GOING, GOING, GONE: THE ONLINE LABOR MARKET AND THE GLOBAL REVERSE AUCTION FOR JOBS

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ABSTRACT

Michael Dunn: Going, Going, Gone: The Online Labor Market and the Global Reverse Auction for Jobs
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The online labor market introduces a new spatial restructuring of work that removes nearly all temporal and spatial constraints. The spatial restructuring of work has created an "international virtual reserve army of labor" that directly contributes to lower wages and an increase in precarious work in the U.S. Given the nature and type of work that can be easily done online - primarily "idea-based" work, the more highly skilled U.S. workers, who have traditionally been more immune to globalization, have seen their "good jobs" at risk. This research analyzes wages in four occupations (software development, network and information systems, administrative support, and customer service) to understand how the online labor market is affecting American workers' wages. Furthermore, this research more closely examines two occupations, software developer and customer service, to understand how the online labor market is affecting high-skilled "good" jobs and low-skilled "bad" jobs. Findings suggest that the online labor market is hurting wages in all four occupations but is disproportionately hurting high-skilled workers.

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INTRODUCTION

Technological advancements have always changed both the demand for certain types of workers and the nature of the employer-employee relationship. In the last decade, the widespread proliferation of the Internet has led to the creation of the online labor market, which connects employers with virtual workers. The dramatic increase of work in the online labor market, and its corresponding non-traditional work arrangements, underscores the importance of understanding how these changes affect workers and labor market dynamics globally. In the next two decades, labor scholars have estimated that 20 percent of all work could be done by contracted virtual workers.[1] As the online labor market grows, so do the social, institutional and economic implications of new work arrangements associated with the online labor market. However, to date, the online labor market has received little attention from scholars studying work and occupations.

In this study, I will make the case that online work is not only a natural extension of the globalization of labor markets, but introduces a new spatial restructuring of work that removes nearly all temporal and spatial constraints. The spatial restructuring of work has created an "international virtual reserve army of labor" that drives down the asking wages for workers and increases the prevalence of precarious work in the U.S. I posit that the nature and type of service and knowledge-based work that can be done virtually might disproportionately affect

[1] http://www.businessnewsdaily.com/3917-crowdsourced-workers-standards.html - Retrieved 9/20/13

more highly skilled U.S. workers, who have traditionally been more immune from globalization (Blinder 2006). As the social contract of employment continues to evolve towards more precarious work, the future growth in the online labor market could further exacerbate the polarization of wages for more highly skilled US service and knowledge workers.

My contributions will advance both the work and occupations literature and broader labor market theories in several ways. First, I demonstrate that the structure and institutional framework of the online labor market is a distinctly different, extension of the broader labor market. Next, I introduce a new typology that more precisely demarcates the online labor market within the broader labor market. Lastly, I show that the spatial restructuring of work has created a new labor framework that allows U.S. employers to more effectively and cheaply reach workers, regardless of their location, which creates increased competition for jobs and simultaneously drives down wages within the labor market.

THE EVOLUTION OF WORK: A CATALYST TO THE ONLINE LABOR MARKET

Literature on the online labor market spans many disciplines, from sociology and communications to economics and information science. The research is as varied as the disciplines, but this section will demonstrate that current literature has focused on access, transaction cost of virtual work, and effectiveness of labor, while ignoring the effect of the online labor market on wages. The sociology research has predominately revolved around understanding the effects of technology on mobility and inequality. Dimaggio et al. (2004) explored the digital inequality within the online population in extent and types of use, autonomy of use, and the effectiveness with which desired information can be retrieved, but they did not examine whether these inequalities varied among workers at different skill levels.

Dimaggio (2008) later examined whether people without Internet access are disadvantaged in their pursuit of "good jobs and adequate incomes" (2008:2) and found that U.S. workers who used the Internet increased their earnings at a faster rate than their offline counterparts. He showed a definite correlation between internet usage and earnings, but his analysis was limited to workers already employed in a traditional work setting. Other sociological research has focused on the "digital divide" and found that minorities in all groups had significantly less access to the Internet (Fairlie 2004), which illustrates the importance of both technical skill and technology access to economic mobility, but still falls short of addressing the online labor market.

Examining technological change and labor markets through the inequality and stratification literature a general consensus is that technological change exacerbates inequality by putting a premium on skilled workers. Scholars use return to schooling data as evidence. As technology has increased and changed the labor market, higher educated workers have made more. Wages of college graduates relative to the wages of high-school graduates increased by over 25 percent between 1979 and 1995 and the difference in wages between workers in the 90th percentile and the 10th percentile increased from 266 percent to 366 percent during the same period (Acemoglu 2002). Others have argued a direct causal relationship between technological changes and inequality (e.g. Krueger 1993, Caselli 1999). Caselli (1999) argues that technological change causes the "capital-labor ratio" to drop for low skill workers because employers are devoting more capital to create high-skilled jobs. Others reach the same conclusion that technological change leads to greater inequality but argue that it's the large

increase in the supply of skilled workers that acts as the catalyst for the increase in demand. They argue that these workers enable firms to introduce more efficient techniques that are predicated on a supply of skilled workers (Acemoglu 1998). Conversely, inequality scholars have explained the decrease in wages for low skilled workers through different mechanisms of technological changes. Galor and Moav (2000) argue that technological change creates an "erosion effect," because it reduces the productivity low-skilled workers. Caselli (1999) claims that we are in a “skill-biased” technological revolution that has triggered firms to reallocate resources from low skilled workers and jobs, to high skilled workers and jobs ultimately leading to lower wages for low skilled workers.

While changes in technology have played a significant role in increases in wage inequality, stratification scholars also acknowledge that economic globalization, which exposes national labor and financial markets to international competition, may increase inequality (e.g. Lindert and Williamson 2003). One aspect of economic globalization, relevant to this analysis, is that rising income inequality in many industrial countries has been associated with increasing number of foreign born workers in these countries. Scholars argue that the immigrant population increases the supply of low-skill workers, simultaneously driving down wages and displacing low-skills natives workers (Borjas, Freeman, and Katz 1996; LaLonde and Topel 1991; Lee 2005).

Summarizing the inequality literature discussed, technological change exacerbates inequality by putting a premium on skilled workers. Furthermore, one aspect of economic globalization - increases in foreign born workers increases the supply of low-skill workers,

simultaneously drives down wages and displacing low skilled domestic workers. While this literature has not explicitly addressed the online labor market, they suggest that the online labor market would increase inequality by providing opportunities for high skilled workers and decrease wages for low skilled workers by increasing competition.

Scholars in other disciplines, such as economics, communications, and information science, have all studied specific components of the online labor market, ranging from the applicability of experiments using online participants (e.g. Horton, Rand & Zeckhauser 2010) to the effect of project size on project outcomes (Snir & Hitt 2003). Much of the current work concentrates on the transactions between worker and employer, particularly the transaction costs of virtual work and the process for both worker and employer when dealing with imperfect information. For instance, studies have looked at the use of feedback rating by employers (e.g., Yoganarasimhan 2013a), the effects verified work experience on worker's ability to gain employment (Agarwal et al. 2013), and the increased complexity introduced by virtual work related to communication, coordination, and culture of labor (e.g., Agerfalk et al. 2008). Other studies have examined the mechanism through which employers and workers are matched. Research has looked at the differences in auction designs (open vs. sealed bid) for online platforms (Hong, Wang & Pavlou 2014), the distribution of bids (Yoganarasimhan 2013b) and the employer's selection factors (Banker & Hwang 2008). In short, the preponderance of research has focused on hiring decision factors, the mechanism associated with the employer/worker transaction costs, and the effectiveness of virtual work for project and research outcomes.

Although current work and employment relations literatures haven't directly addressed the online labor market, studying the online labor market, itself, provides a useful context to begin unraveling how work is changing. Literature shows three key developments since the 1970s that are relevant to the online labor market: 1) macro-structural changes in social, political, and economic institutions have changed the organization of work, 2) the internationalization of labor markets has increased access to workers and 3) the nature and type of work since the 1970s has shifted away from manufacturing to a more service and knowledge-focused work force.

Macro-structural changes in social, political, and economic institutions

Scholars have argued that since the 1970's, the macro-structural changes in social, political and economic institutions have changed the organization of work, replacing stable employment systems with greater polarized and precarious work systems (Kalleberg 2011). While other epochs in the U.S. exhibited similar trends, Kalleberg (2011) argues the current changes "represent long-term structural transformations in employment relations rather than being simply reflections of short-term business cycles" (Kalleberg 2012: 21). The new social contract of employment, specifically the increased flexibility for employers, meant the end of lifelong employment and predictable advancement for workers (Cappelli 1999). Globalization of production through the internationalization of labor markets heavily influenced the change in the social contract of employment and was made possible by communication and information technologies, such as the spread of computerization and the development of the Internet (Kalleberg 2011: 26). The internationalization of labor profoundly changed the nature of work by not only increasing the number of workers available, but also the kinds of workers

available to employers. When China, India, and the former Soviet bloc countries entered the global market, the possible global labor pool doubled (Freeman 2007). The redistribution of labor globally led to a spatial restructuring of work, which liberated employers from conventional temporal and spatial constraints (Wallace & Brady 2001). Wallace and Brady (2001) suggested that "spatialization" allowed employers to easily relocate business operations to optimize production to cheap labor.

Furthermore, the increased access and the corresponding decrease in temporal or spatial constraints shifted the power and control dynamic towards the employer (Freeman 2007). In its most advanced form, "spatialization involves the decentralization of work activities across geographic and temporal boundaries while increasing the centralization of managerial control over the labor process" (Wallace & Junisbai 2003: 393). This "spatialization" relies on technocratic control, achieved through "computerized technologies" to "coordinate and control the activities of workers in far-flung corners of the world as if they were under a single roof" (Wallace & Junisbai 2003: 393). With the nearly non-existent temporal or spatial constraints in the online labor market, it's not difficult to imagine further polarized and precarious employment systems. Employment relations literature has not specifically addressed the online labor market or the potential of a global labor force that is spatially and temporally unconstrained. Shifting the focus from the employer, this research will examine what a lack of spatial and temporal constraints means to workers, occupations, and labor markets.

Internationalization of Labor Markets

The "reserve army of labour," a concept first introduced by Engels (1845) and further explored by Marx (1867), theorized that the reserve army was made of floating and latent

laborers. Marx also alluded to the need to look beyond borders for cheap labor by suggesting the pursuit of "an ever extended market" as an "inner necessity" of the capitalist mode of production (Marx 1867: vol. 3 344). Arthur Lewis (1954) further argued that in third world countries with vast, seemingly unlimited supplies of labor, capital accumulation could occur at a high rate. The concept of a more global reserve army of labor was further advanced by Hymer (1979), who argued that the "latent surplus-population," or reserve army of labor in the informal markets of both the developed and underdeveloped economies, creates a continual movement of surplus population into the labor force (Hymer 1979: 81, 86, 161, 262–69). In the four decades since Hymer, technological advancement has removed the geographic and spatial constraints and created a "virtual reserve army of labor" that dwarfs any individual domestic labor market. With almost three billion Internet users,[2] the potential for a "virtual reserve army of labor" is staggering. The online labor market will likely exert downward pressures on wages, further exacerbating the global labor arbitrage already introduced with increased globalization. According to Stephen Roach, economist at Morgan Stanley, global labor arbitrage occurs when "American companies are replacing high-wage workers here with like-quality, low-wage workers abroad."[3] Although Roach is referring to replacing domestic laborers with international workers in their own country, he acknowledges that "with new information technologies allowing products and now knowledge-based services to flow more easily across borders, global labor arbitrage is likely to be an enduring feature of the economy."[4] In other

[2] http://www.internetlivestats.com/ (accessed 3/30/14)

[3] http://www.nytimes.com/2004/07/22/opinion/more-jobs-worse-work.html?pagewanted=2&src=pm

[4] http://www.nytimes.com/2004/07/22/opinion/more-jobs-worse-work.html?pagewanted=2&src=pm

words, the spatial restructuring of work that enables employers to easily and effectively access the virtual reserve army of labor will exacerbate the global labor arbitrage that was introduced with globalization in traditional labor markets.

Decentralized Capitalism and the Evolution of Work since the 1970's

Since the 1970s, because of employers' search of flexibility and profits, coupled with the decline of collective power and rights of workers, employment relations have become increasingly market-mediated. Market-mediated employment relations are based on free market competitions and are associated with lower institutional protections of workers (Kalleberg 2011: 83). One of the features of market-mediated employment relations is the transfer of risk away from the employer towards the employee through flexible work arrangements. The expansion of non-standard work arrangements is only possible if there is a surplus of workers who are willing to take a less stable arrangement, and the online labor market is both increasing the surplus of workers in an environment that is founded and centered on non-standard work arrangements.

Powell (2001) coined the term "decentralized capitalism" to describe the fundamental change in the way work is organized, structured, and governed today, the characteristics of which are quite relevant to the online labor market. First, work is now being organized around projects, not jobs. Bluntly put, "the new system approaches a form of pay for productivity, with little recourse to loyalty or seniority" (Powell 2001: 34). The key consequence of the remaking of the division of labor is that "important tasks no longer need be performed inside the boundaries of the organization" (Powell 2001: 36). In the traditional labor market, this trend has manifested itself in the precipitous rise in nonstandard and contingent work arrangements.

According to Kalleberg (2011), data from a representative sample of U.S. establishments showed over half outsourced some of their activities. The data also showed that the temporary help agency sector has grown 11 percent annually every year from 1972 – 1990. Perhaps most telling is that "virtually all jobs are vulnerable to it (outsourcing), including high-wage, white-collar jobs that were once seen safe" (Kalleberg 2011: 89). The growth and trajectory of the online labor market is not only a natural extension of decentralized capitalism, but also the labor markets' response to the new way that work is organized. So, while virtual workers are able to pick, choose, and leverage multiple online work sites, the "pay for productivity" (Powell 2001: 34) structure of the online labor market magnifies the effects of decentralized capitalism. On the whole, if employers are taking work from traditional labor markets and moving it online, work will become even more precarious.

The second characteristic of "decentralized capitalism" is a move from hierarchies to networks as the basic unit of economic action introducing a "latticework of collaborations with 'outsiders' that blurs the boundaries of the firm" (Powell 2001:36). The new structure of production now relies more on subcontractors, substituting outside procurement for internal production, which suggests a further shift towards outsourcing/subcontracting within the labor market because the availability of an on-demand virtual work force is an attractive and cost effective alternative to traditional work arrangements. The final characteristic of "decentralized capitalism" is the increase in inter-industry cross-fertilization. This is more of an organization-level characteristic and is less directly related to workers, but it is important to note that the idea of leveraging skill and capabilities across industries is changing the way organizations have historically operated. Now "when products and competencies change, old skills may become

obsolete, firms look externally for new capabilities and utilize outsiders for tasks that cannot be done effectively internally" (Powell 2001: 46).

Lastly, the evolution in the type of work is important to explore so that we may understand how the online labor market is both a reaction to and a distinct evolution of how work is completed. Until the 1970s, industrial and manufacturing work had compromised the lion's share of the work. A substantial shift in employment began in the 1970s, toward industries that produced services. The growth has been the driving force of the "knowledge society," in which information has become the central source of power and productivity. In 2009, more than 85 percent of people in the U.S. worked in the service sector, up nearly 70 percent since 1970 (Kalleberg 2011: 29). The service sector has also fueled the expansion of contingent and non-standard work, since service sector jobs tend to be more conducive to flexible scheduling (Kalleberg 2011). While technology was an essential element to the rise of the online labor market, the growth in the service sector certainly fueled the growth in the online labor market because service work can be done virtually, while manufacturing work cannot. The actual size of the online labor market is unknown, but Horton (2010) estimated work in the online labor market in 2009 to be around $700 million. More recent estimates have put work in the online labor market in the billions.[5] Some have projected that in the future, the online labor market could represent 20 percent of all work.[6] The continuing evolution in the nature and type of work since the 1970s to a more service and knowledge industry suggests

[5] http://blogs.ft.com/beyond-brics/2012/05/23/virtual-working-takes-off-in-ems/ - Retrieved 10/14/2013

[6] http://www.businessnewsdaily.com/3917-crowdsourced-workers-standards.html - Retrieved 9/20/13

that the online labor market could continue to grow. It is vital, then, that future research in employment relations account for workers in the online labor market.

In brief, because of the newness and recent proliferation of the online labor market the research to date falls short in two areas which my research will address. First, current labor market research is predicated on spatial and geographic constraints, which do not exist in the online labor market. Secondly, research has not directly addressed the changing organization of work, the internalization of labor, the shift from manufacturing to service work in the context of virtual work.

ONLINE LABOR MARKET: DEFINITION AND BOUNDARIES

Current scholarship has taken a narrow view on attempting to define the online labor market. Kittur et al. (2013) defined it as:

> "…performance of tasks online by distributed crowd workers who are financially compensated by requesters (individuals, groups or organizations). In this sense, crowd work is a sociotechnical work system constituted through a set of relationships that connect organizations, individuals, technologies and work activities." p.1301

As the proceeding discussion will illustrate, Kittur defines a narrow segment of the market. Horton, former staff economist at oDesk.com, provides a broader definition. Horton (2010) defines the online labor market as having three key attributes:

(1) Labor is exchanged for money,

(2) The product of that labor is delivered "over a wire" and

(3) The allocation of labor and money is determined by a collection of buyers and sellers operating within a price system.

I argue that the online labor market has an even greater reach, specifically more than just labor delivered "over a wire," and propose the following key attributes:

(1) Labor is exchanged for monetary compensation,

(2) The exchange of information between employers and job seekers about wages, conditions of employment and job attributes are done virtually,

(3) The product of the labor is either delivered "over a wire" or completed by the worker in physical environment but facilitated through virtual means,

(4) The allocation of labor and money is determined by a collection of buyers and sellers operating within a global price system.

Within the framework of the definition above, I argue that online labor market encompasses three broad spectrums of work – "internet enabled" work, "internet facilitated" work, and "virtual" work. This new typology fully demarcates the boundaries of the online labor market. Definitions to date have mostly focused on components of the "virtual" work spectrum, and because of the narrower scope both the "Internet enabled" work, and "Internet facilitated" work have been excluded. The following sections will examine in detail, "internet enabled" work, "internet facilitated" work, and "virtual" work within the defined framework above.

"Internet Enabled" Work

I define "Internet enabled" work (IEW) as work in which the workers and employees use the internet as the tool to make the connection, but the internet serves no other function in this spectrum of the online labor market – the site does not serve as intermediary, the site is not involved in the financial transaction, and all communication is done directly between

worker and employer not through a third party website or program. The nature of the work is contractual and short term. IEW is mostly comprised of work that requires a physical presence.

The most popular and well known IEW platform is Craigslist. Started in 1995, Craigslist at the most basic level is an electronic classified advertisement site. It is localized to specific cities and at last count boasted over 700 cities in 70 countries. All told, it is estimated that Craigslist generates over 50 billion page hits a month, with over 2 million new jobs posted monthly. The "Jobs" section, along with the "Gigs" section received 31.3 million postings in 2011.

Jobs and tasks on Craigslist vary widely and range from the mundane like moving furniture or landscaping, to the downright bizarre. Posting ad hoc work and tasks has been a common feature of Craigslist since its inception, but on August 1, 2004, the "Gigs" section was added to Craigslist, and in the process, officially adding IEW as a service category. I argue that the online labor market was officially launched on August 1st, 2004.

While the majority of transactions on sites like Craigslist arguably don't fall under the umbrella of the online labor market, it is important to include sites like Craigslist in the discussion for two reasons. First, it was the first widely accepted online site to connect workers with employers. In this respect, Craigslist marks the beginning of the short history of the online labor market. More broadly, the incredible reach and penetration of sites like Craigslist move the online labor market from the periphery to the mainstream. In many ways it legitimized the idea of the exchange of labor as a virtual transaction. Within that context, it is not surprising to see the natural evolution from "internet enabled" work to "internet facilitated" work. As the next section will show, "internet enabled" work is a worthy predecessor to the more internet

dependent, “internet facilitated” work, which is squarely within the boundaries of the online labor market.

“Internet Facilitated” Work

I define “Internet facilitated” work (IFW) as work in which the workers and employers use the internet as the tool to make the connection, AND the internet serves as intermediary – connections, arrangements, and financial transactions are facilitated through the internet. IFW, like IEW, can have a physical presence. The types of work and task are similar to IEW, but the role of the internet is much more prominent. Appendix B summarizes the prominent IFW sites currently in the online labor market.

One of the first successful IFW entities was runmyerrand.com, established in Boston in September 2008. Runmyerrand.com became popular locally and caught wind of venture capitalist funders and by 2010 it had received venture capitalist funding and was rebranded as taskrabbit.com. By 2011, it was reported that taskrabbit.com was generating over $4 million in business each month. It continues to grow and a press release on their website published a target of reaching 1 million verified workers by the end of 2013. While taskrabbit.com might be the most prominent player in the IFW arena, there are other sites. CampusBellHops.com is in 47 cities (within proximity of universities) and mainly focuses on “employers” looking for moving related services and they rely on local students as their labor pool. Thumbtack.com is a site similar to taskrabbit.com in which jobs are posted for completion. Their website indicates over 240,000 registered “service providers”. Zaask.com is local to Portugal, but is actively beginning to build its network of users in the United States, for an anticipated launch in the future. It calls its users “Askers” and “Taskers”: “Askers” are the employers, those who need

someone to help them perform a job, and "Taskers" are workers who are willing to provide the service.

Regardless of the IFW site the basic model is identical. Potential employers will list the task they want completed. Then workers go online and bid for the work. The employer then chooses the worker for the task, usually based on the lowest cost. This tends to create a downward bidding process in which workers compete with one another to offer potential employers the lowest rate possible. All of the sites take commissions from the employer, and all employees are paid via the site (not the employer). The commissions vary between 10-20 percent of the amount bid for the task. Two additional attributes, while not consistent among all of the sites, are prevalent and important enough to mention. Several of the sites "vet" their workers, with taskrabbit.com being the most aggressive by requiring a background check and an online test covering topics in their worker manual. Thus only "pre-approved" workers are allowed to bid on work. Many of the sites also incorporate rating systems so that employers are allowed to rate workers which are included in the worker's profile. While rating systems aren't universal across all sites, their prevalence does set a precedence of "disempowering" the worker in an already extremely precarious work situation. As I discuss later, this problem is amplified in the remaining component of the online labor market, virtual work, as all geographical constraints are removed and the worker becomes the anonymous laborer on the other side of the computer monitor.

Virtual Work – Microtasking and The Virtual Service Industry

Virtual work is third and final component of the online labor market. The following attributes define virtual work:

a) Internet is the tool to make the connection,
b) Internet serves serve as intermediary – connections, arrangements, and financial transactions are facilitated through the internet,
c) All work is done completely online.

Virtual work tends to be the type of work that has traditionally been thought of as the online labor market. Naturally, because geography is not a consideration, virtual work has the greatest number of workers in the online labor market. Another key difference of virtual work versus the other two is the demographic differences in the workers. Virtual work has the greatest share of international workers and boasts the largest workforces available to employers in the online labor market. There are dozens of sites offering "virtual work" including Zhubajie, who reports having 7.6 million workers, Freelancer.com who reports having 6.5 million users, Elance.com who reports 2 million users and Mechanical Turk with over 500,000 workers.

It is important to distinguish the varying jobs and tasks in virtual work as they differ quite significantly in both skill and pay. The continuum of work available ranges from "microtask" sites, like Mechanical Turk (mturk.com) that pay workers a few cents (in many cases) for completion of miniscule tasks, to oDesk.com, which focuses on high-skilled workers to complete more complex tasks or projects. Because the type of work is so different, and the wages structure and skill required are so divergent I distinguish virtual work into two categories - microtasking work and the virtual service industry (VSI).

I will first begin by looking at microtasking work. Microtasking, also known as "crowdworking", can be defined as taking a large project and breaking it down into microtasks. They are small and short-duration activities, conducted by numerous people, which add up to a

larger result. These tasks are completed on a one-off basis by workers. A worker may complete hundreds to thousands of micro-tasks in a given week and the worker might complete the identical task for the same employer numerous times, for example entering an address into a web form from a picture of a business card. Unfortunately for workers, the microtasks come with micro sized compensation. Workers' reported wages vary, but range from $1 to $4 dollars an hour. My research of workers engaged in micro-tasking suggests that workers are earning between $1-$2/hr.[7]

The most well-known microtasking site is Amazon's Mechanical Turk. The site was launched publically November 2, 2005 and was initially loaded with tasks by Amazon that asked workers to look for redundancies on their vast web pages. After the initial launch, the concept and idea of microtasking didn't gain traction until 2007. By the end of 2007, Mechanical Turk had grown to 100,000 workers. This was immediately followed by several years of significant growth, and by 2011 Mechanical Turk had over 500,000 workers in 190 countries. In addition to Mechanical Turk, there are several other microtasking sites. Zhubajie.com is a Chinese microtasking site who reports to have 7.6 million workers. The same company has a US equivalent website called witmart.com. Cloudcrowd.com has over 125,000 workers and mainly focuses on microtasks, but does have a variety of low paying jobs available. Microworker.com is also another large microtask site with over 400,000 workers worldwide. Please see Appendix B for a summary of microtasking sites described.

Regardless of site, the basic framework is identical: employers post tasks on the site, workers accept tasks, complete the tasks, and then receive compensation once the work has

[7] I conducted 900 surveys of workers on mturk.com and found on average workers made <$2/hr.

been approved by the employer. In microtasking work, unlike both the IEW and IFW, there is no bidding process on price. Instead the employer sets the price for tasks. Inherent in the microtasking framework is a severely unbalanced power structure favoring employers. This happens through two mechanisms. First, workers are only compensated after work has been completed. This leaves the workers at the mercy of the employer. This is further complicated by rating of workers by employers. First, workers with poor ratings on many sites are barred from accepting further tasks. Furthermore, employers are allowed to filter out workers based on their approval rating and the practice is commonly promoted by the microtasking sites. On Mechanical Turk for example, the default setting for employers is set to only make tasks available to workers who have a 95 percent or above approval rating. Unsurprisingly, workers are left vulnerable to employers who threaten negative approval ratings.

Transitioning away from microtasking, I will now discuss the other large portion of virtual work – what I refer to as the Virtual Service Industry (VSI). The VSI, like microtasking, is work in which workers and employees use the internet as the tool to make the connection, the internet serves serve as intermediary – connections, arrangements, and financial transactions are facilitated through the internet AND all work is done completely online. Like microtasking, the labor force is global, and the complete virtual nature of the work lends itself well to a global labor force. The main difference between microtasking and the VSI is in both the complexity and duration of the work. Work found in the VSI tends to be "professional" work, and most likely has an equivalent counterpart in the traditional workplace, but does not require a physical presence. This is important because it represents the possibility that jobs are being taken away from workers in traditional office and work settings and being given to workers in

the VSI. The major categories of work in the VSI include web work and programming, design and multimedia work, writing and translation, administration support, sales and marketing work, finance and management, and legal services. The implications of professional and service work moving to the online labor market is that workers who have been less affected by globalization will now face many of the same pressures that manufacturing workers and low-skill workers have historically faced. As I will address later in the paper, a very real possibility could be lower wages for virtual workers when compared to their counterparts in the traditional labor market.

The range of sites for workers in the VSI to choose from is greater than in any other segment of the online labor market. There are a plethora of sites (e.g. 99designs.com, crowdspring.com, createmytattoo.com, iStockPhoto.com, rentacoder.com, articleonepartners.com). While there are a fair number of skill specific sites on the VSI, the majority of the workers and commerce tends to be found on general sites: freelancer.com, elance.com, odesk.com, and guru.com and the number of workers is significant. Freelancer.com has a reported 9.3 million users with over 1 billion dollars of projects posted, oDesk.com has over 2.7 million workers and over 1 million jobs posted in 2012, Elance.com has a reported 2.5 million users, and Guru.com has over 1 million workers. See Appendix B for an overview of VSI sites discussed.

The workers used in my analysis were collected from oDesk.com. I chose to use workers on oDesk.com because it represents the largest online marketplace, as measured by worker earnings, posted jobs and registered workers. As of December 2012, oDesk.com had 2.7 million

workers and 540,000 employers worldwide.[8] Workers on oDesk.com create profiles that list their work experience, expected hourly wage, country of residence, number hours worked on projects booked through oDesk.com, links to sample portfolios of work, any competency tests taken, the last date the worker was active, and the worker's star ratings as evaluated by employers. Workers come from 157 different countries or territories. Potential employers can list jobs and projects and workers are allowed to bid on the job or projects. Potential employers can also contact workers directly about jobs. Work is either done hourly or by fixed price projects. For virtual workers on hourly jobs, workers are required to log into the oDesk.com global online platform. This allows oDesk.com to monitor the rate of keystrokes and mouse activity, and based on this activity, oDesk.com takes "work in progress" snapshots of the virtual worker's computer screen and shares it with the employer. It takes snapshots at random intervals, but for workers with lower keystroke or mouse activity it takes more frequent desktop snapshots. All financial transactions are completed through the online work platform, and hourly workers are compensated weekly for their work. oDesk.com charges employers 10 percent of the hourly rate or fixed price of the project.

There is surprising consistency in the structure of the oDesk.com with the other general VSI sites. All sites have employers post projects which are then bid on by virtual workers. All sites allow employers to either post jobs at a fixed rate or as an hourly rate. All sites have mechanisms in which workers are rated for their work and all sites offer dispute resolution processes in which the site actively becomes involved in disputes. It is unclear based on the

[8] "Virtual offices are altering the future of work". The Globe and Mail. Retrieved October 10, 2014 http://www.theglobeandmail.com/report-on-business/careers/careers-leadership/on-the-digital-job-in-a-virtual-manner/article6789402/

information available on their respective websites as to the exact dispute resolution process, but they all offer those services. The most significant difference between the sites concerns the fee structures. Some of the sites charge the worker, some charge the employer and some charge both. Guru.com charges the worker (between 7-12 percent), Freelancer.com charges both (employers 3 percent, workers 10 percent) and Odesk.com and Elance.com charge the employer (10 percent and 8.75 percent respectively). The premise of charging the worker (or both) is a major departure from all other segments of the online labor market. While it is not clear why the sites would choose to charge the worker, one could argue that charging workers will filter out the less serious workers while simultaneously making the site more attractive to employers than the other sites on the VSI.

When comparing the sites in the VSI to the other segments of the online labor market several points warrant mention. First, the VSI tends to have a more heterogeneous employer base, in part no doubt, because of the diversity of work that is offered. Small businesses use the VSI to contract work they don't have the expertise in house to complete; individuals hire workers for personal projects (e.g. designing wedding invitations); and large corporations outsource entire responsibilities historically given to salaried employees. This diversity suggests that the VSI has the biggest potential for growth. Next, many of the jobs moving to the VSI tend to have come from occupations that have historically been "good jobs". The significance of this can't be understated. The VSI has the potential to replace "good jobs" in traditional labor markets, with contracted workers in the online labor market. On the flipside, the opportunity for workers in developing countries could be significant, potentially at the cost of US workers. What might seem like an extremely low wage for a high-skilled worker in the United States,

could mean a comfortable living for others. I believe the issue of wage differential and the replacement of "good jobs" is perhaps the biggest social and economic implication of the proliferation of the online labor market, and warrants further investigation.

HYPOTHESES

Generally, my research examines what the lack of spatial and temporal constraints in the online labor market means to workers, occupations, and wages. My research will examine workers in two high-skilled occupations and two low-skilled occupations. The high-skilled occupations include software development and network and information systems. The low-skilled occupations include administrative support and customer service. I chose these occupations based on their attributes and typical education requirements as described by the Bureau of Labor Statistics Occupational Outlook Handbook.

The first part of my analysis will focus on differences between virtual workers and traditional workers. I will compare wages between virtual workers and traditional workers in these four occupations to establish if, in fact, a difference in wages exists. If a difference in wages is established, I will focus on the differences between virtual and traditional worker wages in the lower and upper quadrants of the wage distributions to understand if the online labor market is disproportionally hurting workers in certain parts of the wage distribution. More specifically, I will compare virtual workers and traditional workers at various locations along the wage distribution for a high-skilled occupation (software development) and a low-skilled occupation (customer service). I will measure workers at the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles. I expect to see, within the same occupations, the difference in wages between

virtual and traditional workers will be greater at the 10th and 25th percentile than workers at the 75th and 90th percentiles.

The second part of my analysis will focus on virtual workers. I will examine virtual workers' wages along different parts of the wage distribution to understand how the online labor market is affecting lower paid vs. higher paid virtual workers differently within the same occupation and between occupations. I will also create multiple virtual worker wage models that will allow me to identify what drivers within the online labor market might be affecting wages for virtual workers. Regression analysis will be used to understand the relationship between workers' experience, workers' perceived credibility, and workers' skills and wages.[9] More specifically, I will test the following hypotheses:

> Hypothesis #1: For workers in the same occupation, wages for virtual workers will be lower than wages for traditional workers.
>
> Hypothesis #2: Within the same occupations the difference in wages between virtual and traditional workers will be greater for workers in the lower quadrants (10th and 25th percentile) of the wage distribution.
>
> Hypothesis #3: The difference in wages between virtual and traditional workers will be greater in certain occupations. Virtual workers in high-skilled occupations will have the greatest difference in wages compared to their counterparts in the traditional workplace. Conversely, workers in low-skilled occupations will have the smallest differences in wages.
>
> Hypothesis #4: The difference in wages for virtual workers in the lower quadrants (10th and 25th percentile) of high-skilled occupations will be greater than the difference for virtual workers in low-skilled occupations.
>
> Hypothesis #5: Wages within occupations for virtual workers will vary, based on workers' experience, workers' perceived credibility, and workers' skills. Variation will be consistent between high-skilled and low-skilled occupations.

[9] See data section below for comprehensive description of variables

DATA AND RESEARCH DESIGN

I will use primary data I collected from worker profiles on oDesk.com for the wages of virtual workers and I will use BLS wage and occupation data for the workers in the traditional labor market.

oDesk.com Data

Comprehensive worker data for all workers registered on http://www.oDesk.com were captured using web extraction data techniques.[10] All data were collected for all workers on oDesk.com and are summarized in Table 1.[11] While data were collected from oDesk.com workers globally[12], I will focus on workers residing in the U.S., and analysis will only include wages from workers who physically reside in the U.S.,[13] since the wages and data for the occupations in the traditional work settings are for workers in the U.S. It is important to note, that if my analysis did include workers globally, the mean observed wages for all occupations

[10] Data represent workers on oDesk.com on 03/2014.

[11] Data represent workers on oDesk.com on 03/2014.

[12] Includes the following countries: Albania, Algeria, American Samoa, Antarctica, Antigua And Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Bermuda, Bolivia, Bosnia And Herzegovina, Botswana, Brazil, British Virgin Islands, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote De Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gambia, Georgia, Germany, Ghana, Great Britain, Greece, Grenada, Guadeloupe, Guam, Guatemala, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Malta, Martinique, Mauritania, Mauritius, Mexico, Moldova, Monaco, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, Norfolk Island, Norway, Oman, Pakistan, Palestinian Territories, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Romania, Russia, Rwanda, Saint Kitts And Nevis, Saint Lucia, Saint Vincent And The Grenadines, Saudi Arabia, Senegal, Serbia, Seychelles, Singapore, Slovakia, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tajikistan, Tanzania, Thailand, Trinidad And Tobago, Tunisia, Turkey, Tuvalu, Ukraine, Uganda, United Arab Emirates, United States, United States Minor Outlying Islands, Uruguay, Uzbekistan, Venezuela, Vietnam, Yemen, Zambia.

[13] This was determined using the Country of Residence variable

would be significantly lower. Data suggest that virtual workers in the U.S. are making between 40-90% more per hour than their virtual counterparts globally.[14]

Additionally, I excluded worker profiles that seemed suspicious. I believe that many individuals create a profile to "test drive" oDesk.com without any intention of completing work on oDesk.com. Any worker who had 0 hours of work on oDesk.com and had not logged into oDesk.com since 2012 was excluded, as well as any records that displayed suspicious hourly wages (e.g. $.01, $1.11, $11.11, $111.11, $999.99). [15] In total, approximately 38.8 percent of the records were excluded.[16] [17]

Table 2 shows the total number of cases from oDesk.com that were included for each of the four occupations: software development, network and information systems, administrative support and customer service. Those occupations were chosen as they have direct BLS occupational title matches in the wage and occupation data with titles in oDesk.com, which allows for a logical wage comparison. Table 3 summarizes the oDesk.com and BLS occupations that were matched.

[14] See Appendix A for summary of wages for US workers compared to all virtual workers.

[15] Analysis was completed with all data. When compared to analysis with the exclusions mean wages were similar, but standard deviations were significantly greater with all data included. See Appendix A for means and standard deviations for all data and data with excluded cases.

[16] 24,855 workers were excluded from the analysis (prior to excluding workers not active since 2012)

[17] 64,062 workers profiles were extracted total

Bureau of Labor Statistics Data

Secondary data from the Bureau of Labor Statistics' (BLS) wage and occupation data[18] will also be used. The BSL data are collected from employers in all industry sectors in metropolitan and nonmetropolitan areas, in every U.S. state and the District of Columbia. The BLS compiles the responses captured from the National Compensation Survey, the Occupational Employment Statistics Survey, and the Current Population Survey. I used the Standard Occupation Classification System (SOC) to select the four BSL occupation codes that match the oDesk.com occupational categories (Table 3). My analysis includes the BSL wage estimates for the four occupations, as well as the wage hourly rate, the wage hourly rate at the 10th, 25th, 75th, and 90th percentile wages, and the employment percent relative standard error.

Dependent Variable

The key dependent variable will be the hourly wage that the worker posted on their oDesk.com profile, which represents the worker's asking wage for work, not necessarily the actual wage that the worker received for work online.

Within the oDesk.com global worker platform, employers have two ways to hire workers. They can hire workers for a fixed price or hourly. For fixed priced projects, employers either post jobs with a fixed price, request proposals for completion of the project or contact workers directly with a proposal. The second way to hire a worker is hourly. In this case, the employer can post a job and allow workers to apply for the job, or, the employer contacts the worker directly to inquire whether s/he is interested in the job.

[18] May 2013 data used

My data represent the asking hourly rate presented by the worker on their profile. My data do not include work completed on fixed price projects as the number of hours spend on these projects is not available so I am unable to approximate an hourly wage. Although the percentage of work completed on a fixed price project is not publically available, oDesk.com claims on their site that "most people choose hourly contracts". It is also important to note that oDesk.com steers potential employers towards hiring workers hourly through two mechanisms. First, oDesk.com guarantees work when a worker is hired hourly, and if the employer is not satisfied with the quality of the work that was completed by the worker, oDesk.com will refund the employer the cost of those hours. Second, the oDesk.com web interface has a worker monitoring system that is only available to employers when work is contracted hourly. In order to log hours, a worker is required to login to oDesk.com, and the platform monitors the worker's keystrokes and takes periodic screenshots of the worker's computer, which are then available to the employer, so that s/he may monitor the hourly work of the worker.

While using asking wage is not as ideal as using actual wage, four key points demonstrate the merit of using asking wage in this analysis. First, I believe it's less likely that the worker would adjust his/her hourly asking wage on their profile to accommodate an employer request, as this new lower asking wage would then be reflected to all other potential employers. Second, any potential employer has access to all other current job applications for which the worker has applied. Within the application the employer can see the hourly wage the worker indicated in the application. So, a worker who might be applying for multiple jobs simultaneously would be risking receiving a lower hourly wage in other jobs if s/he agrees to

lower his wage for a specific job with another employer. Third, once a job is completed, the employer has the ability to review the worker. If the employer chooses to rate and review the worker, the review will include the hourly rate for that specific job. This means employers, through the reviews, can see the hourly rate other employers have been receiving. The transparency of the worker's hourly wage in their reviews might discourage workers to accept jobs that are lower than their asking wage on their profile because they risk the possibility of future employers negotiating their asking wage down based on their hourly wage history in their reviews. Lastly, given all the different mechanisms available for employers to see the hourly wage the worker has worked for, any wage negotiation would likely result in an actual wage being below the asking wage. Because of this, even if you assume that the asking wage is not representative of the actual wage earned by the worker, then at worst the findings of my research are conservative. That is, any findings suggesting that wages are lower for virtual workers based on my analysis would only be magnified if the measure is not an overestimate of actual wages of virtual workers.

Independent Variables

Four independent variables will be included in my analysis.

Hours Worked Online. This variable denotes the actual number of hours logged by workers in the oDesk.com online work platform.[19] I see this variable as representing the worker's oDesk.com "work experience," and I expect that workers with greater hours will be able to command higher wages. The assumption is that a worker with a greater number hours logged on the oDesk.com global work platform demonstrates to potential employers they are dependable, able to complete work online, and in demand. This will allow workers to command a higher wage. For employers, hours worked on oDesk.com

[19] As described above, it does not include the hours spent on fixed priced projects.

might alleviate any concern about the worker's ability to complete work virtually.

Average User Rating. This variable denotes the satisfaction of previous employers with the worker. Once a job is completed, employers are allowed to evaluate the quality of the work and the worker. All reviews are posted in the worker's profile and available for anybody to peruse. I see this variable as representing the worker's "credibility" and as a proxy for potential employers to assess the quality of work that can be expected. I expect a positive relationship between a worker's "average user rating" and hourly wages.

Number of Tests Passed. This variable denotes the number of oDesk.com skill proficiency tests completed and passed by the worker. Workers have the opportunity to complete 450 different tests[20] in a multitude of different areas. Potential employers are able to see the number of tests taken, whether the same test has been taken multiple times, and the percentage of questions answered correctly. Furthermore, they are allowed to see how long the worker took to complete the test, and how they rank compared to all other workers on the platform who completed the same test. I see this as a proxy measuring the "worker's competency," and I expect a positive relationship with wages.

Number Samples in Online Portfolio. This variable denotes the number of samples in the worker's online portfolio that are available for employers to browse. Depending on the workers occupation the samples in the online portfolio vary. For a software developer, for example, this might include a sample wordpress plug-in created by the worker.[21] These samples are accessible to anybody interested in hiring the worker.[22] Workers are encouraged to post materials in their portfolio so potential employers are able to see the type of work they can expect, in essence a "validation" of skills. I expect to see a positive relationship with wages.

[20] Number of test as of 10/2014

[21] This is an actual example taken from a US Software Developer on oDesk.com

[22] Requires a registered oDesk.com profile

Table 4 summarizes the virtual workers in my data. Not surprisingly, when comparing the hourly rate between the high-skilled occupations and the low-skilled occupations, the high-skilled occupations are earning, on average, about 55 percent more per hour. In general, it also seems as if employers are happy with the work being completed online. The "average user rating" for workers is near 4.7 out of 5 for both models. Looking at the "number of samples in the online portfolios", it seems as if sample work might be more important to high-skilled occupations. Workers in high-skilled occupations have, on average, three samples available, versus two samples for low-skilled workers. Conversely, though, low-skilled workers might put more importance in showing competency through proficiency tests. The "number of proficiency tests passed" by workers in the low-skilled occupations is about 10 percent more than workers in the high-skilled occupations.

FINDINGS AND RESULTS

Mean and Median Differences

Overall, all of the occupations, except administrative support, showed lower *mean* wages for virtual workers. Table 6 summarizes the results. While administrative support showed about 5 percent higher mean wages for virtual workers, the other occupations showed mean differences from about 6 percent lower to as large as 35 percent lower. For *median* wages, all occupations showed lower wages for virtual workers, ranging from about 4 percent lower median wages for virtual administrative support to almost 45 percent lower for virtual network and information system workers. Comparing the mean hourly wages to the median hourly wages for virtual workers, in all instances, the median wage is substantially lower,

suggesting that the distribution of wages is skewed (positively).[23] As the data become skewed, the mean loses its ability to provide the best central location, since the skewed data are dragging it away from the typical value. Also, the mean is susceptible to the influence of outliers. Therefore, I will compare the differences in median wages, not mean wages, between oDesk.com and BLS workers.

The difference in median wage between virtual and traditional workers was greater for the high-skilled occupations (network and information systems and software developers) than the low-skilled occupations (administrative support and customer service). A comparison of median wages along the entire wage distribution between oDesk.com and BLS software developers shows a convergence of wages as earnings increase (see Chart 1). Virtual workers at the 10th percentile earned 59 percent less than their counterparts in the traditional workplace. However, as you move up along the curve, the difference shrinks, and the two distributions converge. At the higher quadrants the virtual workers are actually earning *more* than their counterparts in the traditional workplace.

Next, I compared the wage distributions for virtual and traditional customer service workers (Chart 2). Customer service workers, like software developer, also show a greater difference in wages for virtual workers in the lower quadrants and a convergent of wages as you move up the distribution. Virtual workers at the 25th percentile earned, on average, 23 percent less, and as you move up along the curve, the difference shrinks, and the two distributions converge. Like virtual software developers, virtual customer service workers at the high end of the distribution are actually earning more than their counterparts in the

[23] See Charts 2 and 4 for wage distributions

traditional workplace. In general, my findings show virtual workers earning less and virtual workers in high-skilled occupations earning proportionately less than virtual workers in low-skilled occupations.

My findings raises the question "why is there a greater difference in median (or mean) wages among high-skilled occupations than among low-skilled occupations and why are virtual workers in the lower quadrants earning less proportionally than virtual workers in the higher distribution quadrants?" I propose the answer can be found by looking at both the characteristics of the worker and of the occupations. First, workers in high-skilled occupations will, on average, have higher education, and research shows that households with higher levels of education are increasingly more likely to use computers and have access to the Internet.[24] Thus, because high-skilled workers are more likely to have access to the Internet, high-skilled occupations may have more competition for the jobs because those workers are more likely to access them. I also suggest that the increasing education of workers, globally, is also partially responsible for the difference in wages between virtual and traditional workers. As global workers become more educated, they become viable as workers for high-skilled occupations; occupations that have traditionally remained in the U.S., due to the scarcity of skills globally. On the whole, the world is becoming more educated, while the U.S. is lagging behind. Once the world leader in education, recent research by the Organization for Economic Cooperation and Development showed the U.S. is 15th of 34 nations studied among higher education outcomes and below average for students completing high school. This means that international workers are now, more than they historically have ever been, seen as viable alternatives for workers in

[24] http://cs.stanford.edu/people/eroberts/cs201/projects/digital-divide/start.html

the U.S. Considering that international workers are being paid in U.S. dollars, and their local economic infrastructure might make their cost of living significantly lower than in the U.S., they're likely able to accept lower wages. This might make low paying high-skill work still attractive to the international worker. Thus, employers are able to find high-skilled workers willing to work for less than the typical U.S. worker. Although worker characteristics likely explain some of the difference, I also contend that specific occupational attributes contribute to the observed differences in wages.

Comparing the general attributes of the low-skilled occupations to the high-skilled occupations, it seems that they differ in several key ways: skill type, job autonomy, and language proficiency. High-skilled occupations require hard skills, greater autonomy, and lower reliance on language proficiency.[25] I posit that these three attributes, through different mechanisms, are partially responsible for the differences. First, employers may be more comfortable hiring virtual workers for jobs that require hard skills as they are easier to evaluate and validate. In addition, tasks and projects for high-skilled occupations might tend to be more knowledge/idea-oriented vs customer-oriented. If this is the case, then the work will also tend to be more autonomous, and autonomous work is more conducive to being completed virtually. Generally speaking, work that doesn't require frequent communication or contact, substantive collaboration or strict adherence to schedules or protocols are more conducive to virtual work. According to the US Office of Personal Management federal jobs that are eligible for virtual work arrangements are jobs that don't require face-to-face personal contact, hands-on operation of assets, direct handling of secure materials and activities dependent on a

[25] Summarized and extrapolated from the BLS Occupational Outlook Handbook using Software Developer and Customer Service work as archetypes of higher and lower skilled occupations.

physical presence.[26] In addition, many knowledge/idea-oriented occupations have universal technical languages, while, customer-oriented work may require a higher English language competency. Again, one might expect, then, higher competition for the jobs that either have a low English proficiency requirement or that share universal technical languages, as potential employers are able to leverage the lack of spatial and temporal constraints introduced by the online labor market.

Looking specifically at software developers and customer service workers, these occupations certainly fit the generic attributes of high-skill and low-skill occupations. According to the BLS, software developers "are the creative minds behind computer programs. Some develop the applications that allow people to do specific tasks on a computer or other device. Others develop the underlying systems that run the devices or control networks."[27] The minimum education expected for software developers is a bachelor's degree, and on the job training is not typical, as workers are expected to have skills up front. With the expectation of having skills upfront, comes an understanding that common languages are spoken by software developers, regardless of locale. Coupled with the autonomous nature of computer software development work, language proficiency is less important. The outlook for software developers is better than average, with an expected growth of 22 percent in the next decade.[28] Conversely, customer service workers' minimum education requirement is typically a high

[26] http://archive.opm.gov/pandemic/agency2a-guide.pdf

[27] http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm

[28] http://www.bls.gov/ooh/computer-and-information-technology/software-developers.htm

school diploma and on the job training is expected.[29] Customer service workers typically need good communication skills that require strong language proficiency.

Finally, I believe that the local labor market conditions in less developed countries are affecting the wages for the high-skilled occupations. Workers in occupations with higher wages can more easily be undercut by the online labor market, since these workers have farther to fall before they reach a wage that is not attractive. A worker's reservation wage is the lowest wage rate at which s/he would be willing to accept a particular type of job, and I suggest that the virtual worker's asking wage in low-skilled occupations is much closer to their reservation wage.[30] For illustration, I examine network and information systems, which showed the greatest difference in wages. The average network and information system BLS worker earned $48.82/hr, and the average network and information system oDesk.com worker earned $26.00/hr, a difference of about 45 percent. Despite the significant difference in wages, the average network and information system oDesk.com worker is still earning 134 percent more than the average customer service oDesk.com worker who earned $11.11/hr. So, despite the network and information system worker making much less than s/he would have earned in the traditional workplace, the wage is probably still relatively far from their reservation wage.

Wage Distributions for Virtual Workers: Characteristics of high vs. low-skilled occupations

The characteristics between high and low-skilled occupations might explain the greater difference in wages for high-skilled workers, but they don't necessarily explain why virtual

[29] http://www.bls.gov/ooh/office-and-administrative-support/customer-service-representatives.htm

[30] http://www.econmodel.com/classic/terms/reservationwagerate.htm

workers in the lower quadrants are proportionally earning less. I posit the attributes of the individual wage distribution of virtual workers explains the differences, which I examined next. The wage distribution (see Chart 3) of virtual software developers shows a positively skewed curve. Considering the difference in mean wage and median wage, as illustrated earlier, these results were expected. Examining the distribution more closely, though, it shows approximately 67 percent of the virtual software development workers earning less than the mean wage, which suggests that there are a small number of virtual workers who are earning a substantially higher hourly wage than most of the other workers. The implication, then, is that workers earning less face more competition for jobs, as there are more workers clustered in the lower earning quadrants. The wage distribution of customer service workers (Chart 4) also shows a skewed distribution. Approximately 59 percent of the virtual customer service workers are distributed below the mean. Again, the concentration of workers below the mean wage could explain the greater difference in wages between virtual and traditional customer service workers in the lower quadrants. As clustered workers will compete for work on price (wage), asking wages are driven down. This finding would explain why the difference in wages is greater for the lower wage workers, since competition in the online labor market is driving wages down. The importance of this finding is that the online labor market is disproportionately hurting workers who earn the lowest wages. Still, while the greatest wage difference existed in the lower wage virtual workers in both occupations, virtual workers in software development had a significantly greater disparity, compared to their counterparts in the tradtional workplace. I believe the different characteristics of the software developers and customer service wage distibutions could explain the disparity. Looking at the distributions, software

development has a higher percentage of workers below the mean, and the greatest cluster of workers is far below the mean, unlike the customer service distribution, which showed the largest cluster of workers almost directly on the mean. Furthermore, the customer service distribution is much taller, indicating a greater number of workers clustered in and around the mean wage. As discussed earlier (see Figure 1), software development and customer service vary in key attributes, which I believe contribute to the differences in the distributions.

When you combine the difference in distributions for virtual workers in high-skilled occupations vs. low-skilled occupations with the differences between oDesk.com and BLS distributions, the picture becomes clearer about how the attributes of occupations (see Chart 5) and the online labor market interact. Looking at high-skilled occupations, several important factors contribute to greater wage differences for virtual workers. First, although international workers are becoming more educated on the whole, the level of education for international workers is likely more on par with entry level workers. If this is true, then they will compete with only a subset of the workers within the occupation, the workers on the lower quadrants. Additionally, while international workers are being paid in U.S. dollars, their local economic infrastructure might make their cost of living significantly lower than in the U.S. This might make, by U.S. standards, a low-paid, high-skill job still attractive to the international worker. Lastly, while the difference in wages between virtual and traditional workers is quite high, workers in high-skilled occupations are still earning a moderately high salary in comparison to what they might earn if they took a job in the traditional labor market that only required a low level of skill.

Conversely, the distributions of the low-skilled occupations have several attributes that likely moderate the effects of the online labor market. First, they have workers clustered in and around the mean, suggesting either that there is less competition for work or that wages are low enough to make it less likely that workers would accept lower wages. Second, the attributes of the work in low-skilled occupations make virtual workers less viable. Finally, because of the availability of low-skilled, low-paid workers in the traditional labor market, virtual workers aren't as an attractive option for employers.

Virtual Worker Wage Models

In the final part of my analysis I created several virtual worker wage models to understand what factors might contribute to wage variations for virtual workers. The model uses the information available on the workers' online profiles to uncover what attributes might lead to higher wages. I used regression analysis to understand the relationship between workers' experience ("hours worked online"), workers' perceived credibility ("average user rating"), and workers' skills "(number of proficiency tests passed" and "number of samples in online portfolio") and wages. Since these measures represent the major components by which virtual workers on odesk.com are evaluated by potential employers, understanding how they affect wages is important.

The results show "average user rating" and number of "hours worked online" as significant for both types of occupations. Furthermore, "number of samples in online portfolio" was significant for the low-skill occupations. Looking at the size of the coefficients, the models

-Insert Table 7 here-

suggest that “average user rating” has the greatest impact on wages. Each additional single point increase in “average user rating” increases hourly wages 10 percent for the high-skilled occupations and 21 percent for the low-skilled occupations. The question arises, why is there such a substantial difference in the size of the coefficient for “average user rating” compared to all the other variables in the model? I posit that potential employers use “average user rating” as not only a proxy for competency, but also as a proxy for worker credibility. Absent of the personal interaction of interviews and job references that are typical in traditional workplaces, “average user ratings” become important criteria to estimate the quality of the worker and their work. This conclusion supports the findings of research that has found employers place significant weight on bidder reputation when deciding who to hire (Yoganarasimhan 2013a).

Lastly, to determine if between occupation variation existed, I pooled both samples, created a dummy variable for occupation (low skill=0, high skill=1), estimated a single regression and added interaction terms between the independent variables and the occupation dummy variable. The model showed slight variation in number of “hours worked online” and “number of samples in online portfolio”. Both “average user rating” and “number of proficiency tests passed” were not significant. The small size of the interaction effect coefficients for “hours worked online” (.002) and “number of samples in online portfolio”(-0.159), while significant, suggest that little between occupation variation exists.

In short, my findings from the virtual worker wage models show variation in wages within occupations but only slight variation between occupations. “Average user rating” and “hours worked online” are important proxies for ‘measuring the worker’s competency,

credibility, and ability to complete work virtually for both low and high-skilled workers. The "number of samples in online portfolio" was important for workers in low-skilled occupations.

DISCUSSION

In summary, at the core of all of my findings is that virtual workers earn less. While, on the whole, virtual workers earn less, workers in the high-skilled occupations see greater wage differences.

I argue that many of the various drivers affecting wages discussed in my findings can be traced back to four core determinants. First, the evolution of work since the introduction of the Internet has created a shift from manufacturing to knowledge work, an increase in temporary and contract staffing, and the acceptance of contingent and non-standard work environments – all of which contribute to an environment that is ideal for the online labor market. Second, specific attributes of high-skilled occupations, which offered U.S. workers "good jobs," lend themselves to work being done virtually. Specifically, skill type, autonomy, and language proficiency all contribute. Third, increases globally in education and Internet availability have created a more educated global workforce, which has greater access to the marketplace because of the Internet. Lastly, and possibly most importantly, the online labor market has created a new spatial restructuring of work that removes nearly all temporal and spatial constraints, which has several implications to workers.

The new spatial restructuring gives employers incredible access to an "international reserve army of labor" and enables potential employers to find workers far beyond their physical location, thereby rendering local labor market constraints obsolete. Next, the online labor market provides a framework that further enables non-standard work arrangements that

have been increasing in the U.S. Most work in the online labor market is either task- or project-based, with durations as short as a few minutes to weeks or months. Regardless of duration, the key point is that work is not stable. While workers are able to pick, choose, and leverage multiple online work sites, on the whole, if employers are taking work from traditional labor markets and moving it online, work will become even more precarious. The effects of these structural differences are evident across the four occupations examined, as median wages were lower for all virtual workers.

Finally, the structure of the online labor market is complicit in causing lower wages for virtual workers. Instead of employers being forced to value work based on the task, the onus is put on the worker to establish the lowest rate at which they are willing to do the work. That is, workers post the wage they're willing to work for and allow employers to choose the lowest bidder. This creates a "commodization" of wages, as workers compete against each other to offer the lowest rate, in essence, creating a global reverse auction for jobs. The importance of this can't be overstated because the problem only becomes more acute as more educated international workers are introduced, especially from countries whose standards of living are much lower than that of the U.S. Let's take a software developer in Pakistan as an example. The typical Pakistani software developer earns 52,718 PKR a month, or $514.08 a month. Assuming a 40 work hour week, this translates to an hourly rate of $3.21 for the average Pakistani software developer. Looking at the Pakistani oDesk.com software developers, they are earning an average of $14.10/hr., a significantly higher wage than they can earn locally, yet significantly lower than the average U.S. online software developer. This analysis is the quintessential example of the influence that a global increase of education, coupled with no

temporal and spatial constraints, could have on occupations that have historically been immune to globalization, and the possible staggering effect that the "international reserve army of labor" could have on wages of U.S. workers.

My findings also suggest that the effects of the online labor market on workers' wages are not uniform, and in fact, the online labor market disproportionally hurts the high-paid, high-skilled knowledge workers, particularly those U.S. workers who still have "good jobs." The difference in skill level between high-paid (high-skilled) and low-paid (low-skilled) workers has, until recently, provided more protection from lower wages caused by globalization. Employers were willing to pay a premium for educated, skilled workers, as they were more difficult to find within local labor markets. This has historically created a subset of "good jobs," whose skill set had tempered the lower wages that workers in the service and manufacturing sectors experienced when their education and skills were matched by global workers. As the education of workers increases, globally, coupled with the removal of temporal and spatial constraints in the online labor market, I expect that high-skilled knowledge workers will be more greatly affected by the online labor market, as supported by my findings. In this study, the lowest difference in wages was for the low-skilled jobs (administrative support and customer service), and the high-skilled occupations (network and information system and software developers) showed the highest difference in wages. This suggests that future growth in the online labor market could further exacerbate the growing inequality in the U.S. by continuing to erode wages for workers in high-skilled, "good" jobs.

Limitations and Future Research

The findings of my research, and the implication to U.S. workers' wages, stress the importance of future research that continues to explore how the online labor market is changing the U.S. workers' labor market returns. Future research that begins to profile the online worker will allow for a greater understanding of how online work might be disproportionately hurting different types of workers. My findings also point to the importance of research that more systematically analyzes the effect of the online labor market on "good jobs." Furthermore, research that helps us identify what role online work plays in the worker's labor market strategy is needed to better gauge the potential implications of future growth in the online labor market.

As mentioned earlier, asking wage was used for the online worker, not the actual wage. Although as illustrated earlier, the structure of the oDesk.com global platform likely creates an asking wage that will closely resembles the actual wage. Future research using actual wages earned would allow for stronger assertions to be made on the relative effects of the online labor market on worker wages.

Two unexpected results also suggest areas of future research. First, my research showed that virtual workers in the highest quadrants of the wage distribution earned more than their counterparts in the traditional labor market. One possible explanation could be the result of supply and demand. The online labor market enables employers who can't find traditional workers with certain skills in their geographical area to find workers online. If you assume that the workers who are most difficult to find in a local geographic area are workers with specialized skills, then it will be workers with specialized skills who would be able to

demand and receive the highest wages online. Looking at the distribution of workers, there is a long tail of workers in the upper quadrant suggesting just a small number of workers that are able to differentiate themselves, presumably on their specialized skill set. Given the small supply of those workers, perhaps that is why they are earning higher wages. Potential employers whom don't have those specialized skill sets locally are facing higher competition as they are competing with employers globally for those specialized skills. Future research specifically focusing on the highest paid virtual workers could uncover the reason why.

The second unexpected result was the negative coefficient for "number of proficiency tests passed". I expected that workers who demonstrated proficiency in various subject matters would have resulted in an employer willing to pay higher wages. Yet, the coefficient suggests that every additional proficiency test taken will decrease wages. The objective nature of the testing seems like an effective way to evaluate a worker, whereas, user ratings are inherently subjective. One possible explanation is that workers with less education, fewer skills, or less work experience might be more likely to take tests to try to bolster their online profile.[31] As such, those workers will already be earning less because of their lack of skills or education, and their tendency to take more tests would cause the negative association in the model. Conversely, for the high-skilled occupations, a possible explanation lies in the idea of "outside validation" of skills. Many high-skilled occupations have industry and association certifications that become occupational standards for "hard skills" validation. If this is the case, regardless of the proficiency tests completed, without that credential a worker would be less likely to get substantive work. For example, software developers can be certified in Software Development

[31] Table 4 shows that low-skilled workers, on average, take more tests than high skill workers.

by the Institute of Electrical and Electronic Engineers.[32] Network and Information Systems workers have various certifications available to show competency which are industry recognized.[33] I also believe the "hard skills" expected in high-skill occupations is why a measure, like "number of samples in the online portfolio", does not affect wages in the high-skilled occupations, but is significantly for the low-skilled occupations. Absent a "hard skill," like a certificate or certification, sample work in your portfolio is an alternate way that potential employers might validate a virtual worker's skill. Future research focusing on employers could make a significant contribution. More specifically, research understanding the factors that influence both the decision to seek virtual workers and the factors used in selecting virtual workers.

CONCLUSION

When you consider my findings that showed online wages on average are lower, along with the future potential of growth in the online labor market, the implications for policy can't be overstated. The contingent structure of online work and the precarious nature of contract work suggest that any wage policies need to explicitly include virtual workers. Looking at the hourly rate for virtual customer service workers at the 10th percentile, $5.56, it is well below federal minimum wage. Further investigation shows that 16 percent of virtual customer service workers have their asking wages below federal minimum wage.[34] This illustrates the need for

[32] http://www.computer.org/portal/web/certification

[33] https://www.microsoft.com/learning/en-us/certification-overview.aspx

[34] Specific analysis of the workers below the minimum wage shows they are similar to the other workers in most other attributes. The following were the averages of key variables for these workers: 4.54 average user rating, 123.23 hours worked, 4.40 proficiency tests completed, .869 samples in online work portfolios.

policymakers to include online work on global work platforms in wage policies at a federal level to keep potential employers from shirking established wage policies by hiring virtual workers. It also suggests that online platforms might bear some responsibility of protecting workers from employers paying less than federally-mandated laws.[35] As online work continues to grow, social policy needs to adjust in ways that can support workers whose livelihoods are supported through contingent and contract work in the online labor market and whose wages are determined by a global reserve auction for jobs.

[35] oDesk.com recently implemented a policy that no job can earn less than $5.

Table 1: Description of Data

Table 1 - Description of Data

Variable Name	Variable Description	Variable Type
Occupation	oDesk.com job category. Job category correspond to BLS occupations	Categorical Variable
Hourly Wages	The posted hourly wage that the oDesk.com freelancer indicates they are willing to work for.[1]	Continuous Variable
Worker's Country of Residence	Indicates the country for which the worker marks as their country of residence in their oDesk.com profile	Categorical Variable
Skills Test	oDesk.com offers workers the opportunity to complete various competency test online. oDesk.com has over 450 tests[2] available for workers to take. This variable represents the number of online oDesk.com skill competency test completed and passed by worker	Continuous Variable
Rating	After each completed job, employers are allowed to rate workers on their performance. This variable represents the worker's current average rating of worker based on employer feedback	Continuous Variable
Hours Worked	Number of hours worked on ODesk.com platform	Continuous Variable
Portfolios	Number of samples in the worker's online portfolio available for employers to browse	Continuous Variable
Active Date	The date worker was last active on oDesk.com. Converted variable to the last active year that worker was active (e.g. 1/1/2013 = 2013)	Converted to Categorical

[1] Actual wages agreed upon are not publically available.
[2] Number of test as of 10/2014

Table 2: oDesk.com Occupational Category

Table 2. oDesk.com Occupational Category

	Number
Administrative Support	5,939
Customer Service	3,789
Software Development	2,104
Network and Information System	1,100
Total	12,932

Table 3: oDesk.com and BLS Occupational Matches

Table 3. oDesk.com and BLS Occupational Matches

Odesk Occupational Category	BLS Occupation and Occupational Code
Software Development	15-1130 Software Developers
Network/Information System	11-3020 Information System Managers 15-1142 NETWORK/DB Administrator
Customer Service	43-4051 Customer Service Rep
Administrative Support	43-6014 All Admin minus Legal/Medical 43-9000 Other Office and Admin Support 43-9020 - 22 Data Entry

Table 4: Descriptive Results

Table 4. Descriptive Results

	(1) HIGH-SKILLED OCCUPATIONS				(2) LOW-SKILLED OCCUPATIONS			
	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
Average User Rating	4.648767	0.6816195	1	5	4.674035	0.6382435	1	5
Hourly Rate	34.34746	31.8407	5.28	277.78	15.55659	12.5566	1.22	250
Number of Hours Worked Online	322.2232	963.5008	0	11399	261.2404	852.3737	0	16117
Samples in Online Portfolio	3.103549	8.469318	0	157	1.918925	6.108987	0	157
Number of Proficency Tests Passed	4.003745	4.325932	0	52	4.406147	3.854188	0	53
Last Activity on oDesk.com			2012	2014			2012	2014
	Number of Observations: 3204				Number of Observations: 9728			

Table 5: Correlation Table

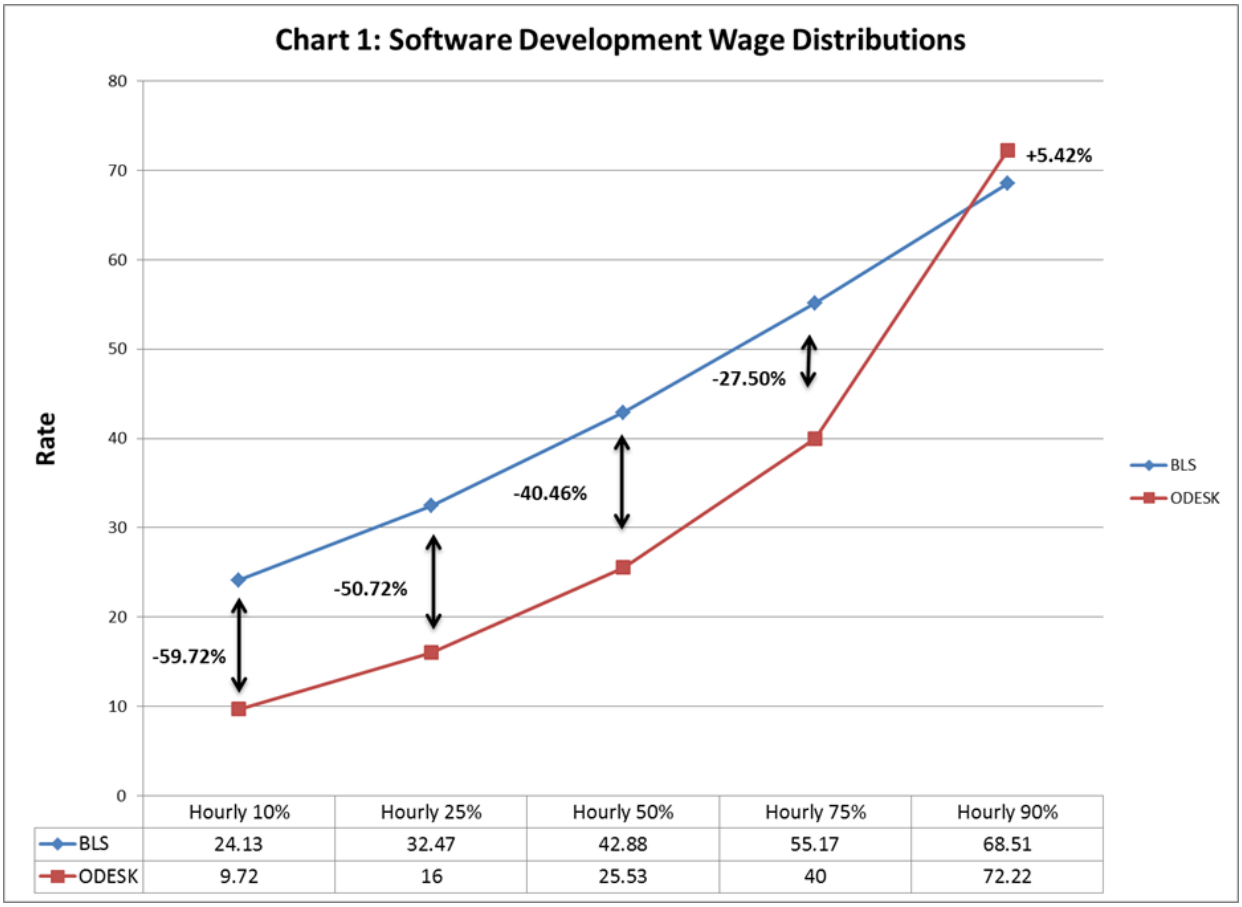
Table 5. Correlation Table					
	Hourly Rate	Average User Rating	Hours Worked	Number of Portfolio Items	Tests Passed
Hourly Rate	1				
Average User Rating	0.0524	1			
Hours Worked	0.0786	0.0465	1		
Number of Portfolio Items	0.0951	-0.01	0.0783	1	
Tests Passed	-0.0062	0.0103	0.1562	0.1359	1

Table 6: oDesk.com Wages vs. BLS Wages for Specific Occupations

Table 6. oDesk.com Wages vs. BLS Wages for Specific Occupations

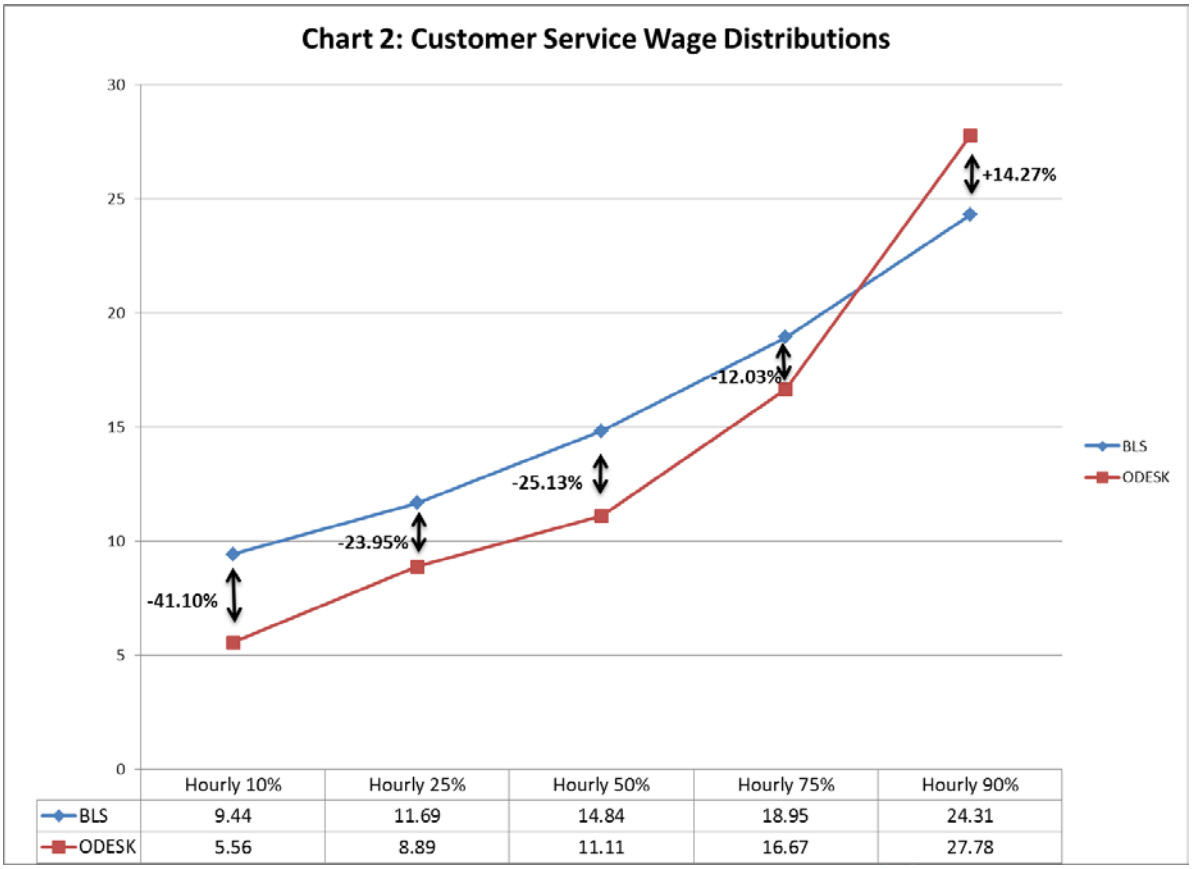
		MEAN WAGES			MEDIAN WAGES			
		oDesk.com	BLS	Difference	oDesk.com	BLS	Difference	
High Skilled	Software Development	$30.19	$44.63	-32.35%	$25.53	$42.88	-40.46%	Largest Difference
High Skilled	Network and Information Systems	$34.03	$49.77	-31.62%	$26.00	$46.82	-44.47%	
Low Skilled	Customer Service	$14.75	$16.04	-8.04%	$11.11	$14.84	-25.13%	
Low Skilled	Administrative Support	$15.60	$14.78	5.54%	$13.33	$14.01	-4.85%	Smallest Difference

Chart 1: Software Development Wage Distributions



	Hourly 10%	Hourly 25%	Hourly 50%	Hourly 75%	Hourly 90%
BLS	24.13	32.47	42.88	55.17	68.51
ODESK	9.72	16	25.53	40	72.22

Chart 2: Customer Service Wage Distributions



	Hourly 10%	Hourly 25%	Hourly 50%	Hourly 75%	Hourly 90%
BLS	9.44	11.69	14.84	18.95	24.31
ODESK	5.56	8.89	11.11	16.67	27.78

Figure 1: Key Occupational Attributes:
Low-Skilled vs. High Skilled Occupations

Figure 1. Key Occupational Attributes:
Low-Skilled vs. High-Skilled Occupations

	Low-Skilled Occupations	High-Skilled Occupation
Skill Type	· Soft Skills Required	· Hard Skills Required
Autonomy	· Low Autonomy	· High Autonomy
Languages	· Language proficency necessary	· Universal Language · Language proficency not necessary
Wages	· Low Wages	· Higher Wages

Chart 3: Wage Distributions for Online Software Developers

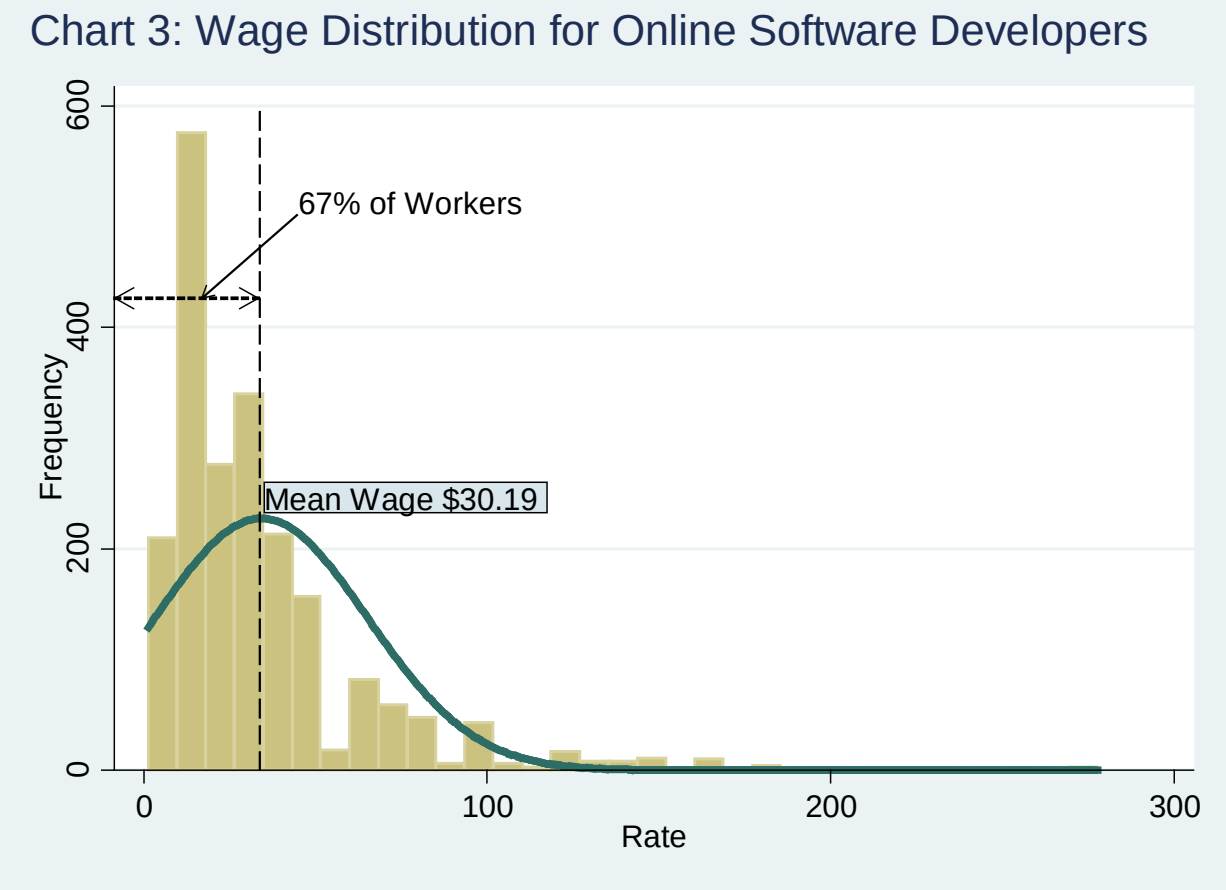


Chart 4: Wage Distributions for Online Customer Service Workers

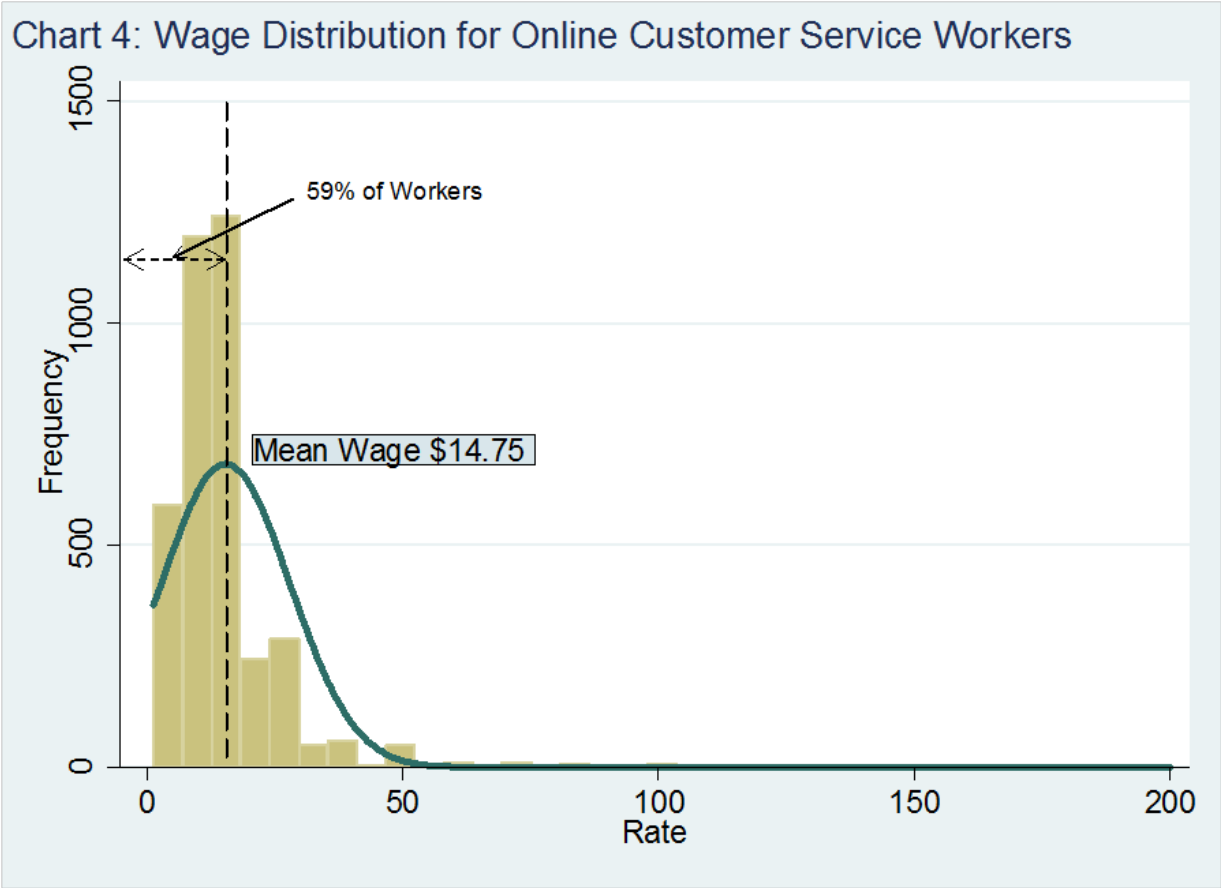


Chart 5: Differences Between and Within Distributions by Low and High Skilled Occupations

Chart 5: Differences Between and Within Distributions by Low and High Skilled Occupations

	Differences Within Distributions	Difference Between Distributions
Low Skilled Occupation Customer Service	-Tall curve with shorter tail -Workers cluster in and around the mean	-Smaller wage difference between oDesk.com and BLS distributions especially in lower quadrants -Faster convergence of wages -Significant surplus for highest oDesk.com workers
High Skilled Occupation Software Development	-Workers cluster well below the mean -Positively skewed distribution with long tail	-Large wage difference between oDesk.com and BLS distributions especially in lower quadrants -Convergence of wage, but far up the distribution

Table 7: Online Worker Wage Models

Table 7. Online Worker Wage Models

	(1) High Skill Occupations (n=2019)		(2) Low Skill Occupation (n=6398)	
	Coefficient	*Standard Error*	*Coefficient*	*Standard Error*
Average User Rating	*2.131 **	*(0.994)*	*1.579 ****	*(0.236)*
Number of Hours Worked on oDesk.com Online Work	0.002 ***	(0.0006)	0.001 ***	(0.0002)
Samples in Online Portfolio	0.673	(0.074)	0.227 ***	(0.023)
Proficiency Test Successully Passed	-0.139	(0.155)	-0.051	(0.040)
_cons	22.94 ***	(4.747)	7.44 ***	(1.127)

* p < .05; ** p < .01; *** p < .001

Table 8: Pooled Model with Interactions

Table 8. Pooled Model with Interactions		
	Coefficient	*Standard Error*
Average User Rating	1.579***	(0.356)
Number of Hours Worked on oDesk.com Online Work Platform	0.001*	(0.0002)
Samples in Online Portfolio	0.226***	(0.0340)
Proficiency Test Successully Passed	-0.051	(0.060)
Occupation Dummy low=0, high=1	15.502***	(3.317)
Occupation * Average User Rating	0.552	(0.695)
Occupation * Hour Worked Online	0.002***	(0.0004)
Occupation * Samples in Portfolio	-0.159**	(0.056)
Occupation * Tests Passed	-0.089	(0.111)
_cons	7.435***	(1.696)
* p < .05; ** p < .01; *** p < .001		

APPENDIX A: Summary of wages, US workers vs. all virtual workers

	All Data		Data with Excluded cases	
Occupation	Mean	Std. Dev.	Mean	Std. Dev.
Administrative Support	15.726823	12.539366	16.009519	18.072639
Business Services	25.475945	29.970702	26.258022	38.780029
Customer Service	15.289749	12.580589	16.20518	21.476975
Design and Multimedia	23.969882	21.999469	24.759695	25.222918
Network and Information System	34.619755	33.539785	35.688469	46.062005
Software Development	34.205105	30.92249	34.56962	36.372924
Web Developer	31.147782	29.423282	31.257587	36.267065
Writing and Translation	20.16473	19.729042	20.72678	23.112954
Total	22.573246	23.32117	23.438242	29.379152

Occupation	ALL WORKERS	US WORKERS	Difference in Means	% Wage Advantage for US Worker
Administrative Support	$ 11.18	$ 15.73	$ 4.54	40.62%
Customer Service	$ 10.72	$ 15.29	$ 4.57	42.65%
Design and Multimedia	$ 14.09	$ 23.97	$ 9.88	70.17%
Network and Information System	$ 17.33	$ 34.62	$ 17.29	99.77%
Software Development	$ 18.25	$ 34.21	$ 15.95	87.42%
Web Developer	$ 17.41	$ 31.15	$ 13.73	78.87%
Writing and Translation	$ 13.02	$ 20.16	$ 7.14	54.85%

TABLE 2 – Software Developers by Country

Country	Mean Wage	Std. Dev.	Freq.
INDIA	$14.53	24.530094	13,176
UNITED STATES	$34.57	36.372924	5,107
PHILIPPINES	$8.94	33.529804	3,749
PAKISTAN	$14.10	20.463498	3,324
BANGLADESH	$11.33	23.818631	2,282
UKRAINE	$21.51	12.098287	2,145
RUSSIA	$23.32	30.314145	1,921
UNITED KINGDOM	$28.69	31.298442	805
OTHER[36]	$21.51	16.4646	11,279

[36] Includes the following countries: ALBANIA, ALGERIA, AMERICAN SAMOA, ANTARCTICA, ANTIGUA AND BARBUDA, ARGENTINA, ARMENIA, ARUBA, AUSTRALIA, AUSTRIA, AZERBAIJAN, BAHAMAS, BAHRAIN, BARBADOS, BELARUS, BELGIUM, BELIZE, BERMUDA, BOLIVIA, BOSNIA AND HERZEGOVINA, BOTSWANA, BRAZIL, BRITISH VIRGIN ISLANDS, BULGARIA, BURKINA FASO, CAMBODIA, CAMEROON, CHILE, CHINA, COLOMBIA, COSTA RICA, COTE DE IVOIRE, CROATIA, CYPRUS, CZECH REPUBLIC, DENMARK, DOMINICA, DOMINICAN REPUBLIC, ECUADOR, EGYPT, EL SALVADOR, ERITREA, ESTONIA, ETHIOPIA, FIJI, FINLAND, FRANCE, GAMBIA, GEORGIA, GERMANY, GHANA, GREECE, GRENADA, GUADELOUPE, GUAM, GUATEMALA, GUYANA, HAITI, HOLY SEE, HONDURAS, HONG KONG, HUNGARY, ICELAND, INDONESIA, IRELAND, ISRAEL, ITALY, JAMAICA, JAPAN, JORDAN, KAZAKHSTAN, KENYA, KUWAIT, KYRGYZSTAN, LAOS, LATVIA, LEBANON, LIBYA, LITHUANIA, LUXEMBOURG, MACEDONIA, MADAGASCAR, MALAWI, MALAYSIA, MALDIVES, MALTA, MARTINIQUE, MAURITANIA, MAURITIUS, MEXICO, MOLDOVA, MONACO, MONGOLIA, MONTENEGRO, MOROCCO, MOZAMBIQUE, NAMIBIA, NEPAL, NETHERLANDS, NEW ZEALAND, NICARAGUA, NIGERIA, NORFOLK ISLAND, NORWAY, OMAN, PALESTINIAN TERRITORIES, PANAMA, PARAGUAY, PERU, POLAND, PORTUGAL, PUERTO RICO, QATAR, ROMANIA, RWANDA, SAINT KITTS AND NEVIS, SAINT LUCIA, SAINT VINCENT AND THE GRENADINES, SAUDI ARABIA, SENEGAL, SERBIA, SEYCHELLES, SINGAPORE, SLOVAKIA, SLOVENIA, SOUTH AFRICA, SOUTH KOREA, SPAIN, SRI LANKA, SWEDEN, SWITZERLAND, TAIWAN, TAJIKISTAN, TANZANIA, THAILAND, TRINIDAD AND TOBAGO, TUNISIA, TURKEY, TUVALU, UGANDA, UNITED ARAB EMIRATES, UNITED STATES MINOR OUTLYING ISLA, URUGUAY, UZBEKISTAN, VENEZUELA, VIETNAM, YEMEN, ZAMBIA.

APPENDIX B: Online Labor Market Sites

TABLE 1 - Online Labor Market: Internet-Facilitated Work Sites (IFW)	
Site	***Description***
RunMyErrand	First well known IFW site. Started in 2008 and rebranded in 2010 to taskrabbit.com
TaskRabbit http://www.taskrabbit.com	Site that allow employers to post jobs and tasks to others in their local area. Employers name the task they need done, name the price they are willing to pay or allow for workers to bid, and workers bid or accept jobs. Workers are screened, including background checks, before they are allowed to bid for work. Once job is complete site facilitates payment plus a 20% service fee billed to the employer. As of Dec. 2013 TaskRabbit is operating in Atlanta, Austin, Boston, Chicago, Dallas, Denver, Houston, Los Angeles & Orange County, Miami, New York City, Philadelphia, Phoenix, Portland, San Antonio, San Diego, SF Bay Area, Washington DC
Campus Bellhops http://www.campusbellhops.com	Located in 47 cities (within proximity of universities) and mainly focuses on “employers” looking for help local moving type services and they rely on local students as their labor pool. They charge employers $40 per hour for each bellhop. Hourly wage given to workers is not known.
ThumbTack http://www.thumbtack.com	Similar to TaskRabbit, Thumbtack allowed employers to post jobs and tasks which are bid on by workers for completion. ThumbTack has workers in all 50 states and has over 240,000 workers available nationally. All workers are screened including national background checks by ThumbTack before they are able ot bid on work.
Zaask (Portugal) http://www.zaask.com Airtasker (Australia) http://www.airtasker.com	Prominent IFW sites in other countries. Zaask is anticipating entering the US market in the future. Airtasker is the most prominent IFW site in Australia Airtasker is unique to IFW sites in that it charges the worker 15% of completed task instead of the employer.
Task Hero http://www.taskhero.com	US based site only using Veterans or military family for workers.Currently in Beta testing in San Diego.
GoGofers http://www.gogofers.com	Similar to many sites, employers post jobs, workers bid. GoGofer is differentiates itself as if has a "rewards" program for both workers and employers. For every job posted and paid by employers they receive reward dollars to be used toward hiring other workers. Worker for every job they bid, even if not accepted, recieve rewards in which they can redeem for free online skills classes they can take in Gogofers "Do It Yourself University".

TABLE 2 - Online Labor Market: Virtual Work - Microtasking Sites	
Site	***Description***
Mechanical Turk http://www.mturk.com	First microtasking site. Owned and operated by Amazon.com. Reportedly over 500,000 workers in over 190 countries. Most workers located in US and India. Employers post Human Intelligence Tasks (HITS) which workers accept and complete. Prices for each task are posted. Employers are allowed to limit workers to specific countries and can pre-vet workers with specific requirements and approval ratings. Workers in US and India can link bank accounts and have payments deposited. All other workers are paid with Amazon gift card credit. Employer are charged between 10%-30% of task amount per task depending on workers selected.
Zhubajie (China) http://www.hubajie.com Witmart http://www.witmart.com	Zhubajie and Witmart are run by the same company. Zhubajie is specific to China and reports having over 7 million registered workers. Witmart is their United States equivalent and reports over 9 million registered workers. Jobs on witmart can be posted in English or Chinese. Similar set up as Mechanical Turk, although some larger paying tasks available on site, most fit under the umbrella of microtasks.
Microworkers.com http://www.microworkers.com	400,000 workers worldwide. Similar set up as Mechanical Turk. Workers are paid once their task balance reaches $9 and are required to have a paypal.com or MoneyBookers.com. Worker must request payout. Employers are charged between 7.5% to 10% of "campaign" value depending on workers selected.
CloudCrowd.com http://www.clowdcrowd.com	Slighty different model than other sites as it focuses on large scale jobs. Employers visit either http://www.serv.io or http://www.crowdsource.com and put is request to have their large scale job complete. Job is broken down into microtasks(by serv.io or crowdsource.com) and posted on CloudCrowd for workers to complete. Completed tasks are aggregated and then delivered back to employer by serv.io or crowdsource. Each task that is completed is reviewed by another worker who accepts or rejects the task (review of task is set up as another microtask). All workers are given a "credibility" score 30 when they sign up, and based on completed tasks that are approved (by other workers in process described above) their credibility score increases. Rejected tasks decreases credibility score. If credibility task dips below and unpublished amount the worker is suspended from completing further tasks. Workers must have paypal account and facebook account. Jobs are posted on CloudCrowd facebook application, and once a task is completed, worker is paid via paypal within 24 hours.

TABLE 3 - Online Labor Market: Virtual Work - Virtual Service Industry Sites	
Site	***Description***
Freelancer http://www.freelancer.com	According Freelancer.com Freelancer.com the site is "the world's largest freelancing, outsourcing and crowdsourcing marketplace by number of users and projects." The site has a reported 9.5 million users in 247 countries with over 1 billion dollars of projects completed. Freelancer is based in Australia and is a publically traded company (ticker ASX:FLN). Freelancer.com is unique in its fee structures as itcharges both employers (3%) and workers (10%). Empolyers post a job, receives bids, and pays worker once task is complete. Workers are several options to recieve payment including wire transfer, EFT and Paypal depending on location. Furthermore freelance.com only allows workers to bid on 8 projects a month, unless they have membership plan with them. They have five different membership plans for workers ranging from Basic to Premium and plans vary with features, maximium monthly bids and fees charged. Monthly plans for workers range from $4.95 a month for the basic plan to $49.95 a month for the premium plan. Employers also have different membership plans which varies features and fees, but they are not limited on the number of jobs that can be posted with the free membership. Monthly plans for employers range from $4.95 a month for the basic plan to $49.95 a month for the premium plan.
Elance http://www.elance.com	Elance.com has a reported 2.5 million users and over 800,000 active employers. Elance fee structure is simple. It charges employers 8.75% of the value of the job. There is no charge for employers to post jobs and recieve bids. Once an employer places a job, they recieve bids on the work as well as profiles of each worker who placed a bid including their work portfolio, work history, tests passed, job feedback/rating, and work history. Once a worker is awarded a job, the employer is required to upload the amount of the job in an elance escrow account. Once the work is approved by the employer the worker is paid. Payment options vary for each worker depending on their country.
Guru http://www.guru.com	Guru.com has over 1 million workers. Like other sites, employers post jobs and workers place bids to complete jobs. Guru is different in its fee structure than other sites in the VSI in that it charges the worker, not the employer for work accepted. Like Freelancer though, Guru has different membership plans that vary features and access to proposal. It has three different plans, its basic plan with is free limits you to 10 bids a month. The other plans allow for up to 100 bids a month, but workers can by addtional "bid paxs" if they want to bid for more work. Guru plans vary depending on what work you want access too with sales & marketing and administrative jobs having the lowest membership fee. Access to engineering, finance and technology related jobs have the highest membership fee. Monthly fees range from $9.95 to 34.95 a month. There are no membership plans or restrictions for employers. Once the work is approved by the employer the worker is paid. Payment options vary depending on location. Guru also has skills tests that workers are invited to take to increase their attractiveness to employers.
oDesk http://www.odesk.com	oDesk.com has over 4.5 million workers and over 1 million jobs posted in 2012. Like Elance, oDesk fee structure is simple. It charges employers 10% of the value of the job. There is no charge for employers to post jobs and recieve bids. Once an employer places a job, they recieve bids on the work as well as profiles of each worker who placed a bid including their work portfolio, work history, tests passed, job feedback/rating, and work history. Once the work is approved by the employer the worker is paid. Payment options vary for each worker depending on their country.

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