There has been rapid growth in platforms that connect workers, acting as free agents, with customers who require a time-sensitive service\(^1\). This growth has not been without controversy and some observers argue that the expansion of these platforms has come at the expense of workers. One controversial aspect of this growth, and the focus of this paper, has been the effort of platforms, such as Uber, to aggressively recruit more workers (presumably to support growth in demand and to improve quality of service to customers by reducing delay in responding to service requests). The growth in the labor pool size is potentially harmful to workers if it depresses wages and dilutes the fraction of demand allocated to each worker\(^2\).

The following statements from a recent article in the New York Times (2017) summarize some of this perceived tension between the interests of platforms and those of workers:

“Uber’s interests and those of drivers are at odds on some level. Drivers prefer some scarcity in their ranks to keep them busier and push up earnings. For its part, Uber is desperate to avoid shortages, seeking instead to serve every customer quickly, ideally in five minutes or less.”

“Having more drivers on the road benefits ride-share companies, but drivers profit from scarcity in their ranks.”

“Faster pickup times mean more idle drivers.”

However, it is not clear to what extent such misalignment between the interests of the two parties always exists. For example, a counter-argument to the “earnings dilution” that comes with more labor supply is the “demand expansion” that results from an increase in labor supply. In particular, everything else remaining the same, more labor supply implies faster response time. This enhances the value of the service to customers, and, therefore, could result in

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\(^1\)Examples of such platforms are many and include in the U.S., among others, Uber and Lyft for transportation services, Instacart and Postmates for home deliveries, and TaskRabbit and Handy for the running of errands.

\(^2\)In many platforms, workers are not guaranteed a salary and are paid only for actual work carried out.
more demand. More demand leads in turn to workers being busier which could potentially push their income higher.

In this paper, we investigate these two counteracting factors. We do so by using an equilibrium model that accounts for the interaction between labor supply and demand. We analyze equilibrium outcomes for workers, including wages, workload and average welfare. Specifically, we consider the setting of a platform that relies on a workforce that consists of independent workers (whom we call agents) who decide how much, if at all, to make themselves available to the platform. Whenever available, agents are allocated a fraction of service requests received by the platform (what we call demand) and are paid at a specified wage rate for the duration of the service request. Customers are sensitive to both price and delay. Therefore, in deciding to seek service with the platform, customers assess both the price of the service and the cost of delay. Delay is determined by the congestion in the system, which we assume is decreasing in labor supply and increasing in demand. The platform decides on wages and prices so as to maximize its own profit.

The following is a summary of our main findings.

- We show that average labor welfare (the difference between the income an agent earns and the agent’s opportunity cost) is non-monotonic in the size of the labor pool (the pool of potential agents who may decide to join the platform). In particular, we show that labor welfare first increases in the labor pool size and then decreases. This is despite the fact that the wage rate paid by the platform always decreases in the labor pool size. These results are driven by customers sensitivity to delay. When customers are insensitive to delay, an increase in the labor pool size always results in lower average labor welfare. Similarly, we show that agent workload is non-monotonic in the labor pool size, also first increasing and then decreasing. In other words, initial increases in the labor pool size make agents more, not less, busy.

- We explain these results by noting that, depending on the size of the labor pool, the system can be in one of two regimes, a congestion regime where delay is significant and a cost regime where congestion is negligible. In the congestion regime, an increase in the labor supply stimulates demand, with the increase in demand proportionally
higher than the increase in supply, resulting in higher agent workload. The increase in workload is sufficiently high to more than offset the reduction in the wage rate, resulting in a net increase in an agent’s income (and consequently an increase in labor welfare). In the cost regime, increases in labor supply have a negligible stimulating effect on demand, as delay is already small, resulting in lower agent workload and, therefore, lower agent income and lower labor welfare. In other words, in the congestion regime, agents act as complements, with additional agents having a beneficial effect on the labor welfare of everyone; while in the cost regime, agents act as competitors with increases in their numbers reducing labor welfare as they compete for a relatively fixed amount of demand.

• We show that a reduction in delay cost to customers (e.g., through more effective matching of supply and demand) may not necessarily be beneficial to agents and that agents can be better off when customers incur some degree of delay cost. In particular, we show that labor welfare is not necessarily monotonic in delay cost and can instead first increase and then decrease. We explain this result by noting that higher delay cost requires the platform to keep additional supply to mitigate this cost, resulting in higher surplus for agents. We show that this is more likely to occur when the labor pool size is large.

• We show that higher variability in the agents’ opportunity cost, while providing the platform with access to more agents with low cost, may not necessarily depress agents’ income and lead to lower labor welfare. This is because the increased availability of low cost agents allows the platform to deploy more supply. Hence, the effect of higher variability in agents’ costs is similar to that of a larger labor pool size. In particular, we show that the effect of variability on labor welfare is non-monotonic. There are again two regimes: (1) a congestion regime, in which more low cost agents (agents whose realized opportunity cost is low) improves labor welfare (due to the increase in demand associated with the increase in supply) and (2) a cost regime, in which more low cost agents reduces labor welfare (in this regime, delay becomes negligible and more supply ceases to induce significant increases in demand).