < 0 < \beta_{b2}$)
Wage gaps across countries and asymmetric information

## Reduced form results

**OLS works well; IV somewhat less so**

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>U.S employers only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS (1)</td>
<td>OLS (2)</td>
</tr>
<tr>
<td><strong>Quote in $</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prior experience with freelancer's country</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good / 10</td>
<td>0.003 ***</td>
<td>0.017 ***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>Bad / 10</td>
<td>**-0.007 *****</td>
<td>**-0.025 *****</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>(Good / 10)$^2$</td>
<td>**-0.0004 ***</td>
<td>**-0.0004 ***</td>
</tr>
<tr>
<td>(Bad / 10)$^2$</td>
<td>0.0011 ***</td>
<td>0.0014 ***</td>
</tr>
<tr>
<td>(Good / 10) X (Bad / 10)</td>
<td>-0.0021 ***</td>
<td>**-0.0017 **</td>
</tr>
<tr>
<td>ln(number of reviews + 1)</td>
<td>0.020 ***</td>
<td>0.020 ***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Number of previous</td>
<td>0.020 **</td>
<td>0.021 **</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>Bids (observations)</td>
<td>336,556</td>
<td>336,556</td>
</tr>
<tr>
<td>Projects (fixed effects)</td>
<td>26,447</td>
<td>26,447</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Conclusion

- Rich, diverse, lively labor markets on freelancer.com
- Cross-country wage (hiring) gaps exist on website as well
  - Slightly decrease for freelancers with good individual reputation
- Employers learn to screen future freelancers from experience with past freelancers
  - Analysis made possible thanks to market being an online platform
Thank you!
All of our great clerks were from the Philippines

Data entry clerks for the discrimination and family background project

Hardest working, highest quality data entry clerks are from the Philippines

![Image of data entry system]

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Last logged in at</th>
<th>Last logged in from</th>
<th>Recode prob</th>
<th>Records overall (online)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Elizabeth Navaleta</td>
<td>2011-11-23 19:20:10</td>
<td>121.54.91434369</td>
<td>0.05</td>
<td>29992</td>
</tr>
<tr>
<td>13</td>
<td>Alma Salas</td>
<td>2011-11-16 03:34:46</td>
<td>112.204.85.121</td>
<td>0.05</td>
<td>19837</td>
</tr>
<tr>
<td>11</td>
<td>Jennifer Juraberta</td>
<td>2011-11-15 04:52:22</td>
<td>112.206.179.111</td>
<td>0.05</td>
<td>19474</td>
</tr>
<tr>
<td>17</td>
<td>Myra Mae Quejadas</td>
<td>2011-11-14 20:08:17</td>
<td>119.92.91.50</td>
<td>0.0578813</td>
<td>19274</td>
</tr>
<tr>
<td>18</td>
<td>Elisea Ramos</td>
<td>2011-11-16 19:11:37</td>
<td>121.54.85.678632</td>
<td>0.05</td>
<td>17940</td>
</tr>
<tr>
<td>32</td>
<td>Mary Rose Marquez</td>
<td>2012-01-07 06:11:26</td>
<td>112.206.179.111</td>
<td>0.05</td>
<td>10455</td>
</tr>
<tr>
<td>24</td>
<td>Erlinda Yuces</td>
<td>2011-12-13 12:21:00</td>
<td>112.206.179.111</td>
<td>0.05</td>
<td>10348</td>
</tr>
</tbody>
</table>
Public ratings are almost perfect

Distributions plotted for all freelancers bidding on PHP projects in 2010, weighted by the number of bids.
Measuring the interaction of country- and freelancer-reputation

- Basic approach: predict winning from bid characteristics
  - For now, linear probability model with project fixed effects

\[
\text{won}_{bp} = \phi_p + \sum_{c \in C} \gamma_c c_{bp} + \sum_{c \in C} \beta_c c_{bp} \times \ln (1 + \text{rates}_{bp}) + \delta \ln P_{bp} + \lambda \text{pastProj}_{bp} + \varepsilon_{bp}
\]

- Price quoted may be correlated with unobservables
  - Exchange rate as an instrument: Graph
    - Affects freelancers’ costs, shouldn’t matter for USD-based employers
  - Alternatively, bid order, or timing relative to bids in other projects (planned)
Selected exchange rates fluctuations

Exchange Rate Indexes

Local currency per 1 USD on 12/1/09 set to 1 for each currency
Moving Average from 15 days prior to 15 days after the day
**Country and individual reputation results: table**

Country effects and country-specific ratings effects mostly in right directions

<table>
<thead>
<tr>
<th>Dependent variable: Bid won</th>
<th>All</th>
<th>OLS</th>
<th>OLS</th>
<th>U.S employers only</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ln(Quote in $)</td>
<td>-0.076 ***</td>
<td>-0.075 ***</td>
<td>-0.076 ***</td>
<td>-0.566 ***</td>
</tr>
<tr>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.115)</td>
<td></td>
</tr>
<tr>
<td>ln(number of reviews + 1)</td>
<td>0.020 ***</td>
<td>0.021 ***</td>
<td>0.024 ***</td>
<td>0.045 ***</td>
</tr>
<tr>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>Have matched in the past once?</td>
<td>0.020 **</td>
<td>0.020 **</td>
<td>0.026 ***</td>
<td>0.021 ***</td>
</tr>
<tr>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.006)</td>
<td>(0.001)</td>
<td></td>
</tr>
</tbody>
</table>

Freelancers from:

- **Canada**
  - from Canada? 0.005 0.011 -0.013 (0.006) (0.010) (0.014)
  - Canada X ln(reviews + 1) -0.002 -0.007 -0.012 (0.004) (0.007) (0.008)

- **Australia**
  - from Australia? 0.008 -0.020 -0.054 *** (0.008) (0.013) (0.019)
  - Australia X ln(reviews + 1) 0.035 *** 0.027 ** -0.006 (0.007) (0.011) (0.012)

- **India**
  - from India? -0.037 *** -0.044 *** -0.080 *** (0.002) (0.003) (0.010)
  - India X ln(reviews + 1) -0.003 ** -0.004 * -0.002 (0.001) (0.002) (0.002)

- **Bangladesh**
  - from Bangladesh? -0.044 *** -0.051 *** -0.180 *** (0.003) (0.005) (0.031)
  - Bangladesh X ln(reviews + 1) 0.001 0.001 0.018 *** (0.002) (0.003) (0.005)

| Bids (observations) | 336,556 | 336,556 | 137,619 | 137,398 |
| Projects (fixed effects) | 26,447 | 26,447 | 11,218 | 11,215 |

Additional countries in regression entered similarly (not shown). Omitted country is U.S. One country is “all other countries” (not shown)