

Households in Transit: COVID-19 and the Changing Measurement of Welfare

Extended Abstract

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April 15, 2022

Abstract

The COVID-19 pandemic placed new constraints and prices on commuting to work around the world. This has significant implications for household expenditures. However, traditional methods of measuring household welfare (and, accordingly, poverty and inequality) based on expenditures or consumption have not taken into consider the implications of these changes. We propose a new method to impute transportation cost equivalents for household consumption or expenditure aggregates. First, we outline the theory showing significant mis-measurement of welfare for households who are able to shift into remote work during the pandemic. We combine labor force survey and household income and expenditure survey data through the end of 2020 to estimate which households are likely able to work remotely and the reduction in transportation costs associated with this ability. We then impute pre-pandemic transportation costs and calculate poverty and inequality. We will show that taking transportation costs into account has important implications for evaluating the impacts of the pandemic.

Keywords: poverty measurement, inequality measurement, consumption aggregate, expenditures, imputation, living costs, COVID-19, welfare

JEL codes: I32, D30, R20, J32

The World Bank estimates that the COVID-19 pandemic has pushed nearly an additional 100 million people into poverty globally through 2021 (Mahler et al. 2021). Poverty is measured by using household consumption or expenditure in all low-income countries and the majority of middle-income countries (Mancini and Vecchi 2022). Consumption-based measures of poverty have theoretically better welfare properties, as they allow for household consumption smoothing over seasons and shocks, and are easier to compute in contexts where measuring income is difficult and self-employment or informal labor is common (Deaton and Zaidi 2002). Consumption is often largely approximated by expenditures. When interpreted in terms of a money metric unit, expenditures give a measure of how much money is needed for a household to reach a given level of living standards (Mancini and Vecchi 2022; Deaton and Zaidi 2002).

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However, the COVID-19 pandemic has introduced new challenges for this method of measuring welfare and poverty. National lockdowns and increased health risks have constrained consumer choice, causing households to reallocate their expenditures. To the extent that households face different constraints on their decision making and different (unmeasured) prices, expenditures during the pandemic do not necessarily map one-for-one to welfare. And to the extent that these constraints are unequally distributed, this may have significant implications for the measurement of poverty and inequality.

In this paper, we will focus on the case of transportation costs. During the pandemic, many workers gained the opportunity to work remotely. This implies a significant price reduction for commuting to work for households who are unconstrained by being required to work in-person. However, when there is a price reduction and expenditure measures are not adjusted, welfare increases but expenditures may decline. Further, access to remote work is not equally distributed among households and occupations, meaning that consumption-based measures may mask significant inequality. If the highest income households are more likely to face the commuting cost reduction allowed by remote work, then inequality may increase significantly while consumption-based measures of it decrease.

We first lay out the theory of household welfare maximization. Households h in time t maximize utility u over consumption c_{ht} , savings s_{ht} with an interest rate r_{ht} , and labor l_{ht} with wage w_{ht} . Assume that the utility function is monotonically increasing in c_{ht} and decreasing in l_{ht} (disutility of working). Take $t = 0$ to represent the pre-pandemic period and $t = 1$ to represent during or after pandemic. Households are of two types: in-person only and remote work shifters. The former faces a constraint in both periods: if $l_{ht} > 0$, they must pay a transportation cost tr_{it} and receive disutility from commuting d_{it} for all t . Thus, the in-person only household i faces the problem in each t :

$$\begin{aligned} & \max_{c_{it}, s_{it}, l_{it}} u(c_{it}, l_{it}) - d_{it} l_{it} \\ \text{s.t.} \quad & c_{it} + tr_{it} l_{it} + s_{it} \leq rs_{it-1} + wl_{it} \end{aligned}$$

We can rewrite the budget constraint to become $c_{it} \leq rs_{it-1} + (w - tr_{it})l_{it}$. Effectively, working in person means that the net wage rate is lowered.

The remote shifter household j faces the above problem for $t = 0$. However, for $t = 1$, the remote shifter household faces $tr_{j1} = 0$ and instead solves

$$\begin{aligned} & \max_{c_{jt}, s_{jt}, l_{jt}} u(c_{jt}, l_{jt}) \\ \text{s.t.} \quad & c_{jt} + s_{jt} \leq rs_{jt-1} + wl_{jt} \end{aligned}$$

There are two differences from the above: the household faces a higher net wage rate (or a price reduction in the cost working). In addition, they are not penalized by the disutility of commuting. In this setting, as long as $r > 0$, a price reduction will unambiguously increase welfare. The removal of the disutility of

commuting also unambiguously increases welfare.

However, expenditures for any household h are given by $e_{ht} = c_{ht} + tr_{ht}l_{ht}$. For any fixed \bar{t} (that is, under a fixed $tr_{h\bar{t}}$ and fixed prices), welfare should increase monotonically with e_{ht} . If the household chooses a larger level of c_{ht} or l_{ht} , it must be because these are the utility-maximizing values. However, between $t = 0$ to $t = 1$, welfare does not vary monotonically with e_{ht} . The key distinction is that tr_{ht} is a cost that does not enter directly (or positively) into the utility function, unlike c_{ht} and l_{ht} . There are several sources of this divergence:

- Remote households are unambiguously better off, even though their e_{jt} has decreased, as described above.
- If $tr_{i0} < tr_{i1}$, that is, if transportation costs increased during the pandemic (e.g., because public transportation was closed), we may have $e_{i0} > e_{i1}$ while welfare has declined. The net wage rate decreases, leaving households worse off.
- If $d_{i0} < d_{i1}$, that is, if the disutility of commuting increases (e.g., because of higher risk of infection), in-person households may become worse off with no change in expenditures.

A more appropriate expenditure-based proxy of welfare might take $\tilde{t}r_h$ to be the pre-pandemic transportation cost. Then, we can evaluate $\tilde{e}_{ht} = c_{ht} + \tilde{t}r_h l_{ht}$. We will focus only on transportation expenses, so assume that all other prices are constant. Under certain conditions, welfare increases monotonically with \tilde{e}_{ht} . This is clear for the c_{ht} term because consumption enters directly and monotonically in the utility function. Welfare will increase monotonically with l_{ht} as long as the net wage is positive and labor supply does not decrease for remote households in $t = 1$. That is, we assume that any income effect reducing labor supply is not large enough to offset the substitution effect plus the effect of the removed disutility of commuting term.

An alternative proposed solution could be to subtract out transportation expenses $tr_{ht}l_{ht}$ in the expenditure aggregate. However, this would not be a satisfying answer. First, many household surveys do not collect detailed disaggregated information on transportation expenses – part of the argument of this paper is that they need to consider these in more detail. Second, even when they do, there may be more than one kind of transportation expense. Some kinds of transportation expenses may in fact be associated with increases in welfare, such as travel for leisure. We need to differentiate them.

The mechanism of this model is shown graphically in Figure 1. In this figure, we consider an example. Imagine the case where the remote work shifter household is relatively more wealthy than the in-person household. Pre-pandemic, using an expenditure-based poverty line, the in-person household is poor while the remote work shifter is not. There is large inequality in their expenditures. They both face a disutility of commuting and spend on commuting costs which do not otherwise increase welfare, which means that their true welfare is lower than what is measured by their expenditures by a constant amount.

During the pandemic, the remote work shifter moves to remote work, no longer incurring the disutility from commuting. Their expenditures have also fallen because they do longer pay the commuting cost. Their

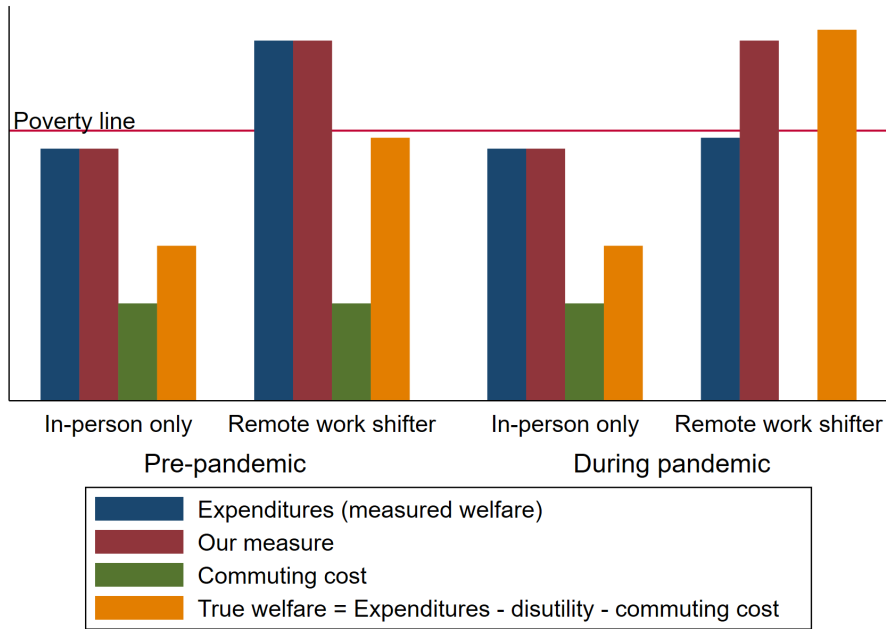


Figure 1: Welfare and expenditures pre- and during pandemic.

expenditures may fall so much that they become poor, even though welfare has increased dramatically. On the other hand, the in-person household faces the same costs and disutility as before (or, we can imagine them being even greater). When we compare poverty based on expenditures only, poverty has increased because of the pandemic, but welfare has also weakly increased for both households. It also appears that inequality has decreased during the pandemic, when true inequality as measured by welfare has increased dramatically. Our measure moves much more closely with true welfare, remaining the same for the in-person household and increasing for the remote work shifter. However, it is important to note that our measure does not completely reflect welfare because we still do not observe the disutility of commuting. Thus, our measure captures much of the increase in inequality during the pandemic, but still underestimates it somewhat.

In our econometric framework, we frame the problem of measuring poverty and inequality as the problem of imputing \tilde{r}_h based on the household head's characteristics. We will use data from Georgia. First, we evaluate which workers are likely to be able to work remotely based on labor force survey data through 2020. We use this model to predict propensity for household heads to work remotely using a detailed income and expenditure survey. Using a regression discontinuity design to compare households who were interviewed with a reference period before the March 2020 national emergency and after it, we can estimate how much transportation costs changed for each type of household due to the pandemic. Then, the difference in expenditure reductions for remote-shifter households compared with in-person only households gives a

sense of how much of the transportation expense may have been due to commuting costs as opposed to, for example, travel for leisure. For example, if predicted remote-shifter households experience a much larger decline in transportation costs than in-person households, we know that the distinction between remote work and in-person work captures a large amount of transportation cost.

Next, we show descriptively what this means for poverty and inequality estimation. We show that the size of this problem by outlining the substantial size of commuting costs for households: pre-pandemic, households in the poorest quintile allocated 4% of their monthly expenditures to transportation, while households in the richest quintile allocated 10% (Figure 2). During 2020, households across the distribution reduced transportation expenditures as a share of total income, with households at the top of the distribution experiencing the greatest reductions. These reductions are concentrated in the months immediately after the initial lockdowns in March 2020, as well as near the end of 2020 when a second wave of lockdowns limited in-person activities again (Figure 3). In fact, these measures mask some of the inequality, since they consider transportation expenses as a share of all expenditures: other expenditures may have also declined during the pandemic, and a 1 percentage point decrease in the transportation share for the wealthiest households is much larger in absolute terms than a 1 percentage point decrease for the poorest households.

Next, we can use our findings on the impact of the pandemic on transportation expenses to impute a transportation expenditure equivalent for the remote-working households. By construction, our measure will reduce the estimated impacts of the pandemic on poverty, since we add transportation expenses and our measure of imputed expenditures will always be larger than the regular expenditure measure. However, the extent to which it affects the estimated poverty impacts is enlightening. We can compare which households would be mis-categorized into or out of poverty using the regular expenditure measure.

More interestingly, we also compute measures of inequality, such as the Gini coefficient, using both expenditure measures. The impacts of the pandemic on inequality may be exaggerated or underplayed by the lack of accounting for transportation expenses in the regular expenditure measure. To the extent that higher-income households are the ones able to work remotely, the pandemic's impacts on inequality in welfare may be severely underestimated by the regular expenditure measure.

Finally, we weaken our assumptions and allow for error in our model and construct bounds on the true poverty and inequality impact of the pandemic under different scenarios.

Contributions

This paper offers several key contributions to the literature. Importantly, we are the first to evaluate the size of the potential problem that commuting costs pose for poverty and inequality measurement by documenting and studying pre- and during-pandemic inequalities in the cost of transportation and commuting, as well as the inequality in opportunities to work from home. As shown by Garrote Sanchez et al. (2020), the ability to work remotely is concentrated among high-income households in all countries. For example, in upper middle income countries like Georgia, nearly none of the poorest decile can work from home, while the

Transport expenses as fraction of total expenditures by expenditure quintile in 2019 and 2020

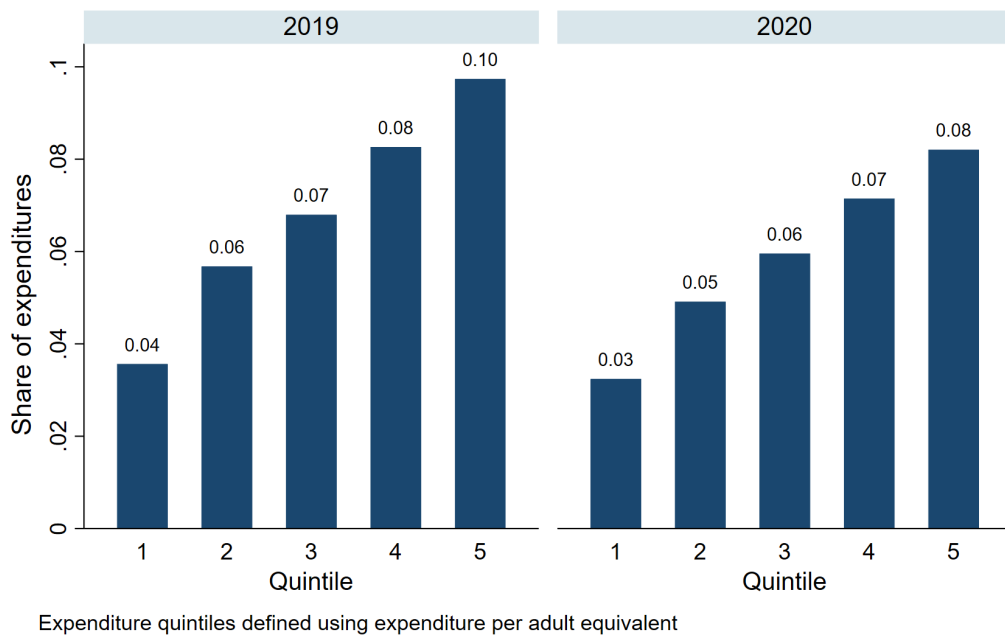
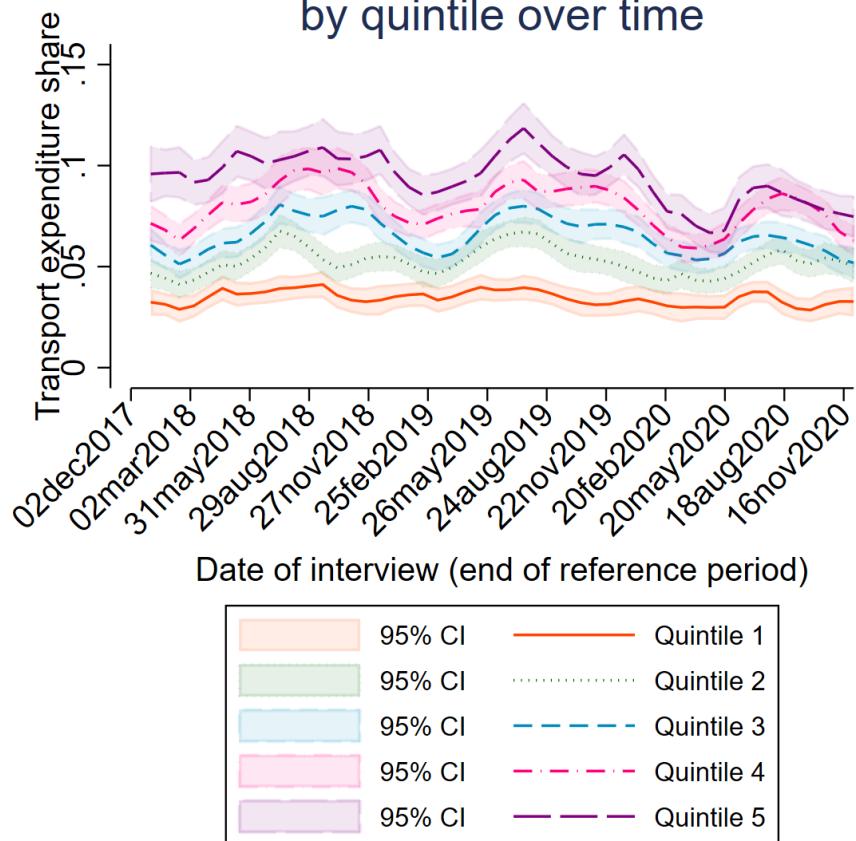


Figure 2: Transportation share of expenditures by quintile, 2019 and 2020. Source: Georgia HIES

Average transportation expenditure share by quintile over time



Local constant regressions with a bandwidth of 20 days

Figure 3: Transportation share of expenditures by quintile over time. Source: Georgia HIES

majority of the richest decile can. They estimate that inequalities in remote work will drive significant income inequality during the pandemic, but do not take into account the difference in commuting cost. We also provide additional evidence on the profiles of remote workers.

Having documented the magnitude of the problem, we are the first to propose methods for consumption-based poverty and inequality measurement during and after the pandemic. Others have attempted to address the huge changes in welfare due to the pandemic by offering multidimensional poverty indexes which take into account unmeasured welfare changes like the risk of infection, but none have attempted to reconcile welfare changes with existing expenditure-based poverty measurement (Tavares and Betti 2021). We also build on previous work on imputing values of unobserved expenses or incomes, such as the literature on rent imputation for owner-occupied housing (Balcázar et al. 2017). We build on previous work showing theoretical problems with the consumption aggregate, including showing that partial consumption aggregates which do not collect information on all goods only satisfy desirable theoretical properties if the associated Engel curves are all linear (Christiaensen et al. 2021). We offer a general method that can be applied to other contexts, settings, and datasets.

In addition, we add to the literature on household decisionmaking during the pandemic by systematically discussing the changes in household welfare and the household utility maximization problem due to the possibility of remote work. To our knowledge, this issue has not been addressed theoretically to date, though we had previously discussed the welfare implications of remote work in an informal blog post (Caron and Tiongson 2021).

We finally contribute also to the study of the poverty and inequality impacts of the pandemic. Many have suggested huge poverty impacts of the pandemic, with some estimating that by June 2020 the pandemic had already caused an additional 68 million person-years spent in poverty (Decerf et al. 2021). The pandemic has also been thought to increase inequality by driving wage losses among low-wage workers (Aspachs et al. 2021). We expand on this literature by offering new estimates of the pandemic’s poverty and inequality impacts, while also illuminating an important driver of them in addition to the unequal distribution of job losses and infection rates.

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