DIGITAL WORK: NEW OPPORTUNITIES OR LOST WAGES?

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This paper investigates wages of online workers and workers in traditional workplaces to understand the effects of the online labor market on wages. Using BLS restricted microdata for 6,754,128 workers in traditional workplaces and wage data for 12,932 virtual workers in the US, I argue that characteristics of work that can be done virtually disproportionately affects more highly skilled workers, who have traditionally been more immune to globalization. I find that online work is not only a natural extension of the globalization of labor markets, but also introduces a new spatial restructuring of work that removes temporal and spatial constraints.

This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

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 rise of the "gig economy". The gig economy is generally characterized by short-term engagements among employers, workers and customers. In this sense, the gig economy is not new. Instead, it represents a digital version of the offline atypical, casual, freelance, or contingent work arrangements characteristic of much of the economy prior to the middle of the 20th century and that have reappeared in the past thirty years. What differentiates work in the gig economy is that it operates in a new work ecosystem that is managed by online platforms, which broker work between employers and workers. Hence, digitization is fueling a new peer-to-peer schema that has important implications for the nature of work and the quality of jobs. One major sector of the gig economy is the online labor market, which connects employers with virtual workers. In this paper, I focus on virtual workers completing work completely online. I compare wages of online workers who have counterparts in the traditional labor market to understand differences in wages. I compare workers in both low and high skilled occupations. Furthermore, I compare workers across the distribution of wages to understand if online work is disproportionately hurting certain workers. I find that online work is not only a natural extension of the globalization of labor markets, but also that it introduces a new spatial restructuring of work that removes nearly all temporal and spatial constraints. The spatial restructuring of work creates an "international virtual reserve army of labor" that drives down the asking wages for workers and increases the prevalence of precarious work in the United States. Using Bureau of Labor Statistics restricted microdata for 6,754,128 workers in traditional workplace settings and primary asking wage data for 12,932 virtual workers in the United States, I argue that the nature and type of work that can be done virtually disproportionately affects more highly skilled U.S. workers, who have traditionally been more immune to globalization (Blinder, Levy, & Murname, 2006).

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 show that the spatial restructuring of work has created a new labor framework that allows U.S. employers to reach workers more effectively and cheaply, regardless of either party's location, a fact which creates increased competition for jobs and simultaneously drives down wages within the labor market. Lastly, I demonstrate that the online labor market disproportionately affects more highly skilled U.S. workers.

ONLINE LABOR MARKET: DEFINITION AND BOUNDARIES

Despite all of the attention given to the "gig" economy in the media and scholarly writings, there is still no consensus on how to define it. For this study, I adopt the Congressional Research Service's as:

> "The collection of markets that match providers to consumers on a gig (or job) basis in support of on-demand commerce. In the basic model, gig workers enter into formal agreements with on-demand companies to provide services to company's clients. Prospective clients request services through an Internet-based technological platform or smartphone application that allows them to search for providers or to specify jobs. Providers (gig workers) engaged by the on-demand company provide the requested service and are compensated for the jobs." (Donovan, Bradley, & Shimabukuro, 2016, p.1-2)

Within the gig economy, the majority of the work takes place in four categories of work platforms: crowdwork platforms, transportation platforms, delivery/home task platforms, and online freelance

platforms (Kalleberg & Dunn, 2016). This study focuses specifically on workers on the online freelance platforms, and what I refer to as the online labor market.[i]

Online freelance platform companies provide workers with specific skills (e.g., web developer) access to gig jobs. Work tends to be "professional" work and most likely has an equivalent counterpart in the traditional workplace, even though it does not require a physical presence. Major categories of work include web work and programming, design and multimedia work, writing and translation, administration support, sales and marketing, finance and management, and legal services.

These platforms are quite different than the other platform categories. They allow workers to negotiate their own wages, differentiate themselves by their portfolios, take competency tests, and rate their employers. Workers can turn down work without penalty and there are clear mechanisms for disputing pay and work. Workers typically are hired on a project basis so the jobs tend to be relatively long in duration. These online platforms explicitly market the idea that workers are independent contractors or freelancers. These jobs also tend to be less connected to a physical location, increasing the worker's flexibility and control.

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, yet the current literature has focused on access, transaction costs of virtual work, and effectiveness of labor, while ignoring the effect of the online labor market on wages. Sociology's contribution to the research has predominantly revolved around understanding the effects of technology on mobility and inequality. Dimaggio et al. (2004) explored digital inequality within the online population with respect to workers' extent, types, and autonomy of use, and the ease with which desired information can be retrieved; however, the authors did not examine whether these inequalities among workers varied by worker skill level. Dimaggio and Bonikowski (2008) later examined whether people without Internet access are disadvantaged in their pursuit of "good jobs and adequate incomes" (Dimaggio & Bonikowski, 2008, p.2) and found that U.S. workers who used the Internet increased their earnings at a faster rate than their offline counterparts. They showed a definite positive correlation between Internet usage and earnings, but his analysis was limited to workers already employed in traditional work settings.

Other sociological research found that all non-whites had significantly less access to the Internet (Fairlie, 2004). This finding underscores the importance of examining the role of technology access in economic mobility, as it may both reflect and further contribute to minority economic disadvantages. Still, knowing that minorities enjoy less access to the Internet leaves us with further questions regarding the demographics of the online labor market.

The general consensus that emerges from examining technological change and labor markets through the lens afforded by the inequality and stratification literature is that technological change exacerbates inequality by putting a premium on skilled workers. Scholars use return-to-schooling data as evidence. As technology has advanced and expanded its reach, it has changed the labor market, and 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 10th percentile increased from 266 percent to 366 percent during the same period (Acemoglu, 2002).

Some, in fact, 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-skilled workers because employers are now devoting more capital to creating high-skilled jobs; at the same time, other scholars agree that technological change leads to greater inequality but argue that it's the large increase in the supply of skilled workers that catalyzes the increase in demand, rather than the increase in the availability of high-skilled positions themselves driving the trend. This latter group argues that the supply of skilled these workers enables firms to introduce more efficient techniques (techniques that rely on highly skilled individuals) (Acemoglu, 1998).

Conversely, inequality scholars have explained the technology-driven decrease in wages for low-skilled workers through varying mechanisms. Galor and Moav (2000) argue that technological change creates an "erosion effect" because it reduces the productivity of low-skilled workers. Caselli (1999) claims that we are in the midst of a "skill-biased" technological revolution that has triggered firms to reallocate resources from low-skilled workers and jobs to high-skilled workers and jobs; this decision, he says, ultimately leads to diminished wages for low-skilled workers.

While changes in technology have undoubtedly played a significant role in increases in wage inequality, stratification scholars acknowledge that economic globalization—which exposes national labor and financial markets to international competition—may also contribute (e.g., Lindert & Williamson, 2003). One aspect of economic globalization, relevant to this analysis, is that rising income inequality in many industrialized countries has been associated with increases in the numbers of foreign-born workers. Scholars argue that immigrant populations increase the supply of low-skilled workers, which simultaneously drives down wages and displaces low-skilled, native workers (Borjas, Freeman, & Katz, 1996; Lee, 2005).

Summarizing the inequality literature discussed here, put simply, technological change exacerbates inequality by putting a premium on skilled workers. Furthermore, as globalization increases the supply of foreign-born (generally low-skilled) workers, wages are driven down, and low-skilled domestic workers find themselves displaced. While the literature identifying these trends has not explicitly addressed the online labor market, the existing research suggests that the online labor market would exacerbate inequality by providing opportunities for high-skilled workers, and the increase in job competition would drive wages down for low-skilled workers.

In other disciplines, such as economics, communications, and information science, scholars have studied specific components of the online labor market. Studies range from an evaluation of the applicability of experiments that use online participants (e.g., Horton, Rand & Zeckhauser, 2011) to the effect of (online) 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 the parties are dealing with imperfect information. For instance, studies have looked at the use of feedback rating by employers (e.g., Yoganarasimhan, 2013a), the effects of verified work experience on workers' ability to gain employment (Agarwal, Lacetera, & Lyons, 2013), and the increased complexity that virtual work introduces into communication, coordination, and the overall culture of labor (e.g., Agerfalk & Fitzgerald, 2008).

Other studies have examined the mechanism through which employers and workers are matched. Research has examined the differences in auction designs (open vs. sealed bid) for online platforms (Hong, Wang, & Pavlou, 2015), the distribution of bids (Yoganarasimhan, 2013b), and factors that influence employers' selection (Banker & Hwang, 2008). In short, the preponderance of research has focused on factors in hiring decisions, mechanisms associated with employer/worker transaction costs, and the effectiveness of virtual work for project and research outcomes.

Although current work and employment relations literatures have not yet directly addressed the online labor market, studying the online labor market itself provides a useful context for beginning to unravel 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 available 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 and the Internationalization of Global Labor Markets

Scholars have argued that since the 1970s, the macro-structural changes in social, political, and economic institutions have transformed the organization of work, replacing stable employment systems with more highly 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 2011, p.21). The new social contract of employment, specifically the increased flexibility for employers, meant the end of lifelong employment and of predictable advancement for workers (Cappelli, 1999). Note that the expansion of nonstandard work arrangements, on- and offline, is only possible if there is a surplus of workers willing to accept a less stable arrangement, and the online labor market is founded and centered on nonstandard work arrangements; as such, the online labor market is not only increasing the availability of nonstandard work arrangements but also, by providing such opportunities, the number of workers who turn toward them.

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, both on- and offline 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, p.34). The key consequence of the reworking of the division of labor is that "important tasks no longer need be performed inside the boundaries of the organization" (Powell, 2001, p.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 that over half of these 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, p.89).

The growth and trajectory of the online labor market is not only a natural extension of decentralized capitalism, however; it also reflects the labor markets' response to the new way that work is organized. Hence, while virtual workers are able to pick, choose, and leverage multiple online work sites, the "pay for productivity" (Powell, 2001, p.34) structure of the online labor market magnifies the effects of decentralized capitalism. That is, on the whole, if employers are taking work from traditional labor markets and moving it onto the Internet, work will become even more precarious.

Globalization of production through the internationalization of labor markets has also 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, p.26). The internationalization of labor profoundly changed the nature of work by increasing not only the number, but also the variety, of workers available to employers. When China, India, and the former Soviet Bloc countries entered the global market, the global pool of available labor effectively doubled (Freeman, 2007). As labor was redistributed globally, a spatial restructuring of work resulted, liberating employers from conventional temporal and spatial constraints (Wallace & Brady, 2001). Wallace and Brady (2001) have suggested that "spatialization" allowed employers to easily relocate business operations to optimize production through cheap labor. Now, with over three billion Internet users worldwide,[ii] 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.

Furthermore, the increased access to workers and the corresponding decrease in temporal and spatial constraints has 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, p.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, p.393). With the nearly non-existent temporal or spatial constraints in the online labor market, it is not difficult to imagine further polarized and precarious employment systems. However, employment relations literature has not yet 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, the current research will examine what a lack of spatial and temporal constraints means to workers, occupations, and labor markets.

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 comprised the lion's share of available work. A substantial shift in employment began in the 1970s, toward industries that produced services; this growth has been the driving force of the "knowledge society" we live in today, 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, p.29). The service sector has also fueled the expansion of contingent and nonstandard work, since service sector jobs tend to be more conducive to flexible scheduling (Kalleberg, 2011).

In brief, because of the newness and recency of the gig economy's proliferation, research to date falls short in two areas that my own research will address. First, current labor market research is predicated on spatial and geographic constraints, which do not exist in the online labor market. Second, existing research has not directly addressed the changing organization of work, the internalization of labor, or the shift from manufacturing to service work in the virtual work context. If the online labor market is, indeed, a natural extension of the globalization of broader labor markets, then one would expect a negative effect on workers' wages as temporal and spatial constraints in the organization of work are removed.

RESEARCH DESIGN AND DATA

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 two high-skilled (software development and network and information systems) and two low-skilled (administrative support and customer service) occupations to establish if, in fact, any real difference in wages exists.

If a difference in wages is established, I will focus on the differences between virtual and traditional workers' wages in the lower and upper quadrants of the respective wage distributions to ascertain whether the online labor market disproportionally hurts workers in certain parts of the distribution; more specifically, I will compare virtual workers and traditional workers at various locations along these distributions, measuring at the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles.

The second part of my analysis will focus solely on virtual workers. I will examine virtual workers' wages at different points along the wage distribution to understand how the online labor market is affecting lower-paid vs. higher-paid virtual workers differently (a) within the same occupation and (b) between occupations.

My data for virtual workers comes from primary data I collected from a large online workplace platform that I will refer to as "OWP." For workers in the traditional labor market, I use restricted Bureau of Labor Statistics (BLS) Occupation and Employment microdata. Both datasets are summarized below.

Virtual Worker Data

OWP represents one of the largest online platforms for work. Workers create user accounts that include a worker profile for prospective employers to browse. Employers are then able to invite workers to apply for any job they have posted. The site also allows employers to post open jobs that all workers can view and are allowed to bid on. Employers can either pay a fixed price for a job or hire a worker hourly. The entire transaction is completed on the OWP platform, including messaging, reporting, and compensation. Once a job is complete (or on specified time intervals) the worker is paid through the OWP platform the negotiated rate minus the OWP service fee. OWP only collects service fees from workers. It is important to point out that my analysis is gross of platform fees.

Comprehensive worker wage and occupation data were collected for all US based workers registered on OWP using web extraction data techniques.[iii] I specifically focus on workers who physically reside in the U.S.,[iv] since BLS wages and data are limited to U.S. workers; it is important to note that if my analysis did include workers across the globe, the mean observed wages for all occupations would be

significantly lower. My data suggest that virtual workers in the U.S. are making between 40 – 90% more per hour than their virtual counterparts, globally.

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

Table 1 shows the total number of virtual workers 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 occupational title matches with BLS occupation categories in the wage and occupation data. This matching allows for a logical wage comparison. Table 2 summarizes the specific OWP and BLS occupation titles that were matched, and Table 3 tabulates the total number of BLS workers in the analysis.

---Insert Tables 1 and 2 about here ---

Bureau of Labor Statistics Data

Restricted microdata from the Bureau of Labor Statistics' (BLS) wage and occupation data[viii] will also be used. The BLS 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 OWP occupational categories (Table 2). My analysis includes the BSL wage estimates for the four occupations, as well as the mean wage hourly rate, the wage hourly rate at the 10th, 25th, 75th, and 90th percentile wages.

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FINDINGS AND RESULTS

Mean and Median Differences

Overall, all occupations, except administrative support, showed lower *mean* wages for virtual workers. Table 4 summarizes the results. While administrative support showed about 6 percent higher mean wages for virtual workers, the other occupations showed mean differences from about 5 percent lower to as large as 30 percent lower. Difference of means test for all occupations show statistically significant differences in wages between virtual and traditional occupations.

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 systems 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).[ix]

---Insert Table 4 and Table 5 about here ---

The difference in median wages between virtual and traditional workers was greater for the high-skilled occupations (network and information systems and software developers) than for the low-skilled occupations (administrative support and customer service). A comparison of median wages between OWP and BLS software developers along the entire wage distribution shows a convergence of wages as earnings increase (see Chart I). For example, 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. In fact, in the higher quadrants, the virtual workers are actually earning *more* than their traditional-workplace counterparts.

Next, I compared the wage distributions for virtual and traditional customer service workers (Chart II). Customer service workers, like software developers, also show a greater difference in (and lower) wages

--- Insert Chart I and Chart II about here --

for virtual workers in the lower quadrants, with a convergence of wages as one moves up the distribution: specifically, virtual customer service workers at the 25th percentile earned, on average, 23 percent less than their traditional-workplace counterparts, with the difference shrinking and the distributions converging as earning percentile increases. Furthermore, like virtual software developers, virtual customer service workers at the high end of the distribution are actually earning more than their non-virtual counterparts. In general, my findings show virtual workers earning less overall, and—interestingly—high-skilled virtual workers earning *proportionately* less than low-skilled virtual workers, compared to their respective counterparts in the traditional workplace.

Wage Distributions for Virtual Workers

The wage distribution (see Chart III) 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, one finds 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 others. The implication, then, is that lower-earning workers face more competition for jobs, as there is a greater number of workers clustered in the lower-earning quadrants.

The wage distribution of customer service workers (Chart IV) 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

--- Insert Chart III and IV about here ---

virtual and traditional customer service workers in the lower quadrants. As clustered workers will compete more fiercely for work, asking wages are driven down. This finding would explain why the difference in wages between virtual customer service attendants and traditional-workplace customer service attendants is greater among the lower-wage workers, since greater competition in the online labor market is driving wages down for the former group. The importance of this finding is the fact that it reveals that the online labor market disproportionately hurts workers who earn the lowest wages.

Still, while the greatest wage difference existed among the lower-wage virtual workers in both occupations (compared to their non-virtual counterparts), virtual workers in software development had a significantly greater disparity. Looking at the wage distributions, software development shows an even higher percentage of workers below the mean, and the greatest cluster of workers is far below it. Furthermore, the customer service distribution is much taller, indicating a greater number of workers clustered in and around the mean wage. Chart V summarizes the difference in distributions.

---Insert Chart V about here ---

Although individual worker characteristics likely explain some of the gap between virtual and traditional-workplace wages, I contend that occupation-specific attributes contribute to the observed differences in wages as well. Comparing the general attributes of the low-skilled occupations themselves to the high-skilled occupations, it seems that they differ in several key features: required skill type, level of autonomy, and language proficiency (see Figure 1). High-skilled occupations require hard skills and greater

autonomy, but rely less on language proficiency.[x] 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 these are easier to evaluate and validate. In addition, tasks and projects for high-skilled occupations might tend to be more knowledge-/idea-oriented than customer-oriented. If this is so, then the work will also tend to be more autonomous, and autonomous work is more conducive to being completed virtually.

Generally speaking, work that does not require frequent communication or contact, substantive collaboration, or strict adherence to schedules or protocols is more conducive to virtual work. According to the U.S. Office of Personnel Management, federal jobs that are eligible for virtual work arrangements are those that don't require face-to-face personal contact, hands-on operation of assets, direct handling of secure materials, or any other activities dependent on a physical presence.[xi] 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.

--- Insert Figure 1 about here ---

DISCUSSION

I argue that many of the various drivers affecting wages discussed in my findings can be traced back to five core determinants. First, work has evolved in ways that create an environment ideal for virtual work. There has been a shift from manufacturing work to knowledge work, and an increase in the use of temporary and contract staffing has driven the acceptance of contingent and non-standard work environments.

Second, the attributes of many of the high-skilled occupations that historically represented "good jobs" for U.S. workers—these attributes being skill type, autonomy, and language proficiency—actually lend themselves to virtual work completion.

Third, worldwide increases in education and Internet availability have created a more educated global workforce, for whom the Internet now offers greater access to the marketplace beyond their countries' borders.

Fourth, 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 quality with which the task is performed—or the time or degree of specialization that goes into it—the onus is now on the worker, instead, to establish the lowest rate at which s-/he is willing to work. That is, workers post the wage they're willing to work for and allow employers to select the lowest bidder. This creates a "commoditization" 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 trend 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 in the U.S.

Lastly, and possibly most importantly, the online labor market has created a new spatial restructuring of work in which nearly all temporal and spatial constraints dissolve. This has several implications to workers. The new spatial restructuring gives employers incredible access to an "international reserve army of labor" and enables the former 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, which 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 this type of work is not stable. While workers are able to pick, choose, and leverage multiple online work sites, if employers are taking work from traditional labor markets and moving it online, work, on the whole, 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.

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 U.S. workers' labor market returns. Research that begins to profile the virtual 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." Understanding this variability in the quality of jobs will help assess the conflicting benefits and costs associated with virtual work.

Furthermore, research that helps us understand the role that online work plays in the worker's labor market strategy would allow for a more fruitful conversation about the tradeoffs of this non-standard work arrangement. Research has shown that temporary work disproportionally hurts certain workers (e.g. Di Natale, 1999). Could the greater reliance of technology in the gig economy, further exacerbate the problem by exposing another damaging attribute of the digital divide? Imagine companies who have historically relied on temporary agency workers turning to the gig economy and its supply of works not constrained to local labor markets. Research has also shown that workers in the gig economy skew young. Those aged 18 to 34 are much more strongly represented in the freelancer ranks than in the workforce as a whole.[xii] Depending on a worker's strategy for the gig economy, the long-term implication for social mobility could be drastic.

On the flipside, perhaps the gig economy offers opportunities to groups whom otherwise would not have had access? For example, a recent immigrant facing institutional difficulties obtaining full time work can leverage the lower barriers of entry in the gig economy. In addition, workers themselves might find contingent work advantageous. The flexibility offered by the gig economy also suits the youngest cohort of workers, who prioritize autonomy and work-life balance more than previous generations (Myers & Sadaghiani, 2010; Fromm, 2015).

Lastly, understanding how this type of work fits into a worker's career strategy will advance career and management literatures. Does this type of work fit into Arthur and Rousseau's (1996) boundaryless careers perspective, and contribute to the notion that workers view multiple employer experiences in a positive light because they support skill development, enhance personal satisfaction, and shifts career control to the employee or does it support the literature that argues temporary workers are locked into a labor market underclass, with low wages, no benefits, negligible job security, little training and no possibility of advancement (Segal & Sullivan, 1997).

CONCLUSION

My findings suggest that workers completing work virtually earn less, but that the effects of the online labor market on workers' wages are not uniform. In fact, the online labor market disproportionally hurts the high-paid, high-skilled knowledge workers, particularly those U.S. workers who still have (and/or seek) those jobs traditionally considered "good jobs". Until recently, the difference in skill level between high-paid (high-skilled) and low-paid (low-skilled) workers has provided more protection from the lower wages caused by globalization; employers were willing to pay a premium for educated, skilled workers, as they were more difficult to find locally. This has historically created a subset of "good jobs," whose specialized skill sets had tempered the lower wages that workers in the service and manufacturing sectors experienced when their own 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 increasingly affected by the online labor market. This is a prediction that my findings already seem to support and, if borne out by further studies, would suggest 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.

The potential for the continued erosion of "good" jobs suggests that wage policies explicitly need to include virtual workers. As an example, looking at the hourly rate for U.S.-based virtual customer service workers at the 10th percentile—$5.56—one notes that it is well below federal minimum wage. Further investigation shows that 16 percent of virtual customer service workers in the U.S. set their own asking wages below federal minimum wage. This phenomenon highlights policymakers' need to include online work on global work platforms in federal wage policies, in order to keep potential employers from hiring virtual workers as a means of shirking established policies. It also suggests that online platforms might bear some responsibility in protecting workers from employers' paying less than federal laws mandate.[xiii] As online work continues to grow, social policy needs to adapt in ways that can support those all workers. Policy needs to reflect the reality that many workers' livelihoods are supported through contingent and contract work in the online labor market and current labor and wage laws are not structured in ways to adequately protect them. But it isn't just online workers who need to be protected. Even workers who don't work online are going to suffer from the lower-wage trends, because as any employers realize they can pay less by hiring online, jobs will continue to move out of the traditional workplace. Simultaneously, those positions (in the same fields) that remain in the traditional workplace will have little reason to pay wages that keep pace with inflation, so, in time, even the domestic non-virtual workers will see a decline in wages.

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TABLE 1
OWP WORKERS BY OCCUPATIONAL CATEGORY

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

TABLE 2
OWP AND BLS OCCUPATIONAL MATCHES

OWP 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 3
BLS WORKERS BY OCCUPATION CATEGORY

15-1130 Software Developers	973,884
11-3020 Information System Managers 15-1142 NETWORK/DB Administrator	1,315,332
43-4051 Customer Service Rep	1,479,624
43-6014 All Admin minus Legal/Medical 43-9000 Other Office & Admin Support 43-9020 - 22 Data Entry	2,985,288
Total	6,754,128

TABLE 4
OWP WAGES VS. BLS WAGES FOR SPECIFIC OCCUPATIONS

		MEAN WAGES			MEDIAN WAGES			
		OWP	BLS	Difference	OWP	BLS	Difference	
High Skilled	Network and Information Systems	$34.62	$49.77	-30.44%	$26.00	$46.82	-44.47%	Largest Difference
High Skilled	Software Development	$34.21	$44.63	-23.35%	$25.53	$42.88	-40.46%	
Low Skilled	Customer Service	$15.28	$16.04	-4.74%	$11.11	$14.84	-25.13%	
Low Skilled	Administrative Support	$15.72	$14.78	6.63%	$13.33	$14.01	-4.85%	Smallest Difference

TABLE 5
DIFFERENCE OF MEANS TEST BY OCCUPATION

Software Development

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
SD	2104	34.2051	.6741423	30.92249	32.88305	35.52716

mean = mean(SD) t = -15.4639
Ho: mean = 44.63 degrees of freedom = 2103

Ha: mean < 44.63 Ha: mean != 44.63 Ha: mean > 44.63
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Network and Information Systems

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
NIS	1100	34.61975	1.011263	33.53979	32.63553	36.60398

mean = mean(NIS) t = -14.9815
Ho: mean = 49.77 degrees of freedom = 1099

Ha: mean < 49.77 Ha: mean != 49.77 Ha: mean > 49.77
Pr(T < t) = 0.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 1.0000

Customer Service

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
CS	3789	15.28975	.2043801	12.58059	14.88904	15.69046

mean = mean(CS) t = -3.6709
Ho: mean = 16.04 degrees of freedom = 3788

Ha: mean < 16.04 Ha: mean != 16.04 Ha: mean > 16.04
Pr(T < t) = 0.0001 Pr(|T| > |t|) = 0.0002 Pr(T > t) = 0.9999

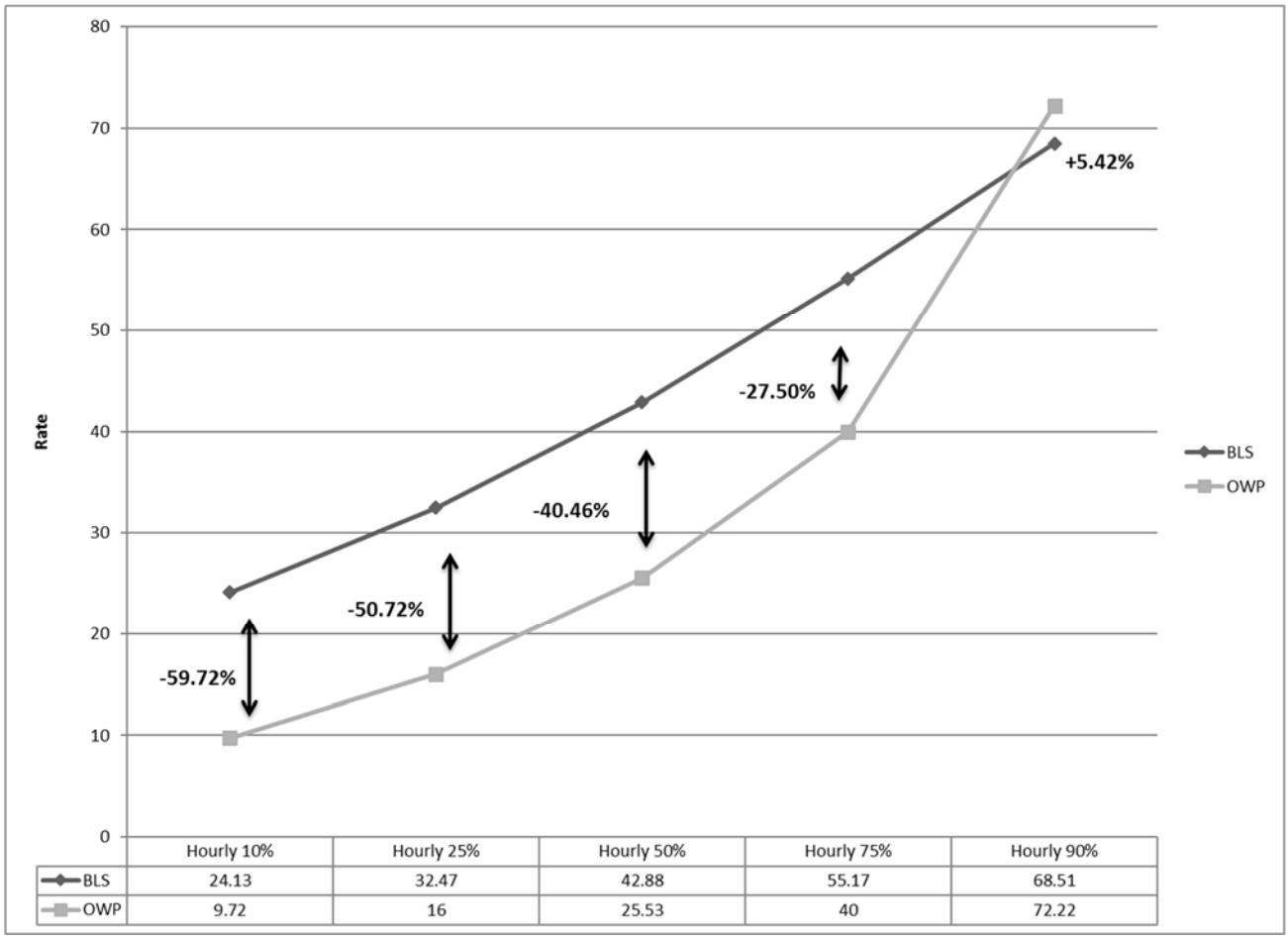
Administrative Support

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
AS	5939	15.72682	.1627118	12.53937	15.40785	16.0458

mean = mean(AS) t = 5.8190
Ho: mean = 14.78 degrees of freedom = 5938

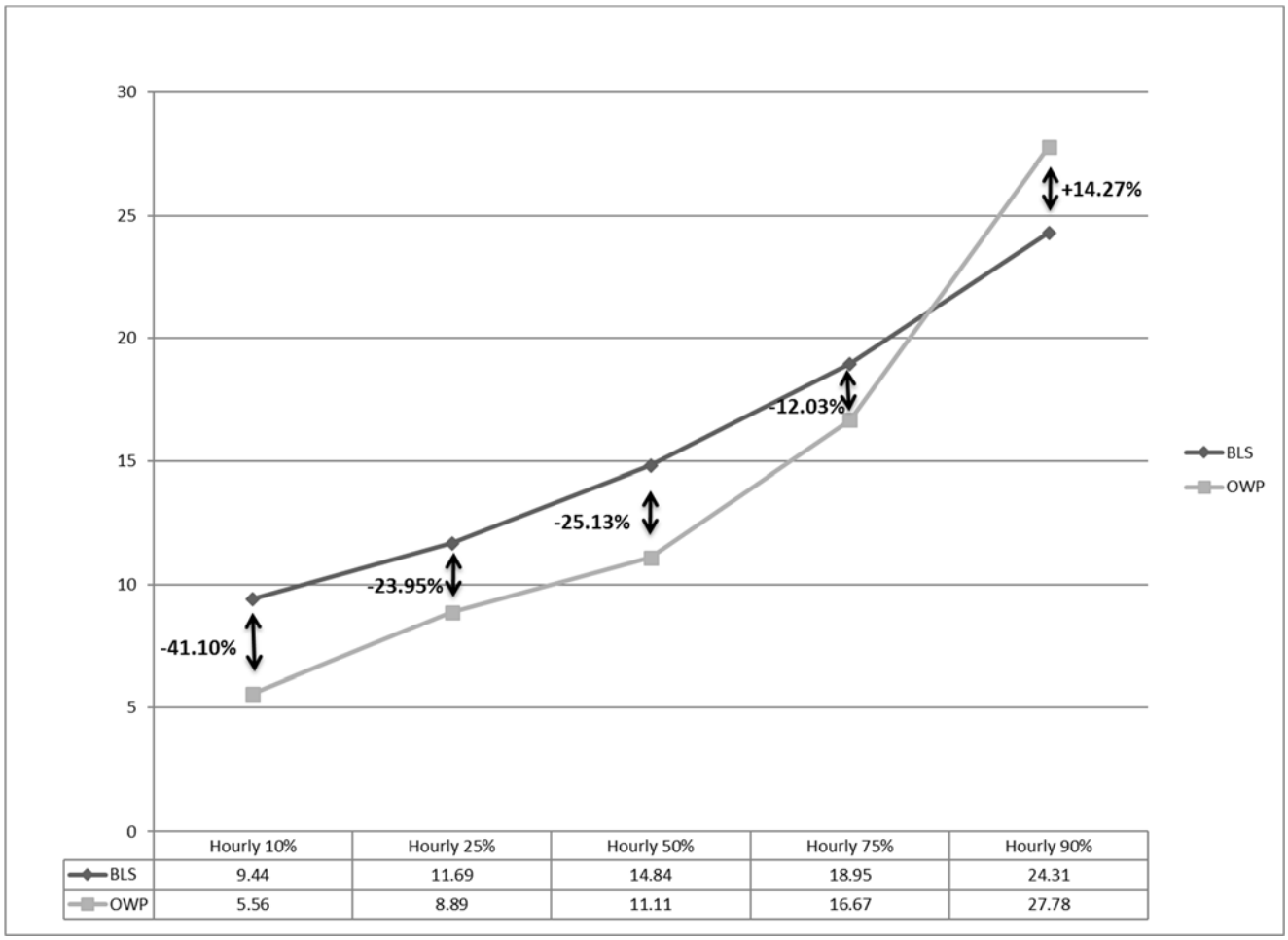
Ha: mean < 14.78 Ha: mean != 14.78 Ha: mean > 14.78
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000

CHART 1
SOFTWARE DEVELOPMENT WAGE DISTRIBUTION



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

CHART 2
CUSTOMER SERVICE WAGE DISTRIBUTION



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

CHART 3
WAGE DISTRIBUTION FOR ONLINE SOFTWARE DEVELOPERS

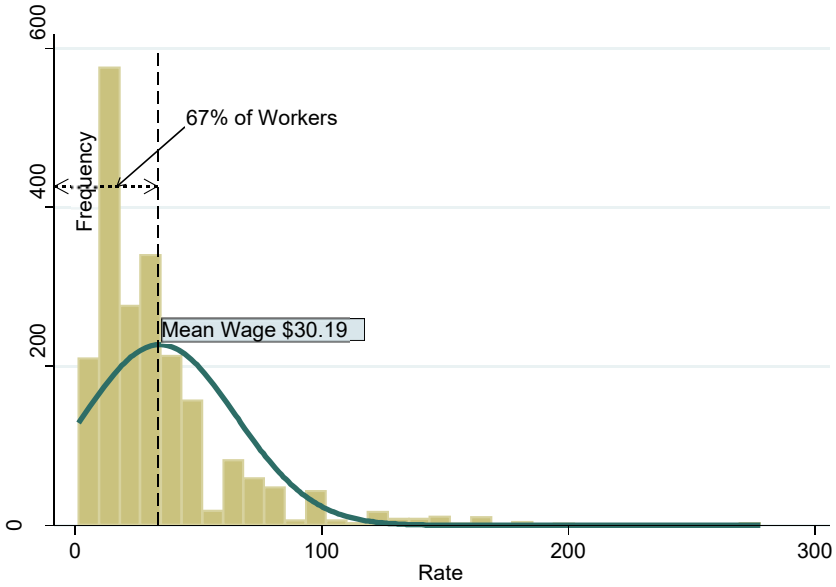


CHART 4
WAGE DISTRIBUTION FOR ONLINE CUSTOMER SERVICE WORKERS

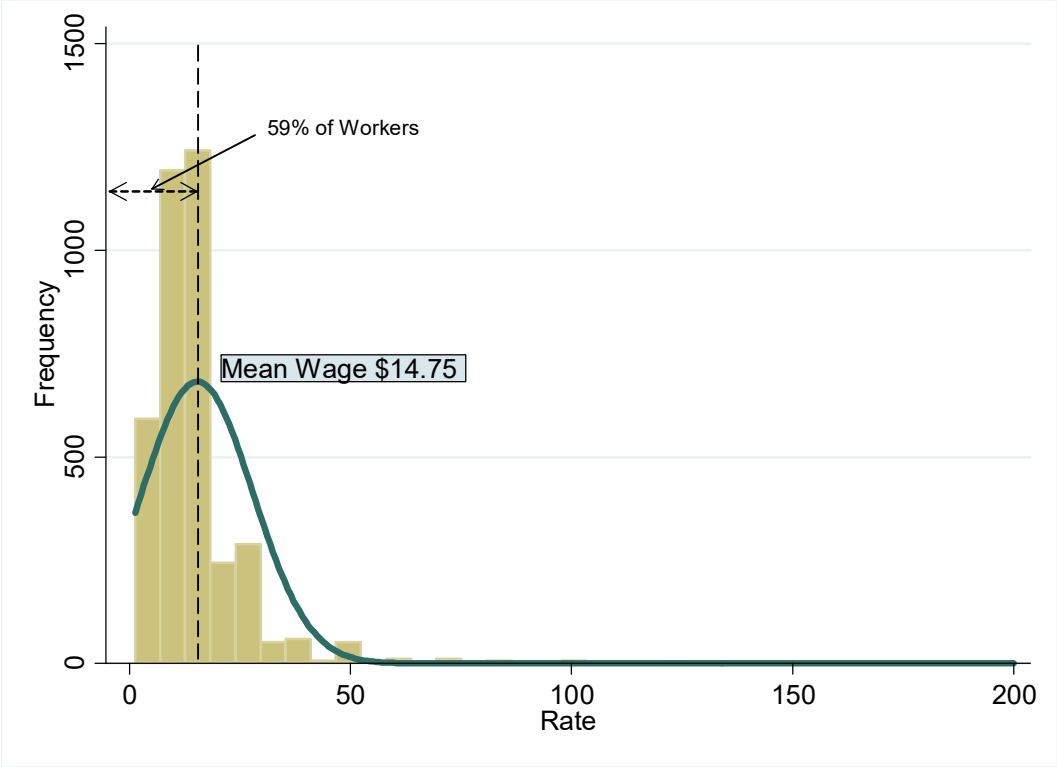


CHART 5
DIFFERENCES BETWEEN AND WITHIN DISTRIBUTIONS BY LOW AND HIGH SKILLED OCCUPATIONS

	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 OWP and BLS distributions especially in lower quadrants -Faster convergence of wages -Significant surplus for highest OWP workers
High Skilled Occupation Software Development	-Workers cluster well below the mean -Positively skewed distribution with long tail	-Large wage difference between OWP and BLS distributions especially in lower quadrants -Convergence of wage, but far up the distribution

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 proficiency necessary	· Universal Language · Language proficiency not necessary
Wages	· Low Wages	· Higher Wages

ENDNOTES

[i] Crowdwork platforms also make up part of the online labor market as work on crowdwork platforms are also all completed virtually. Thus, online freelance platforms and crowdwork platforms constitute the online labor market
[ii] http://www.Internetlivestats.com/ (accessed 1/03/17)

[iii] Data represent workers on 03/2014.

[iv] This was determined using the Country of Residence variable
[v] 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.

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

[vii] 64,062 workers profiles were extracted total

[viii] May 2013 data used
[ix] See Charts II and IV for wage distributions
[x] Summarized and extrapolated from the BLS Occupational Outlook Handbook using Software Developer and Customer Service work as archetypes of higher and lower skilled occupations.
[xi] http://archive.opm.gov/pandemic/agency2a-guide.pdf

[xii] http://www.bloombergview.com/articles/2015-10-01/gig-economy-is-growing-but-not-growing-up
[xiii] OWP recently implemented a policy that no job can earn less than $5.