Bus Econ
DOI 10.1057/s11369-017-0053-1

America's online 'jobs': conceptualizations, measurements, and influencing factors

Christopher Alex Hooton[1]

Abstract The paper examines the size and distribution of online income positions (OIPs) from internet platforms in the United States. While researchers have developed traditional internet sector employment estimates (e.g., engineers), this secondary OIP market remains largely unmeasured due to shortcomings in industrial codes, conceptualizations, and methods. The estimates that do exist vary greatly. The paper addresses these shortcomings through original survey data collected directly from internet sector companies, allowing it to develop the first comprehensive look at the market for online income opportunities. The paper provides national and state-level estimates, finding approximately 23.9 million OIPs exist currently in 2017. The paper finds that these OIPs are present across all 50 states and the District of Columbia and that their distribution is less tied to population levels than traditional employment. The paper also develops a model for OIP levels with a surprisingly strong fit, which demonstrates that OIPs are driven by relative cost to income factors, exposure to the 'tech' sector, and internet access, but not by unemployment. To the extent of the paper's knowledge, this is the only research that has drawn on actual internet firm data to estimate the size of the OIP market.

Keywords Internet · Internet sector · Sharing economy · Digital economy · Labor markets

1 Introduction

For approximately three decades, the internet has been developing into a unique economy with its own assets, currencies, goods, services, and more. One critical component of the internet sector's maturation has been the revolutionary development of new online markets for work and commercial opportunities.

There are two aspects to this: (1) the development of new 'traditional' jobs through new products and services and (2) the facilitation of new types of work, job arrangements, and other commerce opportunities through new technologies.

This latter aspect is defined by a very wide array of activities conducted by a wide array of individuals. These range from work for traditional firms to microbusinesses to freelance labor and more. The exact nature of the work (i.e., full-time versus part-time, primary income source versus supplementary, freelance versus salaried) varies tremendously depending on each individual's preferences and needs, while the terms lobbed at the positions and activities are often oversimplified, weighted with connotation, and representative of only a fraction of the overall online market. The one important aspect that unites these commercial activity types across their differences is that they allow individuals to earn income. The defining characteristic of the market overall has been its elusiveness to accurate measurement up to now, likely in part due to conceptual limitations linked to traditional labor models.

This paper won the Edmund A. Mennis Contributed Paper Award for 2017 and was presented at the NABE Annual Meeting on September 24, 2017.

✉ Christopher Alex Hooton
economics@internetassociation.org

[1] Internet Association, Washington, DC, USA

Currently in 2017, there are (at least) approximately 23.9 million *online income positions*[1] in the United States. To provide a scale and more context for that number, there are 20.7 million jobs in *Professional and business services*, 15.7 million *Healthcare* jobs, 12.4 million *Manufacturing* jobs, and 0.8 million *Telecommunications* jobs in the United States as of June of 2017. State by state, online income positions (OIPs) range from approximately 5.8 million (the most) in California to just under 20,000 (the least) in North Dakota. In addition to this OIP market, the internet sector supported an additional 3–3.6 million traditional jobs as of 2014.[2] The one important note of temperance, however, is that this paper is unable to examine the intensity of these positions and so it is inappropriate to think of each one as the equivalent of a regular, full-time position.[3]

The paper finds that the number of OIPs is largely driven by relative income levels (cost of living, poverty, and GDP per capita levels), but not by unemployment. In other words, there is evidence that OIPs are serving as income supplements—for example in high-cost areas or in areas with weaker economies—but not primarily as job replacements.

These figures come directly from Internet Association's (IA) member companies, which represent a significant portion of the internet sector, and the author argues that the data offer a largely accurate estimate for the internet sector overall.[4] The paper has compiled this proprietary information through a survey of its members along with publicly available resources from its member companies. All data have been aggregated and anonymized at the US state and national levels to allow for analysis and in accordance with antitrust regulations. To the extent of the author's knowledge, this is the only report and IA the only organization with access to this data.

The report begins in Sect. 2 with a discussion of the existing literature estimating the OIP market or some component thereof. Section 3 describes the data and methodology. Section 4 offers a series of analyses to describe the OIP market including some simple modeling of OIPs using standard multiple regression. The report finds a surprisingly robust model for the number of OIPs in states through a series of exploratory specifications. Section 5 discusses policy implications and Sect. 6 concludes.

2 Estimates of the online labor force

2.1 Definitions

There is an initial point of clarification to make: this report combines all types of online commercial activities by individuals into one. In other terms, rather than comparing oranges and apples individually by fruit type, it throws every fruit into the same basket. This is unique relative to other literature, which has often looked at segments of OIPs like online retailers or short-term rental hosts, and is important because it uses the broadest perspective possible out of a wide range of options for how to define the OIP market.[5]

The paper defines *online income positions* as registered commercial positions that are (1) facilitated through online intermediaries, which also serve as financial intermediaries in the transactions, and (2) that allow an individual or business to earn revenue. Some prototypical examples of OIPs include ride-sharing programs (e.g., Lyft, Uber, etc.) and micro-business platforms (e.g., Etsy). The paper defines the *OIP market* as the full ecosystem of OIPs. Finally, it defines the internet labor market as the combination of OIPs, direct internet sector jobs (captured by formal NAICS codes), and indirect sector jobs (captured by formal industry code multipliers).

Within the literature that has attempted to define and capture the OIP market, there appears to be broad consensus that the primary characteristics include the following: (1) the short-term nature of the transactions (i.e., the duration of a particular task and payment by task), (2) high degree of worker autonomy, and (3) the use of an online intermediary to connect buyers to sellers on demand (see Table 1 for sources from which the paper draws this conclusion).

[1] The report strongly notes that the term 'position' is imperfect and that readers should not equate OIPs to traditional jobs. The use of the word 'position' reflects the fact that each OIP represents unique activity, but not necessarily a unique person since we are unable to determine if an individual pursues multiple types of activities (or OIPs). Another way of phrasing OIP is the term *online income participant,* which better reflects the fact that these are not jobs and, rather, individuals *participating* in online marketplaces. The word *participant* is not used here for a similar reason—to more clearly represent the fact that each OIP does not necessarily represent a unique individual. Yet another potential alternative is *online income opportunities*, which perhaps offers less association with "jobs," but fails to capture that the opportunities are indeed registered.

[2] Internet Association estimated approximately 3.0 million jobs for 2014 in its 2015 report "Measuring the US Internet Sector," while the unadjusted estimates by state provided here total approximately 3.6 million as of 2014.

[3] For example, while we have figures for ride-sharing, it is impossible to know if a person drives seven days per week, once per month, or if they simply registered and have never actually driven.

[4] The figures here are not a complete picture in the sense that there are other non-member companies for which we do not have data. This suggests the estimates here are slightly low.

[5] The author also recognizes that such an approach limits the ability to conduct analysis and to gain insights on the performance of components, such as the 'sharing economy.' This is partially by design because of the competitive nature of the data used here, which prohibits the author from more refined geographic aggregation and more refined industrial/activity analysis.

The use of an online intermediary is what distinguishes an OIP from traditional forms of independent work, including independent contractors or freelancers. However, there is inconsistency among the limited amount of research on what constitutes an online intermediary (see Table 1 for a full breakdown of previous literature definitions). For example, Harris and Krueger (2015) defined their "independent worker" as individuals who can choose their work, but who are restricted in the way they charge customers via the intermediary (e.g., Uber, Lyft, Amazon Mechanical Turk).

This, by definition, excludes individuals using many OIP intermediaries, such as home-sharing services where there are generally no restrictions on how pricing is set or general listings services where there are few restrictions in general for income (e.g., Craiglist). Farrell and Greig (2016) explicitly exclude intermediaries that (1) do not serve as financial middlemen (e.g., Craigslist) and (2) do not serve the exchange of goods and services explicitly (e.g., Couchsurfing). Katz and Krueger (2016) only consider online intermediaries that serve as the primary work of the individual (thus, eliminating 'side gigs' and other forms of 'commercializable' activities from consideration if the individual is traditionally employed in addition to their OIP).

The current paper argues that these distinctions are important to refine further, but that a comprehensive taxonomy of digital OIP activity types is likely a more useful first step. One primary reason for the variation in what constitutes online intermediaries and, subsequently, OIPs have been the lack of data from which researchers can draw. Another has been the lack of a standard definition from the internet sector itself or from a relevant government agency. Unfortunately, the current examination does not resolve either of these issues for the broader literature.[6] What it does add, however, are accurate numbers reported directly from a significant share of online intermediaries to provide context and a guidepost for future measurement attempts.

2.2 Previous estimates of the market for online positions

12 reports have been found that have examined the OIP market. Of these, five provided an estimate of the size of the OIP market based on their respective definitions. And in these studies, the estimated size of the OIP market varies considerably, ranging from Katz and Krueger's (2016) estimate of 0.453% of all U.S. adults, to Robles and McGee (2016), who estimated the size of the OIP market to be 7% of work-eligible adults. For reference, these equate to approximately 930,000 individuals and 14.4 million individuals, respectively, if we use the approximate 205.4 million individuals in the U.S. aged 15–64 as of April of 2017 (OECD 2017).

Other estimates of the OIP market include the following:

- Farrell and Greig (2016), using national data from JPMorgan Chase, estimated that 4% of adults (ages 15–64) had income using an online work platform within four years (2012–2015), and 1% of adults had income from an online work platform in September 2015.
- Harris and Krueger (2015) provide an estimate of 0.4% of adults in independent work using 21 well-known online intermediary platforms using Google Trends data.
- Katz and Krueger (2016) estimated that 1.358% of adults (ages 18 or older) engaged in direct selling[7] using an intermediary service as their main job, and just a third of this subset (0.453%) noted that they used an online intermediary.
- Manyika et al. (2016) reported that about 3–5% of the total working age population in both the U.S. and EU-15 (which varied by region) were engaging in independent work using an online platform.
- Robles and McGee (2016) estimated that roughly 7% of work-eligible adults engaged in enterprising and informal online paid work.

Appendix 1 provides a summary of the full summary of studies and their results. Table 2 provides a summary of volume estimates based on the findings.[8]

What immediately becomes clear from these previous studies is the large discrepancy in volume estimates between the approximate 23.9 million OIPs this report will document and the smaller figures found by previous reports. The differences on how the OIP market is defined certainly play a role in the volume estimate variations between the five papers and this report. For example, the most consistent findings were shown for Harris and Krueger (2015) and Katz and Krueger (2016), which is unsurprising given the papers share one author. In another example, the definition from Manyika et al. (2016) includes

[6] The determination of a single "correct" definition of the OIP market and OIPs is beyond the scope of the current report, but it is certainly worthy of debate. Furthermore, an effort that placed that definition clearly within the bounds of standard industrial codes and other taxonomies would prove incredibly useful.

[7] Direct-selling refers to the selling of goods and services directly to the buyer.

[8] There are additional key works from Bracha and Burke (2017), Abraham et al. (2017) and Jackson et al. (2017) that provide discussions, definitions, and estimates of 'free-lancers,' 'gig economy workers,' etc. from a general standpoint and with excellent detail and insights. However, this paper focuses specifically on estimates that can be derived of the OIP market and OIPs.

Table 1 Definitions online income positions

Articles	Term used	Definition
Farrell and Greig (2016)	Online work platform	"Marketplace for work by unbundling a job into discrete tasks and directly connecting individual sellers with consumers. These flexible, highly accessible opportunities to work generate earnings that are volatile by choice"
Hathaway and Muro (2016) and Muro (2016)	Gig economy	"App-based freelancing" (operationalized by the number of non-employer firms)
Harris and Krueger (2015)	Independent worker	Those who can choose their work (like independent contractors) but are restricted by an intermediary on how much they can charge for goods and services
Katz and Krueger (2016)	Alternative work arrangements	Non-traditional work as the individual's main job, such as temporary help, on-call jobs, independent contract work, and freelancers (with emphasis on subset of those direct selling using online intermediaries)
Manyika et al. (2016)	Independent work	Work with 3 distinctive features: (1) high level of control and autonomy, (2) payment by task, assignment, or sale, and (3) short-term duration
Robles and McGee (2016)	Enterprising and informal work activity (online)	Paid work related to (1) completion of online tasks through websites, (2) renting out property through websites, flyers, and ads, (3) selling or new or used goods, and handcrafts through websites, and (4) other online paid activities
Smith (2016)	Shared, collaborative, and on-demand goods and services	Use of one or more of the following services: (1) purchasing used or second-hand goods online, (2) using programs offering same-day or expedited delivery, (3) purchasing tickets from an online reseller, (4) purchasing handmade or artisanal products online, (5) contributing to an online fundraising project, (6) using ride-hailing apps, (7) ordering delivery of groceries online from local store, (8) working in a shared office space, (9) hiring someone online for errand/task, and (10) renting clothing, other products for a short time online
Torpey and Hogan (2016)	Gig work	"Single project or task for which a worker is hired, often through a digital marketplace, to work on demand"
Upwork (2016)	Freelancers	"Individuals who have engaged in supplemental, temporary, project- or contract-based work, within the past 12 months"

Table 2 Volume estimates of the OIP market

Authors	Percent finding	Applicable population	Volume estimate
Farrell and Greig (2016)	4% (over 2012–2015)	205,354,000[a]	2.9 million
	1% in September 2015		2.1 million
Harris and Krueger (2015)	0.4%	249,454,440[b]	1.0 million
Katz and Krueger (2016)	0.453%	249,454,440[b]	1.1 million
Manyika et al. (2016)	3–5%	165,145,000[c]	5.0–8.3 million
Robles and McGee (2016)	7%	205,354,000*	14.4 million
Hooton (2017a, b)		23.9 million[d]	

*Adults (ages 15–64), OECD

[b] Adults (ages 18 or older), Census Bureau

[c] US Labor force (2017), Bureau of Labor Statistics

[d] OIPs, current report

no specific statement regarding online intermediaries, while the inclusion of individuals using direct transactions is explicitly excluded from the definition used by Harris and Krueger (2015).

The largest results, found by Robles and McGee (2016), are closest to the figure of approximately 23.9 million found by this report, though is still significantly lower, particularly given the authors are looking at income generation as opposed more intense definitions like full-time job equivalents.

A full explanation of the discrepancies—those among the previous works and those between previous works and the current report—is not immediately clear beyond general statements on definitional scopes. The best suggestions may relate to (1) the use of actual company data by this report, (2) narrower definitions of the OIP market by

some of the previous studies, and (3) an inability of reports (this one included) to determine intensity levels of the OIPs that they record. The hope is that the figures reported here may serve as a more accurate benchmark for future methods and studies.

In addition, there is a broader issue involving the conceptualization of OIPs and the market for them. In many senses, the application of traditional concepts of work to these positions can be arguably inappropriate and misleading. This topic falls beyond the current paper's scope, but the discrepancy between the previous estimates and those presented here should clearly illustrate how conceptualizations likely impact research.

3 Data and methodology

This report draws on a survey of Internet Association's 40+ member companies[9] in the Spring and Summer of 2017. The survey requested a set of five variables/indicators for 2012–2017 and for multiple geographic aggregations within the United States; this included an indicator for *online income positions*. The author collected those data and anonymized all observations to prevent identification of individual companies and activity types.

Given the differing nature of OIPs between the 40+ companies, the survey provided explanations for how each of the five variables was conceptualized within the activity type of each specific companies. Broadly speaking, the OIPs measured by the survey include any income generating online activity for individuals in an on-demand fashion, offered across all of IA's membership.

Upon initial analysis of the collected data, two types of gaps/missing observations existed.

First, some companies did not report all variables. To address this, publicly available data provided exclusively from company-produced and or company-reported materials was utilized. An example of such a source is an annual corporate report. In other words, while not every observation was captured in the survey, all missing observations were still filled using direct, company-reported data.

The second source of missing observations related to the variation of company-reported data in terms of the years of observation and geographic aggregation (i.e., not all companies provided the same years and aggregation levels for all data). As a result of this second issue and to protect sensitive market information at lower geographic levels, only aggregations and years of observation where full data were available and full anonymity could be preserved. Subsequently, only state-level and national level figures for 2017 are reported.[10]

It is also important to note that not every IA member company facilitates OIPs. Finally, due to the competitively sensitive nature of the data collected and the role of Internet Association as a trade association for the sector, the report cannot provide more detail on the data.

4 The state of the US online income position market

4.1 Assessing the state of the online income position market

Given the novelty of the data used by this report, it is prudent to give ample context. As mentioned, the state with the largest number of OIPs is California with over 5.8 million. This is by far the largest volume of OIPs and more than three times the number found in the state with the second most, Florida with approximately 1.8 million OIPs. Rounding out the top five largest states are New York (1.7 million), Texas (1.4 million), and Illinois (0.9 million).

On both a *per capita basis* and a *per employee basis,* California remains the state with the highest concentration of OIPs. The state has 0.15 OIPs per capita (aka per resident) and a remarkably high 0.34 OIPs per employee (aka per traditional job).

On per capita basis, the District of Columbia (0.14), Hawaii (0.12), Massachusetts (0.12), and Colorado and Washington (both at 0.10) complete the top five slots. On a per employee basis, Hawaii (0.26), Massachusetts (0.23), Colorado (0.22), and Washington (0.22) again complete the top five slots after California.

Given the relatively large number of OIPs in California compared to other states, the median is a more representative aggregate figure; this is just under 207,000 OIPs. The average among states is just under 468,000 OIPs, though that drops to approximately 361,000 if California is removed (as an outlier). For comparison, the average state employment is approximately 2.8 million.

Table 3 presents the breakdown of OIPs recorded by state. Table 4 provides standard descriptive statistics for the state-level data.

[9] An up-to-date full list can be found at: https://internetassociation.org/our-members/.

[10] Similarly, the report does not discuss the other variables requested in the survey because of their incompleteness.

4.2 Assessing the distribution of OIPs across states

The U.S. OIP market demonstrates greater dispersion in total volumes than traditional employment, even apart from California's large lead in volume and concentration of OIPs. This mirrors internet sector employment, though with a higher degree of concentration. Put differently, traditional employment volumes are more even across states than OIPs or internet sector employment. This is not particularly surprising given the historical development of the technology sector (and internet sector) in the state of California around Silicon Valley, and in a few other established tech clusters such as Massachusetts's Route 128 corridor. Furthermore, the ratio of OIPs to a state's population varies in a matter somewhat different than the ratio of traditional employment to population.

When the report weights OIP volumes on a per capita basis or per employee basis, the distribution becomes far more even than overall volumes, providing evidence that it is not simply the residents of a few states that are taking part in the OIP market. To the contrary, participation in OIPs is strong across the country regardless of state. These are illustrated in Figs. 1 and 2.

We can turn to Zipf's law and rank-size distributions to provide some quantitative basis for assessing OIP employment by state. Originally from linguistics and often discussed in the context of city-size distributions, Zipf's law describes a rank versus frequency rule in which volume is inversely proportional to rank. Put more simply, the largest volume is about twice as large as the next two volumes, which are twice as large as the next four volumes, and so on. This can be tested through log-volume, log-rank plot, and OLS modeling, which will produce a slope of 1.0 for a distribution that precisely follows this rule. A slope of greater than 1.0 indicates greater dispersion while a slope less than 1.0 indicates a more even distribution.

The report conducted analysis of employment, internet sector employment, and OIPs and presents the results in Figs. 3 and 4—the latter removes California because of its large volume of OIPs. They show that overall employment levels among states follow the distribution closely with a slope of 1.05 (just over the 1.0 mark). However, internet employment and OIPs have slopes of 1.25 and 1.30, respectively, indicating dispersion (i.e., greater variation between states). When conducted using per capita levels, the state OIP log rank-volume distribution slope changes to approximately 0.50 while the slope of overall employment per capita is 0.13, indicating that employment levels have a much more even distribution between states when weighted for population. This is seen in Fig. 5. For both overall OIP volume and per capita OIP, we found a relatively high r-squared from the basic OLS regression, which indicates good explanatory power from the model.

Online income positions are disproportionately concentrated in California and the other four or five top states; however, this concentration is not tied exclusively to the size of the states' population. As illustrated in Fig. 6, when the report examines population-rank against volume levels, we see a clear relationship between population and OIPs (and internet sector employment), but a weaker one compared to traditional employment. The slope for OIPs is 1.23 while the slope for overall employment is 1.04. This suggests that while traditional employment levels in a state closely follows (and can be largely predicted by) that state's population, the number of OIPs within a state is not (to the same degree).

These characteristics suggest that further analysis and discussion of what additional factors may be influencing OIP levels, along with their implications for policy, are needed. The next section reports the results of a more fully developed model.

4.3 Modeling OIPs

An a priori assessment suggests that OIPs would be more prevalent in areas and among individuals where their defining features provide some sort of advantage to other income-earning opportunities. From a more formal theoretical standpoint, the defining features of OIPs closely mirror the market failure removal argumentation of a broad swath of development policy based on the Enterprise Zone concept of Stuart Butler.[11] Specifically, their unique features—(1) the short-term nature of the transactions, (2) high degree of worker autonomy, and (3) the use of an online intermediary to connect buyers to sellers on demand—all appear to lessen barriers to market entry for individuals.[12]

[11] The theory underlying this concept and numerous related policies that build on it, argues that area development can be spurred through the removal of market barriers that prevent individuals from entering markets as businesses or workers. These barriers include licensing requirements, lack of capital, high taxes, etc. The removal of a few or even just one of these barriers may be enough to stimulate development and growth in area. For example, Enterprise Zones offer tax breaks to reduce the overall cost barriers to starting a business. See Butler (1981) for more detail.

[12] Relatedly, we see the flexibility component reflected in survey studies, such as that of Upwork and the Freelancers Union (2016), which found that about two-thirds of freelancers (both online and offline) engaged in their freelance work out of choice with many citing lifestyle reasons as a motivator.

Table 3 Estimates of OIPs and internet sector jobs by US state

	OIPs (2017)	Total employment (2017)	Unemployment (2017) (%)	Population (2016)	Internet employees (2014)	GDP (2014)	OIPs per employee	OIPs per capita
USA: 23,866,547								
AK	33,857	310,000	6.7	741,894	6101	58,067,000	0.11	0.05
AL	133,898	1,932,600	4.9	4,863,300	37,422	197,535,000	0.07	0.03
AR	73,034	1,205,400	3.4	2,988,248	21,538	121,065,000	0.06	0.02
AZ	504,783	2,760,100	5.1	6,931,071	55,621	281,559,000	0.18	0.07
CA	5,822,078	16,923,300	4.7	39,250,017	529,833	2,324,995,000	0.34	0.15
CO	576,781	2,588,600	2.3	5,540,545	109,250	305,367,000	0.22	0.10
CT	206,666	1,685,500	4.9	3,576,452	39,959	250,764,000	0.12	0.06
DC	54,836	441,200	4.7	681,170	14,135	65,485,000	0.12	0.08
DE	134,962	760,900	6.0	952,065	22,725	116,539,000	0.18	0.14
FL	1,792,347	8,538,900	4.3	20,612,439	188,525	835,578,000	0.21	0.09
GA	696,937	4,349,300	4.9	10,310,371	144,227	471,879,000	0.16	0.07
HI	172,251	658,300	2.7	1,428,557	9140	76,425,000	0.26	0.12
IA	114,755	1,542,000	3.1	3,134,693	27,079	170,715,000	0.07	0.04
ID	99,413	691,600	3.2	1,683,140	11,951	63,364,000	0.14	0.06
IL	880,321	5,947,600	4.6	12,801,539	141,714	742,028,000	0.15	0.07
IN	289,015	3,021,700	3.2	6,633,053	44,784	324,289,000	0.10	0.04
KS	102,533	1,384,500	3.7	2,907,289	35,982	146,562,000	0.07	0.04
KY	162,216	1,894,200	5.0	4,436,974	31,338	188,518,000	0.09	0.04
LA	163,690	1,907,400	5.7	4,681,666	25,335	245,791,000	0.09	0.03
MA	802,837	3,530,400	4.2	6,811,779	113,538	456,273,000	0.23	0.12
MD	552,538	2,666,700	4.2	6,016,447	121,506	350,262,000	0.21	0.09
ME	93,201	602,600	3.2	1,331,479	11,653	55,029,000	0.15	0.07
MI	490,149	4,283,000	4.2	9,928,300	74,503	447,221,000	0.11	0.05
MN	298,203	2,839,700	3.7	5,519,952	67,223	320,381,000	0.11	0.05
MO	228,342	2,783,200	3.9	6,093,000	75,535	283,280,000	0.08	0.04
MS	52,493	1,134,000	4.9	2,988,726	11,754	104,938,000	0.05	0.02
MT	54,588	456,500	3.9	1,042,520	7044	44,672,000	0.12	0.05
NC	499,286	4,326,300	4.5	10,146,788	87,970	474,355,000	0.12	0.05
ND	19,839	414,400	2.5	757,952	5224	58,230,000	0.05	0.03
NE	80,483	972,400	2.9	1,907,116	20,276	110,663,000	0.08	0.04
NH	90,685	656,900	2.9	1,334,795	14,024	70,345,000	0.14	0.07
NJ	780,719	4,042,100	4.1	8,944,469	160,060	545,374,000	0.19	0.09
NM	90,679	811,400	6.6	2,081,015	12,994	94,792,000	0.11	0.04
NV	254,836	1,307,800	4.7	2,940,058	17,209	134,052,000	0.19	0.09
NY	1,707,212	9,332,500	4.4	19,745,289	216,478	1,385,776,000	0.18	0.09
OH	481,917	5,365,600	4.9	11,614,373	98,997	588,827,000	0.09	0.04
OK	123,442	1,587,700	4.3	3,923,561	28,803	190,171,000	0.08	0.03
OR	362,769	1,860,700	3.6	4,093,465	32,493	203,328,000	0.19	0.09
PA	754,369	5,799,800	5.0	12,784,227	119,861	672,413,000	0.13	0.06
RI	68,365	478,300	4.1	1,056,426	9629	55,098,000	0.14	0.06
SC	189,793	2,024,300	4.1	4,961,119	35,720	189,656,000	0.09	0.04
SD	28,192	419,900	2.9	865,454	5242	45,600,000	0.07	0.03
TN	348,566	2,947,500	4.0	6,651,194	50,536	300,016,000	0.12	0.05
TX	1,381,564	11,974,700	4.8	27,862,596	289,774	1,601,977,000	0.12	0.05
UT	261,295	1,415,100	3.2	3,051,217	39,864	140,565,000	0.18	0.09
VA	698,013	3,831,600	3.8	8,411,808	221,801	462,243,000	0.18	0.08
VT	59,326	312,600	3.1	624,594	6689	29,662,000	0.19	0.09

Table 3 continued

	OIPs (2017)	Total employment (2017)	Unemployment (2017) (%)	Population (2016)	Internet employees (2014)	GDP (2014)	OIPs per employee	OIPs per capita
WA	703,701	3,227,900	4.5	7,288,000	89,637	422,767,000	0.22	0.10
WI	226,367	2,842,400	3.1	5,778,708	48,380	293,341,000	0.08	0.04
WV	41,762	693,100	4.5	1,831,102	9191	74,433,000	0.06	0.02
WY	26,644	265,800	4.1	585,501	3570	40,876,000	0.10	0.05

Table 4 Descriptive statistics for the OIP market

	Minimum	Median	Mean	Max
Online income positions	19,839	206,666	467,972	5,822,078
Internet employment	3570	35,982	70,663	529,832
Total internet-supported positions	25,062	246,625	538,635	6,351,911
Total employment (any industry)	265,800	1,894,200	2,818,627	16,923,300
Population	585,501	4,436,974	6,335,834	39,250,017
GDP per capita	$35,160	$52,130	$55,950	$159,400
Poverty rate	8.5%	15.3%	15.0%	22.6%
Unemployment rate	2.3%	4.2%	4.2%	6.7%

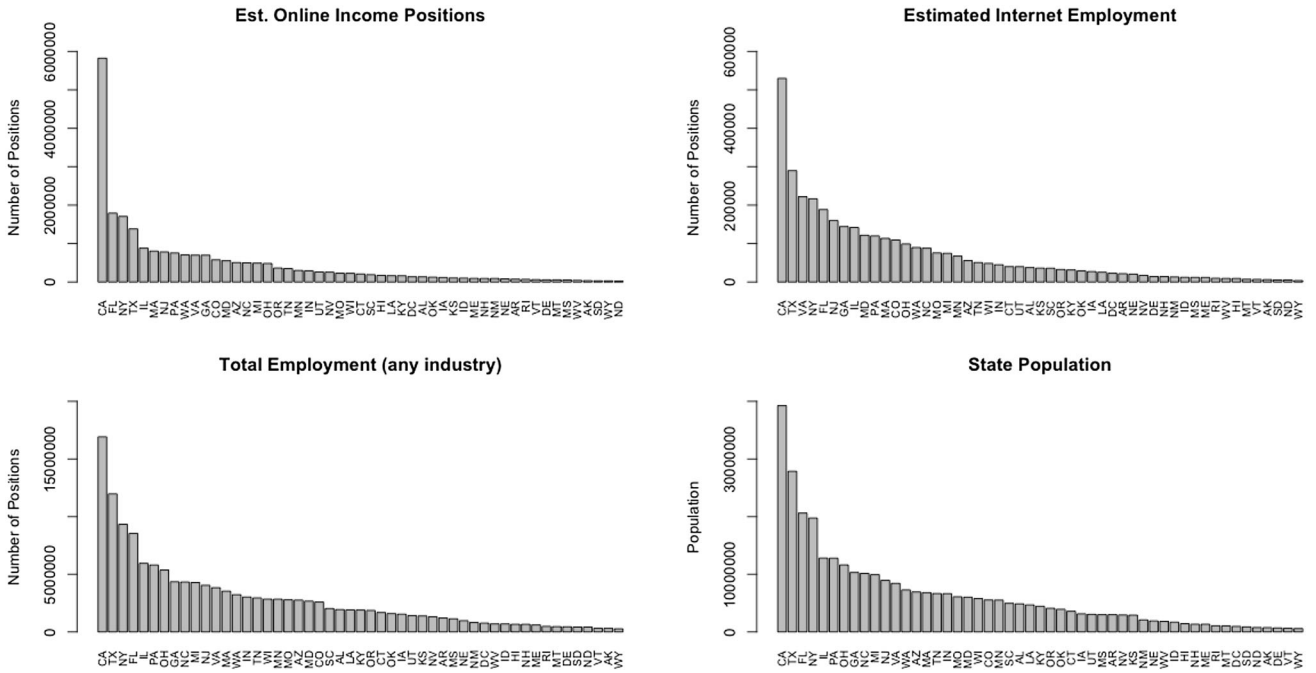

Fig. 1 Distributions of online income positions and comparative measures

The paper consequently conceptualizes OIPs as a function of the health of the traditional labor market, relative costs and incomes, and access/exposure to the OIP market. Using this conceptualization as a guide, the paper examined the relationships of a series of potential corollary indicators including population, GDP per capita, poverty rate, unemployment rate, cost of living, internet sector employment, and IA's own *ease of doing internet business index*[13] along with some of its subcomponents. The paper presents the rationale of each of these in Table 5 and correlation matrix and plots for visualization of these factors are shown in Appendix 2.

[13] See "Measuring the Ease of Doing Internet Business in the United States" (Hooton 2017a, b).

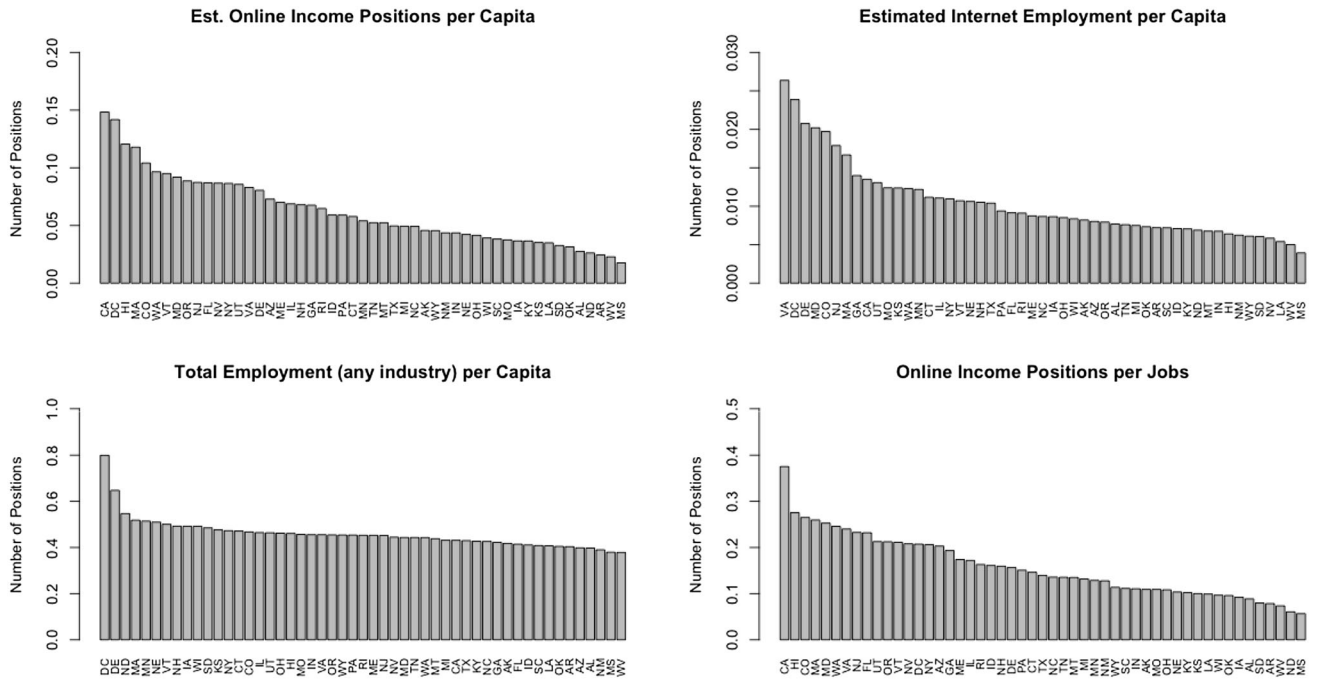

Fig. 2 Distributions of online income positions per capita and comparative measures

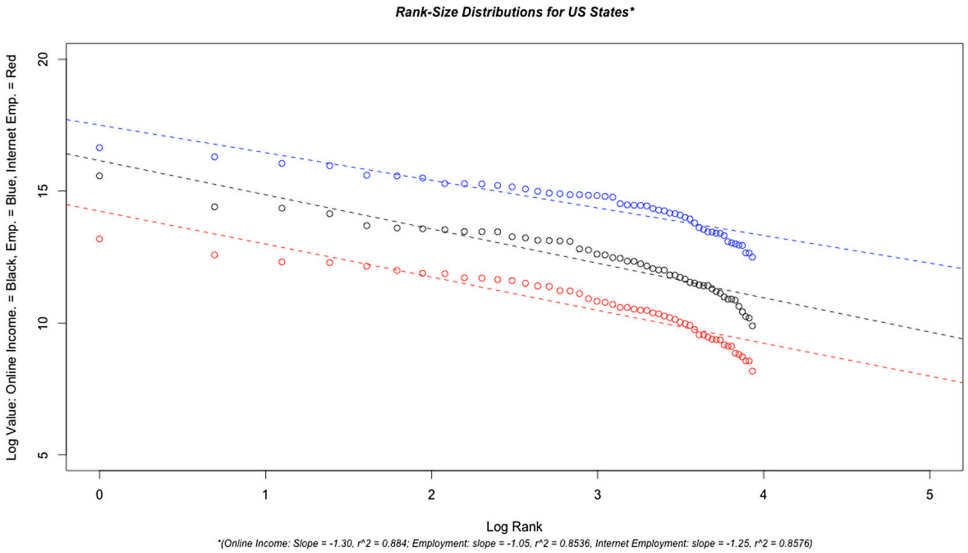

Fig. 3 Analysis of OIP rank-size distribution

The pairwise correlations largely follow the expectations laid out in Table 5, with three exceptions. First, unemployment rates have essentially no correlation with OIPs or internet sector employment—there are no discernible relationships from visual inspection. Second, poverty rates have a negative correlation with OIPs and internet sector employment—poverty rates are lower in states with higher numbers of OIPs and internet sector jobs. Finally, GDP per capita is positively correlated with OIPs. However, with all three of these, it is important to emphasize that no controls are used in the pairwise comparisons.

Moving further, the paper builds a descriptive model through a series of multiple regression specifications that allows it to control for levels of other variables. This is defined as

$$y_i = \beta_{i,0} + \beta_1 x_{i,1} + \beta_2 x_{i,2} + \cdots + \beta_p x_{i,p} + \varepsilon_i, \quad (1)$$

where y is the natural log of OIPs per capita, x_1 through x_p are the paper's set of explanatory variables, tested in

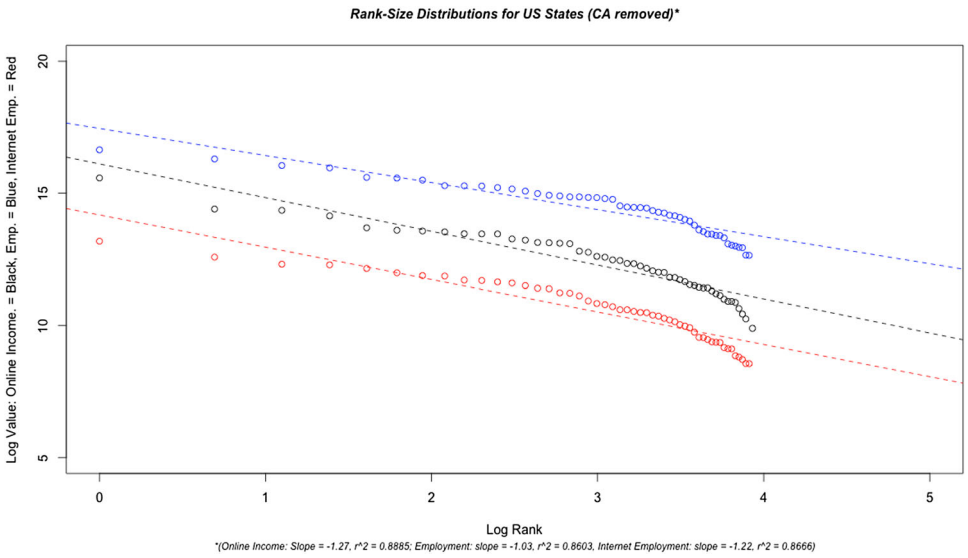

Fig. 4 Analysis of OIP rank-size distribution with California removed

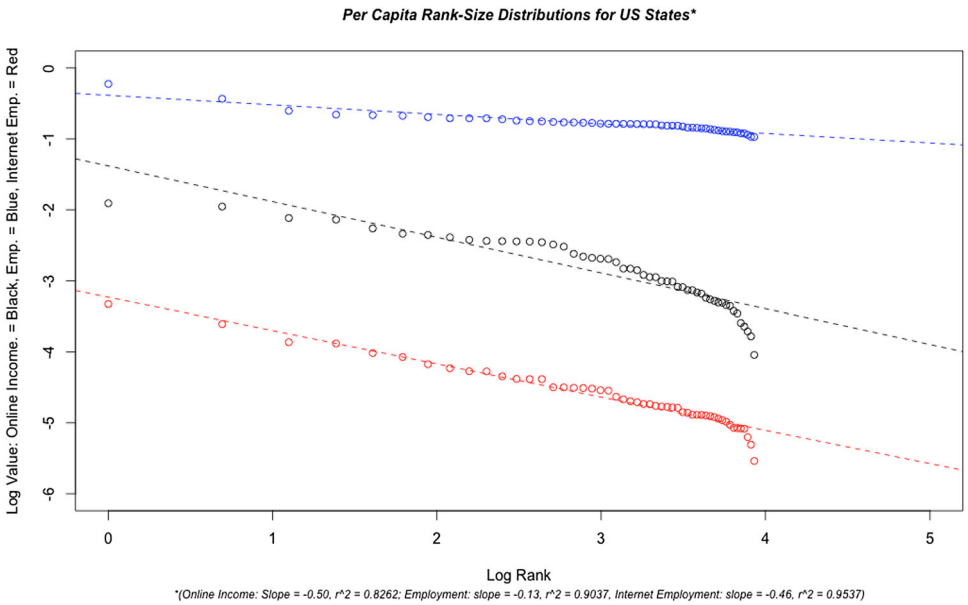

Fig. 5 Analysis of OIP rank-size per capita distribution

various combinations, ε is the error term, and i is an index for US states.

While the model was built for exploratory purposes, the results from the specifications produced a surprisingly strong fit, which is why the paper presents it here. The results should be seen as simply a preliminary guide on OIPs; however, the consistency of coefficients, the high r-squared values, the robustness of the model to a Bootstrap Regression extension all suggest that the theoretical determinants of OIPs developed by the paper are, at a minimum, 'on the right track.'

The paper ran five specifications with varying combinations of independent variables following the conceptualization laid out in Table 5 and presents the results in Table 6. Additionally, plots of model fitted values versus observed values are presented in Appendix 3.

The strongest model fits are from Specification 4 and Specification 5 with the primary difference between them being the inclusion (exclusion) of unemployment rate. Specification 5 which does not include unemployment is arguably the best.[14] In general, all the specifiications produce consistent coefficient estimates and correlations that are in accord with expectations.

[14] The unemployment term is statistically insignificant in each of the other specifications and provides essentially no improvement on the model as evidenced in the marginal difference in the r-squared values between Specification 4 and 5. This is to be expected given the lack of relationship in the plots presented in Appendix 2.

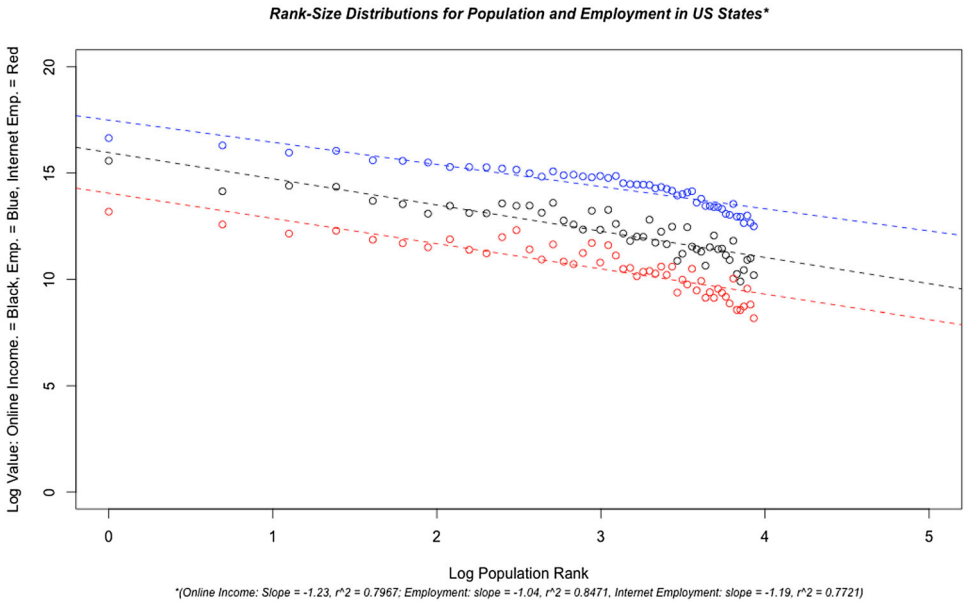

Fig. 6 Analysis of the relationship between OIPs and population

Table 5 Theoretical factors influencing the prevalence of OIPs

Theoretical component	Potential corollary	Expected correlation	Rationale
Traditional labor market health	Population	Positive	Larger number of people who may choose to use OIPs
	Unemployment	Positive	Larger number of people who may need an alternative to a traditional job
Relative costs and incomes	Poverty rate	Positive	Larger number of people who may desire supplemental income
	GDP per capita	Negative	
	Cost of living	Positive	
Access and exposure	Internet sector employment	Positive	Greater familiarity with OIPs and greater willingness to use
	IA ease of doing internet business index	Positive	Lower restrictions on the participation in OIP markets
	IA general business governance index	Positive	
	IA internet access index	Positive	

The results demonstrate that relative income and cost factors are corollaries of the volume of OIPs. Those states with relatively weaker output levels, higher poverty levels, and higher cost of living have higher levels of OIPs than those with higher productivity and lower costs or higher income. All of these metrics are statistically significant in the paper's final and strongest specification (5). These results provide statistical evidence to the claim that OIPs can and do serve as income supplements for individuals. Additionally, the level of internet sector employment within a state (aka internet jobs rather than OIPs) and internet access[15] also positively correlate with OIP levels and are both significant. These suggest that greater access to high-quality internet connections and greater exposure to the internet sector (including its firms, employees, services, and products) increase the use of online intermediaries and the level of OIPs. Unemployment rate, on the other hand, is not significant in any of the specifications, suggesting no relationship with the level of OIPs.[16]

The point values of the coefficents should not be blindly accepted; additional control terms should be included to produce more accurate estimates. In particular, the regressions were unable to include state-level fixed effects

[15] IA's internet access index is comprised of metrics for broadband penetration and broadband speed.

[16] It has relatively consistent coefficient estimates across the three strongest specifications (out of four) in which it is included. Given the consistency, there is some initial evidence that OIPs correlate with lower unemployment when other factors are controlled, though additional modeling is needed before such a conclusion can be reached.

Table 6 Modeling online income positions

	Dependent: log online income positions per capita (standard errors in parentheses)				
	(1)	(2)	(3)	(4)	(5)
Constant	−0.0541	−1.3843	−0.0507	−0.8573	−0.6642
	(1.4069)	(1.6125)	(1.4140)	(1.1968)	(1.0728)
Log unemployment rate	−0.1161	0.3422	−0.0911	−0.0671	
	(0.2098)	(0.2482)	(0.2135)	(0.1767)	
Log poverty rate	0.2553	0.1954	0.2378	0.4745**	0.4320**
	(0.2689)	(0.3107)	(0.2713)	(0.2315)	(0.2006)
Log cost of living index	0.0165***		0.0171***	0.0112***	0.0110***
	(0.0029)		(0.0030)	(0.0027)	(0.0026)
Log GDP per capita	−0.3130	−0.1844	−0.3451	−0.3217*	−0.3375*
	(0.2201)	(0.2490)	(0.2254)	(0.1851)	(0.1786)
Log internet sector employment per capita	0.6827***	0.3026*	0.6927***	0.4238***	0.4205***
	(0.1265)	(0.1725)	(0.1278)	(0.1213)	(0.1199)
IA ease of int. bus. index		0.0278***			
		(0.0072)			
IA general bus. governance index			0.0047		
			(0.0063)		
IA internet access index				0.0130***	0.0130***
				(0.0029)	(0.0029)
Observations	51	51	51	51	51
R^2	0.6711	0.5725	0.6751	0.7726	0.7718
Adjusted R^2	0.6345	0.5251	0.6308	0.7416	0.7465
Residual std. error	0.2972 (df = 45)	0.3388 (df = 45)	0.2987 (df = 44)	0.2499 (df = 44)	0.2475 (df = 45)
F statistic	18.3626*** (df = 5; 45)	12.0549*** (df = 5; 45)	15.2395*** (df = 6; 44)	24.9141*** (df = 6; 44)	30.4473*** (df = 5; 45)

The cost of living term is dropped in Specification (2) because the IA ease of internet business index uses cost of living in its construction. All index scores are on a 0 to 100 basis, with 100 being the best/strongest

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

due to singularities coming out of multicollinearity. Additional years of observation and more refined geographic aggregations that would allow for fixed effects are two obvious extensions that would improve confidence in the coefficient levels.

With that note of caution in place, the results show that the number of OIPs per capita increases by about 43 percent for every 1 percent increase in poverty levels; increases approximately 1.1 percent for every 1 unit increase in the cost of living index; decreases about 34 percent for every 1 percent increase in GDP per capita; increases about 42 percent for every 1 percent increase in internet sector employment per capita; and increases about 1.3 percent for every 1 unit increase in IA's internet access index. Taken together, this model has an adjusted r-squared of 0.7465—it explains approximately 75 percent of the variation of OIP per capita levels from state to state.

The model also holds up well in checks. The variance inflation factors (VIF) score for each of the explanatory variables in the paper's final specification (5) are all well under 3.0, with the highest at just about 2.6, suggesting low collinearity among the variables (see Table 7).[17]

Finally, due to the low number of observations (just 50 states plus DC), the paper ran a Bootstrap Error regression with 2000 replications to adjust for any small-sample bias. The Bootstrap Error regression produced very similar coefficient and standard error estimates to the original model. Testing the significance of the variation between the bootstrap model and the original, the paper found no evidence that the observed estimates were statistically different from bootstrap estimates. This suggests that there is no observable impact from small-sample bias in the paper's model. However, the paper again emphasizes that an extension with more refined geographic units would better address small-sample issues not captured here and improve the robustness of the model overall. Results from the Bootstrap test are provided in Table 8.

Table 7 VIF scores of specification 5

Independent variable	VIF score
Log poverty rate	1.5343
Log cost of living index	1.8961
Log GDP per capita	1.7460
Log internet sector employment per capita	2.0083
IA internet access index	2.6137

5 Policy implications

It is difficult to derive many specific policy suggestions based on the data and results presented here. However, there are some general insights that can provide valuable context in policy discussions generally and there are a few more direct lessons from the evidence.

First, this paper finds a much larger number of OIPs exist than have previously been estimated. The 23.9 million OIPs found through the survey of Internet Association's member companies demonstrate that a verylarge number of individuals are taking advantage of internet platforms and the digital economy to earn additional income. These are not large businesses simply selling wares online; they are individuals and microbusinesses that would not otherwise be able to commercialize their passions, talents, services, ideas, etc. The size of the OIP market should caution all policymakers and other stakeholders against dramatic policies that may influence it. While the paper cannot determine intensity levels of the OIPs recorded here, it is important that the OIPs likely mainly represent individuals. And given the significant correlations found between OIPs and cost/income factors, policies that potentially curb that income should be approached delicately. This is particularly crucial given that several studies are showing that freelance work (online and offline) is increasingly pursued voluntarily by choice rather than out of necessity (Upwork 2016).

Second, these OIPs are distributed across all 50 states and the District of Columbia. Yes, they are more concentrated in the top states than traditional employment; however, they are also less tied to population than traditional employment. This shows that it is not simply population centers that have more OIPs, but that there are other factors that are more important for their creation. This, in turn, suggests that states and areas with smaller populations can indeed take advantage of the online internet economy. California is clearly the leader among states, but the paper argues that is likely due to the high exposure of individuals to the internet sector in the state along with its relatively high cost of living and high-quality internet infrastructure rather than the state's sheer size. Among the other 50 states and DC, there is much less discrepancy in terms of volumes and concentrations of OIPs. When we consider other factors that promote internet sector productivity and firms, such as those found by Internet Association's ease of doing internet business index study, and the similar findings of others, such as the eBay Public Policy Lab's work on the geography of their seller activity and economic

[17] For reference, VIF scores range from 1 upwards and as a 'rule of thumb,' scores of 1.0 suggest no collinearity while scores between 1 and 5 show moderate collinearity and scores over 5 show highly correlated terms.

Table 8 Bootstrap error results (specification 5)

	R	Original	bootBias	bootSE	bootMed	*p* value[a]	95% CI
Constant	2000	−0.6642	0.1129	1.3299	−0.5328	0.4648	(−3.3837, 1.8295)
Poverty rate	2000	0.4320	−0.0046	0.2161	0.4365	0.4893	(0.0130, 0.8601)
Cost of living	2000	0.0110	−0.0005	0.0030	0.0110	0.5092	(0.0056, 0.0174)
GDP per capita	2000	−0.3375	−0.0150	0.2240	−0.3644	0.5417	(−0.7615, 0.1166)
Internet sector employment	2000	0.4205	0.0053	0.1350	0.4257	0.4748	(0.1505, 0.6798)
internet access	2000	0.0130	0.0001	0.0030	0.0133	0.4708	(0.0070, 0.0188)

[a] Difference between sample estimated coefficients and boot estimated coefficients; H0: there is no difference between the original estimate and the bootstrap estimate; no bootstrap estimates values are statistically different from original model estimates

recovery,[18] then state policymakers should take heart in the ability of well-crafted policy to develop their state's internet sector and, subsequently, their state's economy overall.

Third, controlling for population, the paper finds that relative income to cost factors are a key driver of OIPs, along with internet accessibility and exposure to the internet sector more broadly. There is no evidence that unemployment levels contribute (positively or negatively) to the level of OIPs in a state. The paper cannot determine if the cost factors increase OIP levels because individuals *need* or *want* to earn additional income; however, there is no evidence that OIPs are replacing jobs and other evidence from other survey studies showing that OIPs are increasingly pursued by choice. This confirms one popular sentiment that OIPs provide flexible income and further negates another that OIPs are replacing traditional jobs. From Hathaway and Muro's (2016) examination of the sharing economy to Garza and Hooton's (2017) examination of short-term rentals to the current report, evidence is beginning to build that the digital economy is creating new market demand rather than simply replacing it.

And anecdotally we can get a sense of just how much OIPs contribute to the economy. Research has estimated that typical OIPs (think short-term rental hosts, ride-share drivers, etc.) earn between a few thousand dollars per year to around $20,000 per year across platforms. If we take the low end of that ($3000), it equates to approximately $72 billion of additional economic activity and income for individuals. That would be just under the approximate $92.3 billion of annual revenue earned in the "Motor vehicle and parts retail trade" (in 2015).[19] At the higher end, it equates to approximately $478 billion, which would put OIPs' revenues at about half those of the *Construction Services Industry* sector (approximately $1 trillion) and nearly on par with the *Consumer Electronics Industry* ($639 billion).[20]

In terms of future research, the paper believes a valuable first step is an examination of cyclical industries in the paper's model. Put more plainly, service industry presence, and tourism in particular, may provide additional insights on the levels of OIPs. However, such analysis may be misleading unless further geographic refinement at the city or metropolitan level can also be made.

Finally, it is important to recognize the ability of OIPs to remove market entry barriers. There is a budding strain of literature returning to the importance of tapping economic potential through policy as a development strategy,[21] and the unique characteristics of OIPs appear to align quite well with that strain's theoretical foundation. If market barriers are indeed a primary cause of spatial economic inequality and latency of economic resources, then OIPs potentially offer a powerful tool in knocking down those barriers. Far more discussion on how new tools could be developed for broader development efforts in states and localities is needed and could prove fruitful.

6 Conclusion

The OIP market is a relatively new phenomenon, but it has grown tremendously over the past decade. Using data reported directly from internet companies, the report shows that at least 23.9 million OIPs currently exist in the United States. The number of OIPs is equivalent to nearly 13.5

[18] See "Small Online Business Growth Report" and "Platform-Enabled Small Businesses and the Geography of Recovery" as two examples. Available at: https://www.ebaymainstreet.com/lab.

[19] Data from Statista. Available at: https://www.statista.com/statistics/531522/revenue-of-us-motor-vehicle-and-parts-retail-trade/.

[20] Data from CSI Market. Available at: http://csimarket.com/Industry/Industry_Data.php.

[21] See Butler (1981), Roberts (2016), Hooton (2016), Roberts et al. (2017) and Hooton and Farole (2017) for more on the role of economic potential.

percent of the US civilian employment.[22] This is in addition to the approximate 3 million traditional jobs contributed by the internet sector.

The size and rapid rise of the OIP market is impressive and, regardless of personal sentiments toward its development, it is undeniably a massive component of the US economy. While the intensity of OIP utilization and levels of income earned from OIPs are undeterminable here, potentially tens of millions of individuals earn extra income through them. Back of the envelope estimates show that this can easily reach into the tens and even hundreds of billions of dollars.

Yet, the main point, the main goal, from the paper is not determining exact economic contributions, but simply the documentation of a new, rather large, and largely unexamined form of income-earning activity. The paper is careful to not use the term "job" in its discussion of OIPs, because that would be misleading and it has consistently cautioned against drawing more remarkable conclusions. These are activities that provide new opportunities to earn income that are fundamentally different to traditional employment. The evidence presented here and elsewhere increasingly point to the utilization of OIPs for their advantages. More sophisticated analysis aside, the sheer volume of OIPs in the US should demonstrate both their popularity and suitability in a rapidly transforming economy. Perhaps the main lesson of the paper, and the OIP market more generally, is that our conceptualizations of what work should be like are exceptionally outdated.

Appendix 1: Summary of selected OIP market literature

Article	Organization	Data source of study	Results/summary of study	Pros/cons of study
Brainard (2016)	Federal Reserve	NA	This article quotes the results found in Katz and Krueger (2016), Harris and Krueger (2015) Upwork (2016) and Farrell and Greig (2016) Makes the conjecture that the prevalence of freelance work will make a tangible impact on employment (i.e., make it easy to find work, but potentially less stable work overall)	NA
Farrell and Greig (2016)	JPMorgan Chase Institute	A sample of 1 million Chase customers (checking account) between October 2012 to September 2015 was used to pull a subsample of 260,000 individuals who had received income from 30 online work platforms (e.g., Uber, TaskRabbit)	Roughly 1% of adults had income using an online work platform as of September 2015 Roughly 4% of adults had income using an online work platform within the examined 3-year period Generally, the earnings gained from online platforms was for supplementing existing sources of income (i.e., median monthly earnings for active workers in online labor platforms was 33% of median total income, and just 20% for online capital platforms)	Pros: Provides accurate online gig economy employment numbers (for the sample used) Cons: It is unclear if the pattern Is representative of all banking platforms (e.g., Wells Fargo, Bank of America), or transactions not known to the bank (e.g., peer-to-peer) No state-level estimates
Galley (2016)	U.S. Bureau of Labor Statistics	Data collected by Smith (2016)	This article mostly comments on the findings from Smith (2016) (which were already discussed)	Same as Smith (2016)

[22] Though the paper again emphasizes that these should not be considered the same as traditional jobs and that individuals may have multiple OIPs. This figure is for comparison only.

continued

Article	Organization	Data source of study	Results/summary of study	Pros/cons of study
Harris and Krueger (2015)	Brookings Institution	Google Trends (January 2004 to January 2016) to track the number of searches pertaining to 21 well-known online work platforms (e.g., Uber, GrubHub)	The Google Trends data provides an estimate of the size and growth of the online gig economy In 2015, Uber, GrubHub, and Lyft were the three most common searches The number of searches shows a clear pattern of growth for the relevant industries Given that the number of Uber employees is known in the Fall of 2015, assuming that the proportion of searches is proportion to the number of employees (even outside of Uber), then the rough estimate for the number of employees for all examined intermediaries in January 2016 was 0.4%	Pros: Provides a proxy for the growth of the gig economy Cons: It is unclear how much of the number of searches actually pertains to the growth of the industry as opposed to media relevance (e.g., negative press) Paper provides no theoretical narrative for the assumption of proportionality between the frequency of web searches and number of employees No state-level estimates
Hathaway and Muro (2016)	Brookings Institution	Census Bureau's non-employer (self-employed individual operating in small, unincorporated business with no paid employees) statistics at the national level and by metropolitan statistical area (MSA) for only rides/rooms industries (via NAICS codes)	Nationally, the examined non-employer industries showed greater growth in the number of workers (24 million in 2014 vs. 15 million in 1997) than payroll employment (145 million in 2014 vs. 129 million in 1997)—with the 24 million (which includes both online and offline firms) in 2014 being roughly 9.5% of the work-eligible population (16 or over) of the U.S. (based on figures from the ACS 2014) The number of those working in the rides industry under non-employer firms (e.g., Uber, Lyft) saw particularly large growth between 2013 and 2014, especially in comparison to the slow growth of the number of payroll employees in the same industry The number of those working in the rooms industry under non-employer firms (e.g., Airbnb) also saw large growth between 2013 and 2014, though less dramatically than the rides industry Non-employer rides industries showed greatest growth in the number of workers for tech-oriented MSAs: San Jose, San Francisco, Los Angeles, Austin, San Diego, and Nashville (while growth for payroll workers were either subdued or even negative in the same MSAs) Non-employer rooms industries showed greatest growth in 5 MSAs: Austin, San Francisco, Portland, New Orleans, and San Jose, while payroll employment has been generally steady in the same MSAs	Pros: Provides a reasonable proxy for the growth of the gig economy Cons: Non-employer statistics encompass all workers in the specified industry, not just those utilizing digital platforms (as already stated) Gig workers not in rides or rooms industries are obviously not captured by the statistics No state-level estimates (i.e., cannot be aggregated from MSA statistics)

continued

Article	Organization	Data source of study	Results/summary of study	Pros/cons of study
Katz and Krueger (2016)	National Bureau of Economic Research	Modified version of RAND Institute's American Life Panel (ALP) Survey ($n = 3844$) to emulate the Bureau of Labor Statistics' (BLS) Contingent Work Survey (CWS) Both randomized (university panel and random digit dialing) and snowball samples were utilized (with sample weighting via age/gender) Survey was conducted from October to November 2015 Day laborers were excluded from the sample (a small unreported number)	Percentage of workers with alternative work arrangements increased from 10.1% in 2005 (based on the CWS) to 15.8% in 2015 (based on modified ALP) Since total employment is known to have increased 6.5% between 2005 and 2015, this implies that almost all employment gains were due to the alternative work arrangements About 19.4% of those participating in alternative work arrangements indicated that they performed direct selling of goods or services, with 7% of this subset (1.36% of all U.S. adults) indicating that they used an intermediary, and just a third of this 7% (0.45% of all U.S. adults) using online intermediaries (e.g., Uber, TaskRabbit)	Pros: Use of online-based apps (e.g., Uber, TaskRabbit) was specifically queried Cons: Use of snowball sampling (with unclear documentation of compensation via weighting) results in statistics that may be poorly representative of the population (with the authors noting the difference between the weighted sample and the statistics reported by the BLS's Current Population Survey) Possible misinterpretation of "direct selling" by respondents The designation of "alternative work" is determined by an individual's main job, which means that side-gigs are likely excluded from the percentages No state-level estimates
Manyika et al. (2016)	McKinsey Global Institute	McKinsey Global Institute international survey (approx. $n = 8000$) during June and July of 2016 Workers from United States, the United Kingdom, Germany, Sweden, France, and Spain were sampled (with the five European countries representing EU-15)	Outlines 3 distinctive features of independent work: (1) high level of control and autonomy, (2) payment by task, assignment, or sale, and (3) short-term duration Combining both U.S. and E.U. (EU-15), independent workers make up 20–30% (approx. 68 million people) of the working age population, with 15% of independent workers using digital platforms (which is 3–5% of total working age population) For just U.S., the MGI survey estimates that 27% of the workforce is composed of independent workers (as opposed to the 22% reported in other sources)	Pros: Provides a reasonable proxy for the growth of the gig economy Cons: Non-employer statistics encompass all workers in the specified industry, not just those utilizing digital platforms Percentage of U.S. independent workers using digital platforms is unreported No state-level estimates
Muro (2016)	Brookings Institution	Data collected by Hathaway and Muro (2016)	This article provides a more nuanced examination of the Census Bureau's non-employer data to specifically determine if gig work for rides and rooms industries have negatively impacted payroll employment in the same industries Nationally, gig work appears to have no impact on payroll employment At the MSA-level, there does appear to be some regions that have evidence of job displacement, particularly for the rides industry	Same as Hathaway and Muro (2016)

continued

Article	Organization	Data source of study	Results/summary of study	Pros/cons of study
Robles and McGee (2016)	Federal Reserve	A national pool of 12,480 individuals were selected for sampling (with oversampling for respondents with household incomes less than $40,000) and responses were collected from 6898 individuals between October 29th and November 9th of 2015 Respondents completed the Enterprising and Informal Work Activity (EIWA) survey which pertains to work activities during the past 6 months	Of the 6898 respondents, 2483 (36%) were found to be participating in either enterprising or informal work Roughly 26% of those participating in enterprising or informal work saw the work as a primary source of income Of those participating in enterprising or informal work, roughly 32% reported that they sold new or used goods through online platforms (e.g., eBay, Craigslist), 13% reported that they completed online tasks (e.g., Mechanical Turk, TaskRabbit, YouTube), 11% reported that they rented out property (e.g., car, residence) through websites, newspaper ads, flyers, etc., and 19% reported that they performed other online paid activities (in total 19.5% of enterprising or informal workers said "yes" to any of the these categories, which is roughly 7% as a national estimate among all work-eligible adults) Specifically, of those participating in enterprising or informal work, the use of specific services for income included 1.2% for Airbnb, 2.7% for Amazon Mechanical Turk, 15.2% for Craigslist, 14.1% for eBay, 2.0% for Etsy, 2.1% for Uber, 1.2% for Lyft, 1.0% for TaskRabbit, and 1.1% for Upwork	Pros: Provides a reasonably good national sample (as could be reasonably collected given the current scope) Use of online-based apps (e.g., Uber, TaskRabbit) were specifically queried Cons: Some ambiguity in the wording of some of the questions (i.e., renting out property extends beyond the online medium) No state-level estimates
Smith (2016)	Pew Research Center	Pew Research survey ($n = 4787$) Shared/on-demand services specified: (1) purchased used or second-hand goods online, (2) used programs offering same-day or expedited delivery, (3) purchased tickets from online reseller, (4) purchased handmade or artisanal products online, (5) contributed to online fundraising project, (6) used ride-hailing apps, (7) used online home-sharing services, (8) ordered delivery of groceries online from local store, (9) worked in a shared office space, (10) hired someone online for errand/task, (11) rented clothing, other products for a short time online	About 72% of all American adults used at least one of the 11 different shared/on-demand services, with 20% using at least four of these services About 15% of all American adults have used ride-hailing apps About 11% of all American adults have used home-sharing services College degree holders, high income (household income greater than $100,000), and younger age groups (ages 18–44) are generally more likely to use shared/on-demand services	Pros: Provides a good review of the consumer behaviors with respect to shared/on-demand services Cons: Tells us little about gig-economy workers (focus is on the consumer) Statistics for gig-economy goods and services are confounded with general online goods and services (e.g., Amazon, Safeway) and collaborative services (sharing office space) No state-level estimates

continued

Article	Organization	Data source of study	Results/summary of study	Pros/cons of study
Torpey and Hogan (2016)	U.S. Bureau of Labor Statistics	NA	Provides an operational definition of a gig: "single project or task for which a worker is hired, often through a digital marketplace, to work on demand" Cites the BLS's 2005 Contingent Work Survey (also used by Katz and Krueger, 2016) with roughly 2–4% of all workers being contingent workers (workers without explicit or implicit contract for long-term employment) and roughly 7% being independent contractors Cites the Census Bureau's non-employer (self-employed individual operating in small, unincorporated business with no paid employees) statistics, with about 1 million new non-employer businesses gained between 2003 and 2013 Notes the pros and cons of gig employment, and occupations that are particularly well-suited for gigs	NA
Upwork (2016)	Upwork	Online survey of 6002 U.S. adults who have done paid work during the past year between July 29, 2016 and August 24, 2016 (conducted by Edelman Intelligence)	The number of freelance workers increased from 53 million in 2014 to 55 million in 2016 In 2016, roughly 35% of the national workforce (i.e., all those who are working) engaged in freelance activities In 2016, among those who have participated in freelance work, roughly 63% reported that they pursue freelance work by choice (up from 53% in 2014)	Pros: Provides accurate online gig economy employment numbers (for the sample used) Cons: It tells us little about how people are engaging in freelancing (i.e., online intermediaries) No state-level estimates

Appendix 2: Correlation analysis

See Table 9, Figs. 7, 8, and 9.

Table 9 Correlation matrix of variables

	OIPs per Capita	Unemployment	Poverty rate	Cost of living ind.	GDP per capita	Internet employment per capita	IA Int. business environment score	IA internet access score	IA innovation financing score	IA general business score
OIPs per capita	1.0000									
Unemployment	−0.0223	1.0000								
Poverty rate	−0.2612	0.3508	1.0000							
Cost of living ind.	0.5067	0.0447	−0.3307	1.0000						
GDP per capita	0.2486	−0.0112	−0.4416	0.3621	1.0000					
Internet employment per capita	0.4369	−0.0016	−0.3035	0.2679	0.3506	1.0000				
IA int. business environment score	0.1435	−0.3959	−0.4512	0.0217	0.3390	0.4096	1.0000			
IA internet access score	0.5980	−0.0634	−0.3910	0.4945	0.4084	0.4858	0.2236	1.0000		
IA innovation financing score	0.2156	−0.1344	−0.3567	0.2031	0.3871	0.3631	0.3407	0.3100	1.0000	
IA general business score	−0.1853	−0.0057	0.0974	−0.2767	−0.0511	−0.2140	−0.0261	−0.2019	−0.2056	1.0000

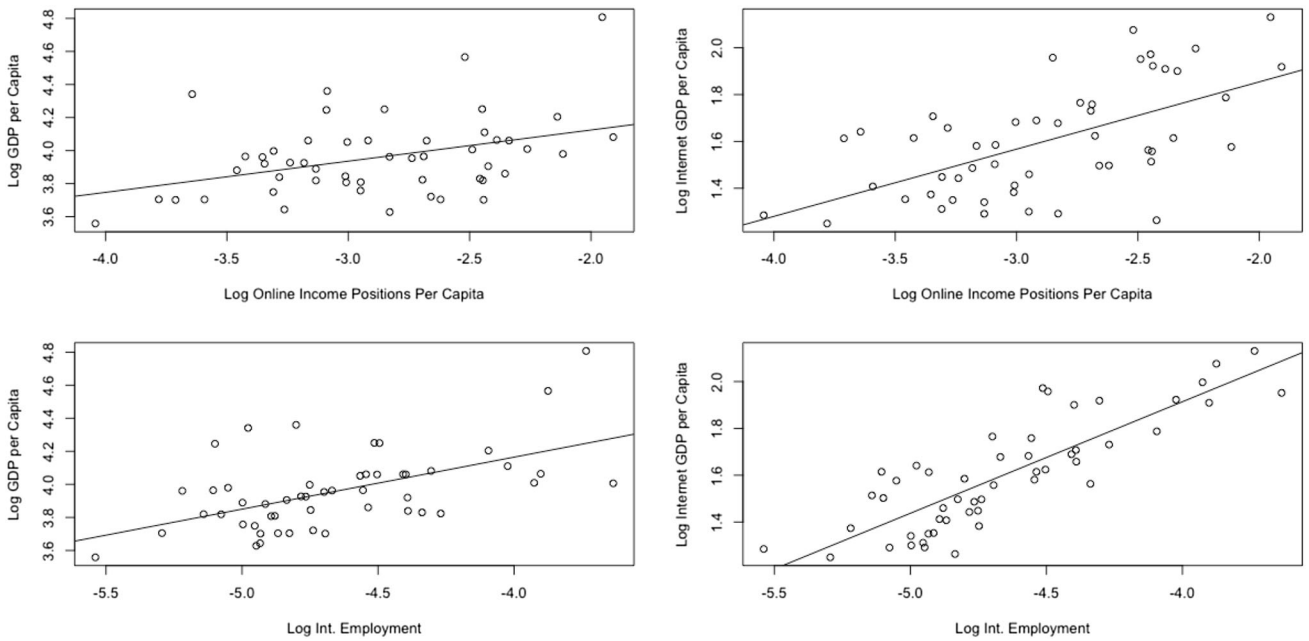

Fig. 7 Correlations between online income positions and economic productivity

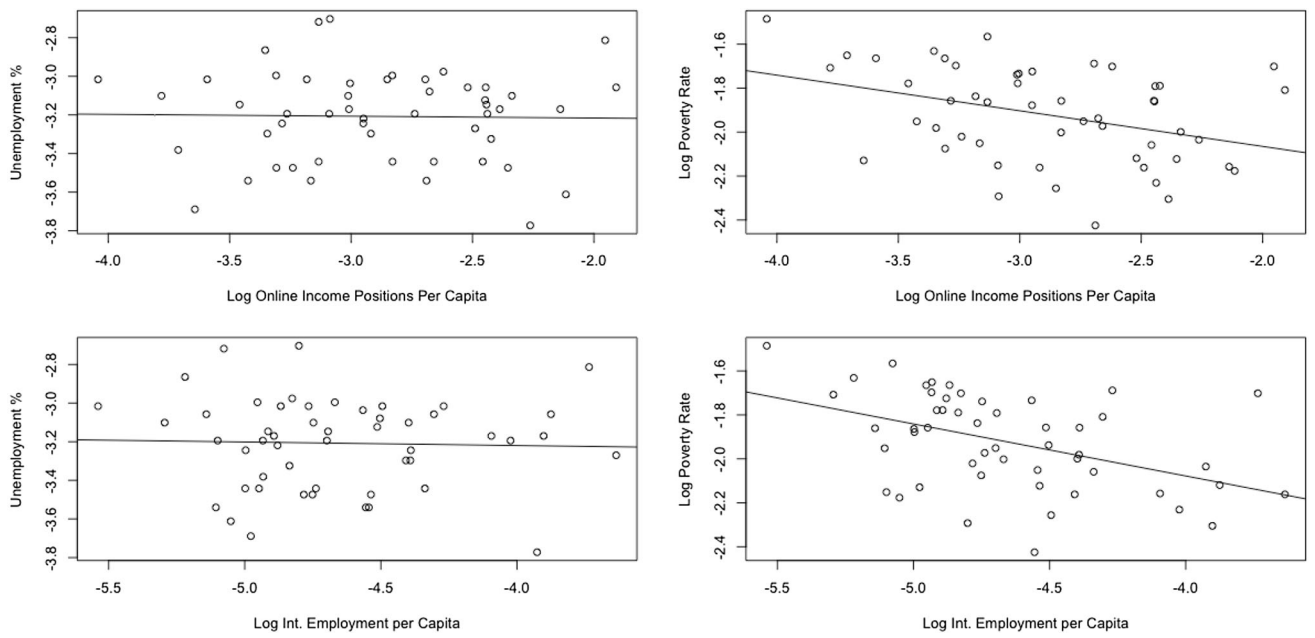

Fig. 8 Correlations between online income positions and economic prosperity

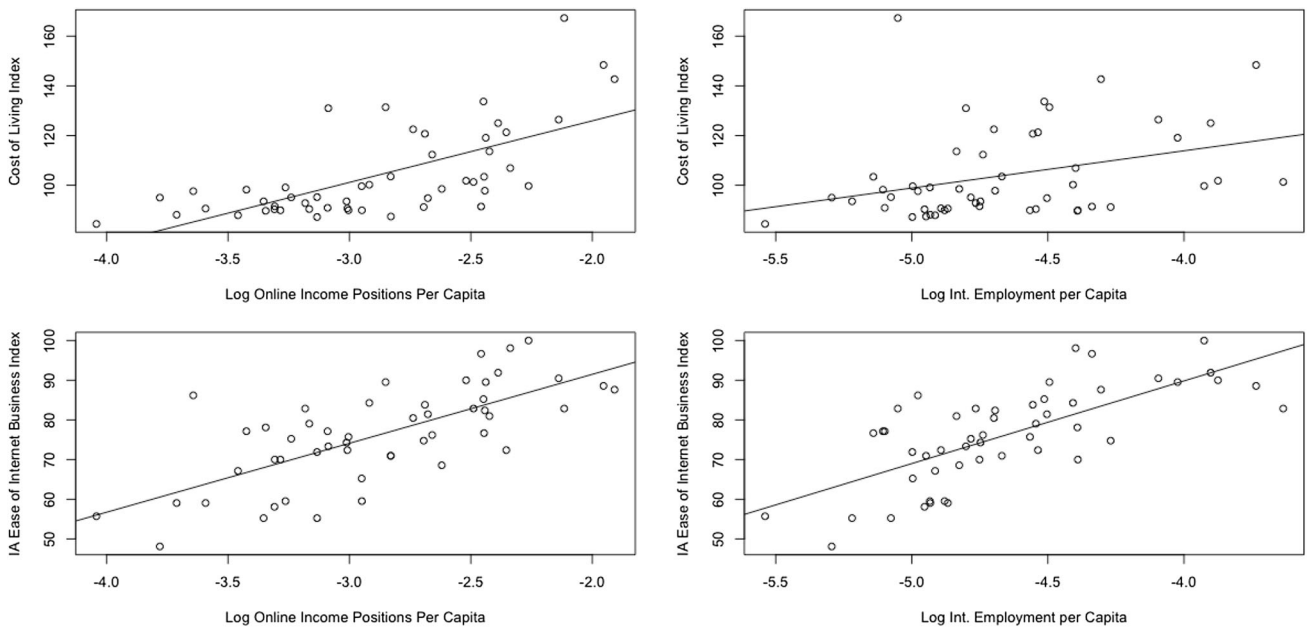

Fig. 9 Correlations between online income positions and business env.

Appendix 3: Examining model fit

Figures 10 and 11.

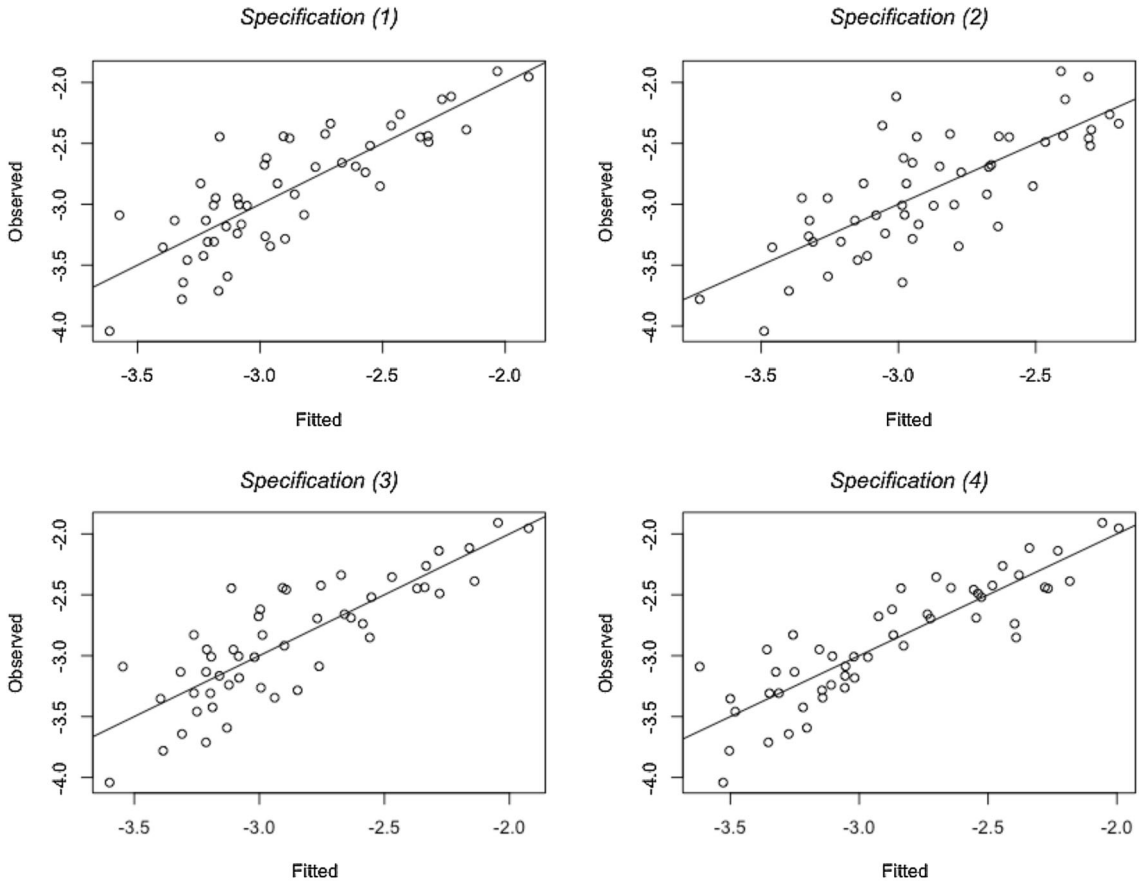

Fig. 10 Modeling online revenue positions by state

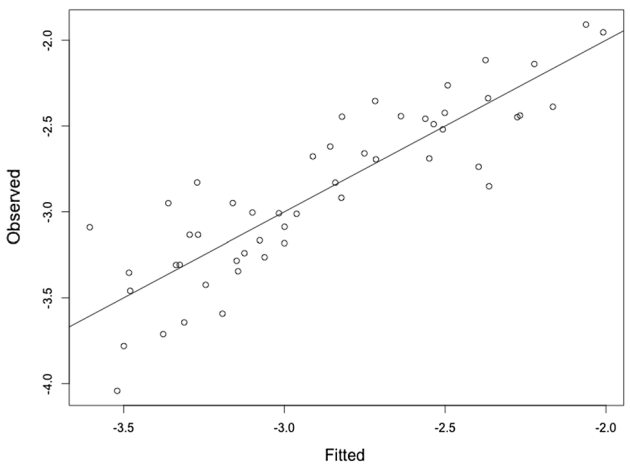

Fig. 11 Final specification (5)

References

Abraham, K.G., J.C. Haltiwanger, K. Sandusky, and J.R. Spletzer. 2017. *Measuring the gig economy: Current knowledge and open issues*. National Bureau of Economic Research. Retrieved March 2, 2017, from https://nber15.nber.org/confer/2017/CRIWs17/Abraham_Haltiwanger_Sandusky_Spletzer.pdf.

Bracha, A., and M. A. Burke. 2017. *Who counts as employed? Informal work, employment status, and labor market slack*. Federal Reserve Bank of Minneapolis, Opportunity & Inclusive Growth Institute. Working Paper 17–18. https://minneapolisfed.org/institute/working-papers/17-18.pdf.

Brainard, L. 2016. *The "gig" economy: Implications of the growth of contingent work*. Retrieved from https://www.federalreserve.gov/newsevents/speech/brainard20161117a.htm.

Butler, S.M. 1981. *Enterprise zones: Greenlining the inner cities*. New York: Universe Books.

Farrell, D., and F. Greig. 2016. *Paychecks, paydays, and the online platform economy: Big data on income volatility*. JPMorgan Chase Institute. Retrieved from https://www.jpmorganchase.

com/corporate/institute/document/jpmc- institute-volatility-2-report.pdf.
Galley, J. 2016. *Awareness and usage of the sharing economy*. U.S. Bureau of Labor Statistics: Monthly Labor Review. Retrieved from https://www.bls.gov/opub/mlr/2016/beyond-bls/pdf/awareness-and-usage-of-the-sharing-economy.pdf.
Garza, Nestor, and Christopher Hooton. 2017. *A comprehensive look at short-term rentals: A Spatial economic analysis of seattle*. Washington, DC: Internet Association.
Harris, S.D., and A.B. Krueger. 2015. *A proposal for modernizing labor laws for twenty-first-century work: The 'independent worker.'*. Brookings Institution: The Hamilton Project, Discussion Paper 2015–2010. Retrieved from http://www.hamiltonproject.org/assets/files/modernizing_labor_laws_for_twenty_first_century_work_krueger_harris.pdf.
Hathaway, I., and M. Muro. 2016. *Tracking the gig economy: New numbers*. Brookings Institution. Retrieved from https://www.brookings.edu/research/tracking-the-gig-economy-new-numbers/.
Hooton, C. 2016. *Micro-geographic economic analysis: the theory, techniques, and evidence of micro-level economic policies and their evaluations*. Cambridge: University of Cambridge.
Hooton, C. 2017a. *Measuring the ease of the doing internet business in the United States*. Washington, DC: Internet Association.
Hooton, C. 2017b. *Refreshing our understanding of the internet economy*. Washington, DC: Internet Association. Retrieved from https://internetassociation.org/reports/refreshing-understanding-internet-economy-ia-report/.
Hooton, C., and T. Farole. 2017. *Rethinking lagging regions—Alternative definitions and implications for policy*. Working Paper, The World Bank, Washington, DC.
Internet Association. 2015. *Measuring the US internet sector*. Conducted for Internet Association by S. Siwek, Economists Incorporated. Retrieved from http://internetassociation.org/wp-content/uploads/2015/12/Internet-Association-Measuring-the-US-Internet-Sector-12-10-15.pdf.
Jackson, E., A. Looney, and S. Ramnath. 2017. *The rise of alternative work arrangements: Evidence and implications for tax filing and benefit coverage*. The Department of the Treasury, Office of Tax Analysis. Working Paper 114. Retrieved from https://www.treasury.gov/resource-center/tax-policy/tax-analysis/Documents/WP-114.pdf.
Katz, L.F., and A.B. Krueger. 2016. *The rise and nature of alternative work arrangements in the United States, 1995–2015*. Retrieved from https://krueger.princeton.edu/sites/default/files/akrueger/files/katz_krueger_cws_-_march_29_20165.pdf.
Manyika, J., S. Lund, J. Bughin, K. Robinson, J. Mischke, and D. Mahajan. 2016. *Independent work: Choice, necessity, and the gig economy*. McKinsey Global Institute. Retrieved from http://www.mckinsey.com/global-themes/employment-and-growth/independent-work-choice-necessity-and-the-gig-economy.
Muro, M. 2016. *The gig economy: Complement or cannibal?* Brookings Institution. Retrieved from https://www.brookings.edu/blog/the-avenue/2016/11/17/the-gig-economy-complement-or-cannibal/.
Organization for Economic Co-operation and Development (OECD). 2017. Working age population: Aged 15–64: All persons for the United States© [LFWA64TTUSM647S], retrieved from FRED, Federal Reserve Bank of St. Louis. Retrieved July 17, 2017, from https://fred.stlouisfed.org/series/LFWA64TTUSM647S.
Roberts, M. 2016. *Identifying the economic potential of Indian districts*. Policy research working paper no. WPS 7623. World Bank Group, Washington, DC.
Roberts, M., T. Farole, and C. Hooton. 2017. *Measuring the Economic Potential of European Regions (working title)*. Working Paper, The World Bank. Washington, DC.
Robles, B. J., and M. McGee (2016). *Exploring online and offline informal work: Findings from the Enterprising and Informal Work Activities (EIWA) survey*. Board of Governors of the Federal Reserve System, Finance and Economics Discussion Series, 2016-089. Retrieved from https://www.federalreserve.gov/econresdata/feds/2016/files/2016089pap.pdf.
Smith, A. 2016. *Shared, collaborative and on demand: The new digital economy*. Pew Research Center. Retrieved from http://www.pewinternet.org/2016/05/19/the-new-digital-economy/.
Torpey, E., and A. Hogan. 2016. *Working in a gig economy*. U.S. Bureau of Labor Statistics. Retrieved from https://www.bls.gov/careeroutlook/2016/article/what-is-the-gig-economy.htm.
Upwork. 2016. *New study finds freelance economy grew to 55 million Americans this year, 35% of total U.S. workforce*. Retrieved from https://www.upwork.com/i/freelancing-in-america/2016/.

Dr. Christopher Alex Hooton is an Economist and Policy Expert specializing in economic development, spatial analysis, and evaluation. He currently serves as the Chief Economist at Internet Association, a leading trade association for internet firms, and as a Senior Scholar at the George Washington University Institute of Public Policy. Prior to joining Internet Association, Dr. Hooton served as a consultant to the World Bank, the Inter-American Development Bank as well as other leading organizations and was formerly a Lecturer at the Social Science Research Methods Centre at the University of Cambridge. He has also written two novels, entitled *Observance* and *Peregrine East*, and a travel memoir, entitled *How to Backpack With Your Parents.* Born and raised in Kansas City, Missouri, Dr. Hooton holds degrees from the University of Miami, the London School of Economics, and his doctorate from the University of Cambridge where he also served as the Captain of the university's boxing team.