Sectoral heterogeneity in the COVID-19 recovery: Evidence from Rwanda

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Abstract

Following the initial COVID-19 shock, developing countries have begun to transition to a COVID-19 economic recovery characterized by eased lockdowns and fiscal stimulus. We leverage high frequency administrative tax records from Rwanda on firm sales and employment to characterize the impacts of the COVID-19 shock and recovery. We show that the aggregate shock peaked in April 2020, with aggregate turnover and employment recovering to pre-COVID-19 levels by September. The aggregate recovery masks meaningful heterogeneity: while the initial shock impacted sectors in which in-person work was most necessary, the sectors in which face-to-face interactions with consumers are most necessary continue to experience a protracted recovery.

1 Introduction

The COVID-19 pandemic has been an unprecedented global crisis (International Monetary Fund, 2020b). While policy response in the early months of the crisis were characterized by lockdowns in order to contain the spread of COVID-19, more recent months have featured eased lockdowns and intervention to support particularly impacted sectors of the economy (International Monetary Fund, 2020a). Understanding

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the impacts of the crisis and responses by policy makers is particularly important in developing countries, where poverty rates and disease burden are relatively high.

While many of the economic impacts of the initial COVID-19 shock have been documented in developing countries (Adjognon et al., 2020; Aggarwal et al., 2020; Banerjee et al., 2020; Chiplunkar et al., 2020; Djankov & Panizza, 2020), there is less descriptive evidence on the ongoing transition to the COVID-19 economic recovery outside of the United States (Chetty et al., 2020). This transition is particularly important to study in developing economies in sub-Saharan Africa, which recent projections have suggested may not have full access to a COVID-19 vaccine until 2023 (Economist Intelligence Unit, 2020). Absent a widely available vaccine, the status quo of the COVID-19 economic recovery in many of these countries of eased lockdowns and ongoing COVID-19 mortality and morbidity is likely to persist. Moreover, as the economic impacts of the COVID-19 shock were heterogeneous across sectors, the COVID-19 recovery is likely to be similarly uneven.

We study the economic impacts of the COVID-19 shock and recovery and shed light on sectoral heterogeneity in these impacts in the context of Rwanda. Rwanda has had well documented success in its management of the COVID-19 crisis, and has maintained low rates of COVID-19 (Condo et al., 2020). In this sense, the impacts of the COVID-19 recovery in Rwanda may offer a best case scenario for other developing economies in sub-Saharan Africa until vaccines are widely available.

In this chapter, we leverage the universe of monthly employment and social security tax filings by formal employers ("PAYE") and electronic billing machine transactions ("EBM") to characterize the aggregate impacts and sectoral heterogeneity in the COVID-19 shock and recovery in Rwanda. These data allow us to document impacts at high frequency with near-universal coverage of formal economic activity. We focus our analysis on total turnover in EBM and formal employment in PAYE, and demonstrate that our aggregate time series are comparable to national statistics on GDP and aggregate employment, respectively.

We replicate existing findings on sectoral heterogeneity in the COVID-19 shock in Rwanda, and extend this work by documenting distinct patterns of heterogeneity during the COVID-19 recovery. First, we begin by showing that Rwanda experienced a large shock to turnover and employment peaking in April 2020. However, by September 2020, aggregate turnover and formal employment had recovered to pre-COVID-19 levels. This suggests that Rwanda has transitioned from the initial

COVID-19 shock, enabling us to study the COVID-19 recovery. Second, we find that the COVID-19 shock was particularly large in sectors where in-person work is most necessary, mirroring evidence from richer economies (Bartik et al., 2020; Brynjolfsson et al., 2020). Third, we document a k-shaped COVID-19 recovery, with some sectors that experienced the most severe contraction during the initial COVID-19 shock returning to pre-COVID-19 turnover and employment (Construction), while other sectors maintaining turnover and employment persistently below pre-COVID-19 levels (Accommodation & Food). This heterogeneity mirrors international projections (International Monetary Fund, 2020a) and suggests that sectors in which face-to-face interactions with consumers are most necessary, distinct from sectors in which in-person work is most necessary, are most likely to experience a protracted recovery (Avdiu & Nayyar, 2020). Given Rwanda's success in managing COVID-19, this highlights that a similar protracted k-shaped recovery is likely across developing countries until vaccines are widely available.

2 Data and context

We characterize the COVID-19 shock and recovery in the context of Rwanda using high frequency data on formally registered firms. Our analysis focuses on two sources of monthly data covering from June 2019 to September 2020, obtained from the Rwanda Revenue Authority. The first source is the universe of monthly employment and social security tax filings by formal employers ("PAYE"), which covers 450,000 workers (13% of total employment). Firms are required to file for all employees with taxable income, or monthly income above 30,000 RwF (30 USD), or for which the firm is making a declaration for pension or other benefits. The second source is the universe of electronic billing machine ("EBM") transactions made through EBM II software, covering 1.2 trillion RwF of value added annually (13% of GDP). All firms filing value added tax (VAT) declarations are required to register sales using EBM, which for firm-to-firm sales include the client's taxpayer identifier used for VAT enforcement. Firms with annual turnover above 20 million RwF (20,000 USD) or quarterly turnover above 5 million RwF (5,000 USD) for three consecutive quarters are required to file VAT. The EBM II software itself is freely available to all taxpayers, and is progressively replacing older physical EBM machines. We aggregate these data to construct employment and turnover, respectively, at the firm-by-month level, which

we use in this analysis. In PAYE, we focus on employment as an outcome, as opposed to renumeration, as it exhibits much less seasonality and evenly weights each worker. In EBM, we focus on turnover as an outcome, as opposed to value added, because for analysis disaggregated to sectors with monthly data, turnover exhibits less noise and seasonality than value added.

We present a brief timeline of key events and policies during the COVID-19 shock and recovery in Rwanda. Rwanda had its first confirmed case of COVID-19 on March 14, 2020, and since then the Ministry of Health has published daily updates, with new daily cases fluctuating but almost always remaining non-zero. As new individuals continued to test positive in the days after March 14, the Prime Minister announced lockdowns starting March 22, including closing schools and non-essential shops, closing international borders, mandating work from home for non-essential workers, and prohibiting unnecessary movements and visits outside the home. A partial reopening was announced on May 4, including an 8pm to 5am curfew and a requirement that masks be worn in all public spaces. Some businesses, including construction, manufacturing, hotels and restaurants, and transportation, were allowed to reopen, often with additional restrictions. Since May 4, additional restrictions have been progressively phased out (and sometimes temporarily reinstated), including allowing motorcycle taxis and travel between provinces on June 2, places of worship reopening on July 15, airports reopening to passenger flights on August 1, and schools beginning a staggered reopening on September 25. Other aspects of the initial lockdown have persisted — for example, as of November 27, a 10pm to 4am curfew remained in place, and stricter curfews are planned from December 15, 2020 through January 4, 2021. In general, we interpret our results on the COVID-19 recovery as caused by responses by firms and individuals to the combination of these policies and the overall health and economic environment.

3 COVID shock and recovery

3.1 Aggregate economic impacts of the shock and recovery

We begin by presenting the COVID-19 shock and recovery in aggregate statistics in Figures 1 and 2, focusing on our series of turnover and employment. However, as a large fraction of Rwandan value added and employment is in the informal sector, we

also compare our time series to official national statistics from NISR. We compare our turnover series to GDP, and our employment series to employment from the nationally representative Labor Force Survey (LFS). We interpret GDP and LFS employment as the benchmark measure, and our time series of turnover and employment as proxies available at a higher frequency and at the firm level. As the national statistics are quarterly, we present our turnover and employment series both monthly and quarterly for comparison.

Figure 1

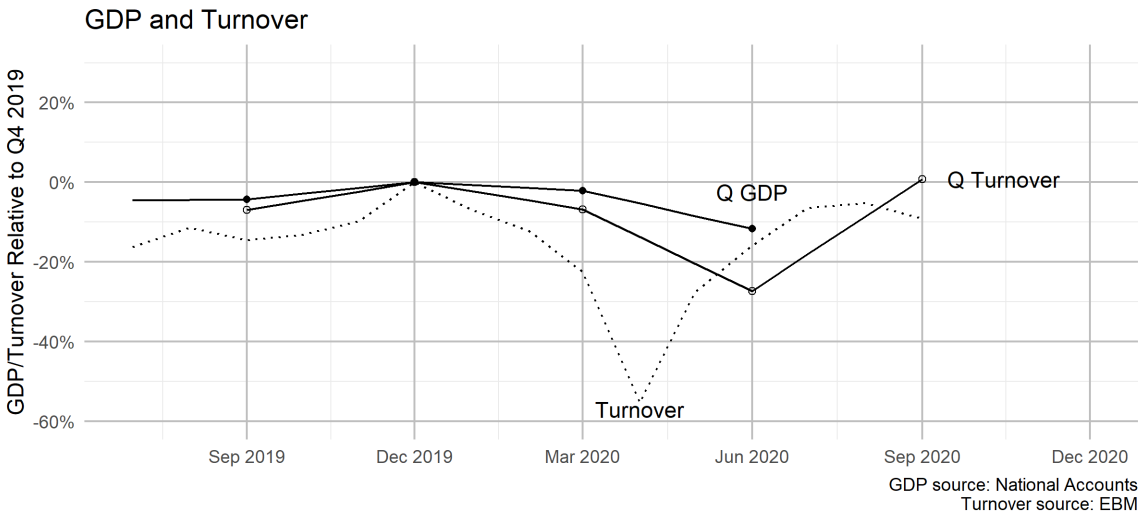
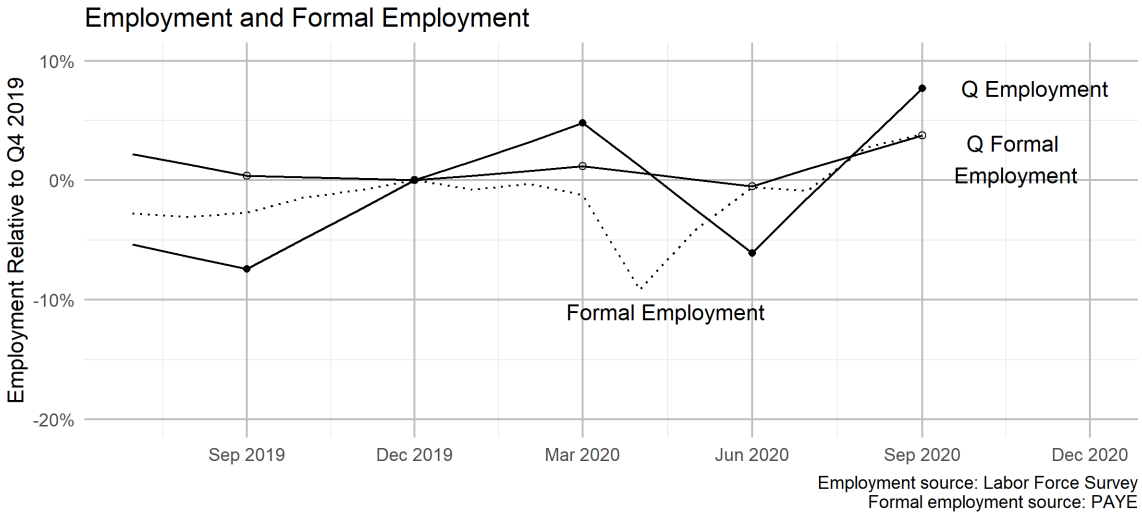


Figure 2



Using our time series, we show that the COVID-19 shock was mirrored by an equally rapid and striking recovery. In Figure 1, we show that EBM turnover fell by 55% in April 2020 relative to December 2019, but by September 2020 remained only 9% below December 2019. Similarly, in Figure 2, PAYE employment fell by 9% in April 2020 relative to December 2019, but by September 2020 was 4% above December 2019. To the extent that the magnitude and the speed of the COVID-19 shock to the Rwandan economy is surprising, we also interpret the magnitude and the speed of the COVID-19 recovery to be equally surprising. However, just as the initial shock was heterogeneous in exposure across sectors, it is natural to expect that the recovery should be heterogeneous across sectors.

Lastly, we verify the external validity of our data on turnover and employment for the broader Rwandan economy. First, we compare EBM turnover and GDP in Figure 1. Comparing the quarterly series, we can see EBM turnover exhibits significantly more fluctuations than GDP. However, much of our sample is during the COVID-19 shock and recovery, and the direct impacts of COVID-19 on economic activity may have been smaller for informal firms (particularly smallholder farmers and other rural self-employed) than for formal firms. Despite these differences, changes in quarterly turnover closely match patterns in the quarterly GDP series, with a correlation coefficient of 0.99 over the four quarters of overlapping data. We note that at the time of writing, 2020Q3 GDP statistics have not yet been released; these results suggest that GDP statistics for Q3 are likely to exhibit a strong recovery. Second, we compare employment in PAYE to employment from LFS in Figure 2. In contrast to turnover and GDP, employment in PAYE is much more stable than employment in LFS. We expect that formal employment is more likely to be full time and carries additional protections relative to informal employment, and should therefore be much more stable than employment in LFS (International Labor Organization, 2020). Once again, despite these differences, our quarterly employment series appears to closely match patterns in the LFS, with a correlation coefficient of 0.68 over the five quarters of overlapping data.

3.2 Sectoral heterogeneity in the impacts of the shock and recovery

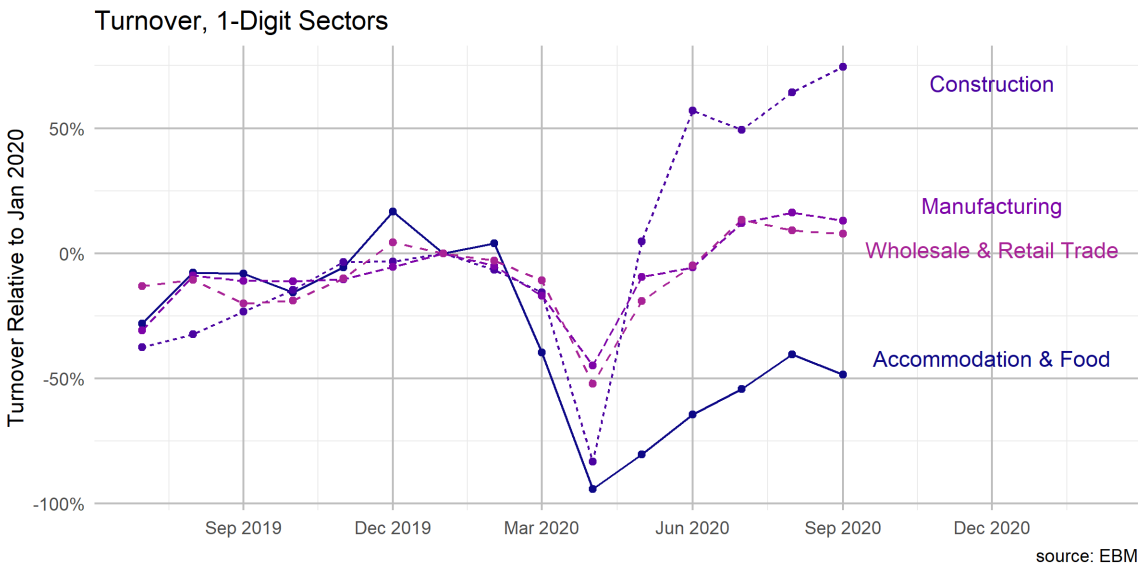
Do the aggregate impacts of the COVID-19 shock and recovery documented above mask heterogeneity? In the previous section, we noted that once aggregated to the same level, our data on turnover and employment produce similar patterns to national statistics on GDP and employment, respectively. However, these data are available at a more granular level, both over time and across firms. In this section, we use this additional granularity to characterize heterogeneity in the COVID-19 recovery in Rwanda, and compare this to heterogeneity in the COVID-19 shock.

We focus on sectoral heterogeneity in the impacts of the COVID-19 shock and recovery. Specifically, we estimate monthly EBM turnover and PAYE employment, relative to January 2020, across one-digit ISIC sectors. Other firm and worker characteristics are available, allowing for greater disaggregation, and we will explore additional heterogeneity in future work. We restrict to sectors that have broad coverage both in the Rwandan economy and in the EBM and PAYE datasets, which leaves us with Accommodation & Food, Construction, Manufacturing, and Wholesale & Retail Trade. In addition, as the public sector is an important employer in Rwanda, we separately compare public and private sector PAYE employment.

We replicate existing results by documenting meaningful sectoral heterogeneity in impacts of the COVID-19 shock. Figure 3 presents EBM turnover across one-digit ISIC sectors. We note that turnover in all four sectors appears to follow similar trends leading up to January 2020. During the COVID-19 shock, meaningful heterogeneity emerges. Turnover in Accommodation & Food and Construction shrunk by 94% and 83%, respectively, while turnover in Manufacturing and Wholesale & Retail Trade shrunk by 45% and 52%, respectively. A large body of analysis of this initial shock, across a range of countries, has noted that sectors for which in-person work is most necessary (Accommodation & Food and Construction, in this case) experienced the largest initial shock (Bartik et al., 2020; Brynjolfsson et al., 2020), and what we find mirrors their results.

However, we note that sectoral heterogeneity in the COVID-19 recovery differs from sectoral heterogeneity in the COVID-19 shock. By September 2020, turnover in Construction, Manufacturing, and Wholesale & Retail Trade were all above January 2020 levels. In contrast, turnover in Accommodation & Food remains 48% below Jan-

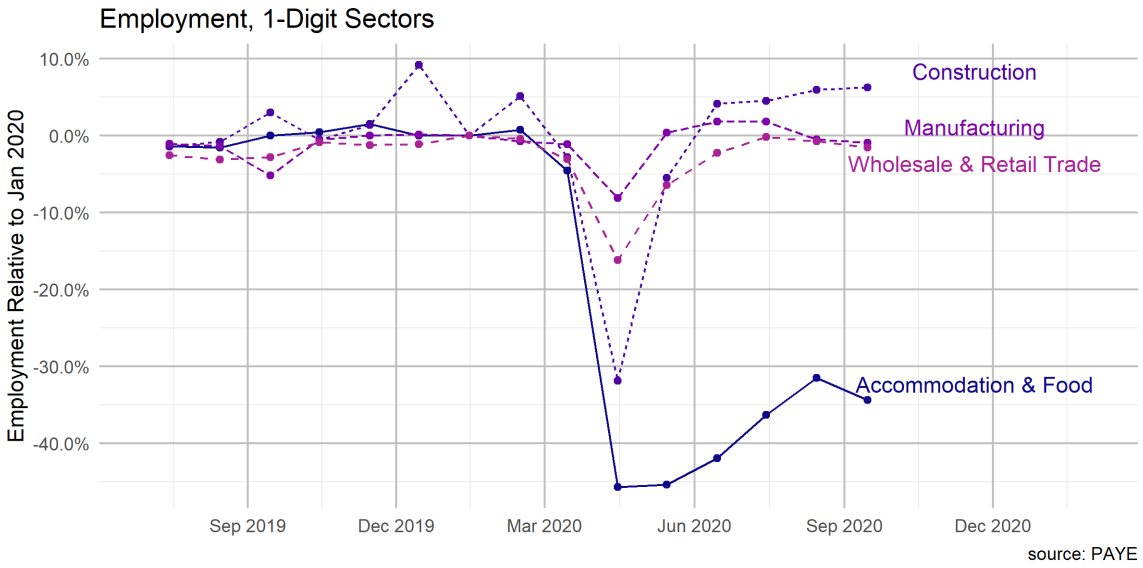
Figure 3



uary 2020. This suggests that while sectors in which in-person work is most necessary were most affected in the initial shock (Accommodation & Food and Construction), sectors in which face-to-face interactions with consumers are most necessary are experiencing the most protracted recovery.

We compare sectoral heterogeneity in responses of employment to the COVID-19 shock and recovery to our results above on turnover, and find broadly similar patterns. Figure 4 presents PAYE employment across one-digit ISIC sectors. The cross-sectoral patterns for employment are similar to the cross-sectoral patterns for turnover, although there are some differences in magnitudes. First, the magnitude of the COVID-19 shock was much smaller on employment than on turnover, as firms retained workers through the shock. However, the shock is still large, with April 2020 employment ranging from 8% below January 2020 employment in Manufacturing to 46% below January 2020 employment in Accommodation & Food. Second, the recovery of employment in Accommodation & Food has been even slower than the recovery of turnover, as September 2020 employment has recovered only 25% of the COVID-19 shock (in contrast to 49% for turnover). This suggests that the recovery of formal employment may lag behind the recovery of turnover in the most impacted sectors. In contrast to Accommodation & Food, employment in Construction, Manufacturing, and Wholesale & Retail Trade appears to have fully recovered.

Figure 4

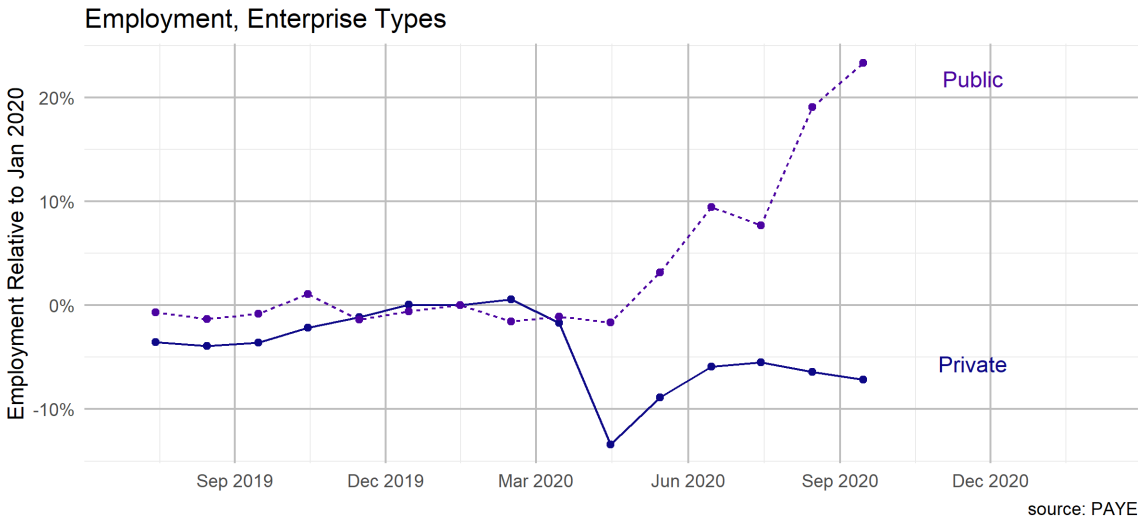


Lastly, we document distinct patterns of heterogeneity in the impacts of the COVID-19 shock on employment across the public and private sector. Figure 5 presents PAYE employment at public institutions and private firms. First, we find that the impacts of the COVID-19 shock on employment are concentrated in the private sector. This is consistent either with greater feasibility of remote work in the public sector, or additional employment protections for public sector employees. However, during the recovery, we begin to observe the gap between changes in public sector and private sector employment has grown, as the aggregate recovery in employment masks public sector employment growing by 23% and private sector employment remaining 7% below pre-COVID-19 levels. This heterogeneity highlights the direct role of fiscal stimulus in employment growth through public sector employment during the COVID-19 recovery.

4 Conclusion

In this chapter, we leverage high frequency administrative data to document the impacts of the COVID-19 crisis in Rwanda. We identify pronounced sectoral heterogeneity in the COVID-19 shock and recovery — while the shock was characterized by contraction in the private sector driven by sectors where in-person work is most nec-

Figure 5



essary, the recovery has been characterized by public sector growth and a protracted private sector recovery in sectors where face-to-face interactions with consumers are most necessary.

We contribute by providing evidence from microdata on heterogeneity in the COVID-19 recovery in a developing country. Our findings match predictions from Avdiu & Nayyar (2020), who highlight that while the COVID-19 shock prevented in-person work, restrictions on face-to-face interactions are likely to remain even as in-person work resumes, and patterns of dependence on in-person work and face-to-face interactions vary meaningfully across sectors through the COVID-19 recovery. The patterns of sectoral heterogeneity in the COVID-19 shock and recovery that we document in Rwanda are similar to those in the United States (Chetty et al., 2020).

Our results suggest that the protracted k-shaped recovery that we document is likely to remain the status quo as long as COVID-19 economic and public health crises persist, and sustained policy response will be necessary. On the public health side, policies and technologies that enable consumers to safely interact with firms face-to-face, and to feel safe while doing so, can tackle both of these crises. On the economic side, the dichotomous recovery across public and private sectors suggests the scaling back of fiscal stimulus caused by constrained government budgets would likely lead to reduced growth; this highlights the importance of designing cost-effective safety nets that can target affected workers and firms. As they provide detailed real-time evidence

on which firms and workers are most vulnerable, data from tax administrations are a powerful tool to ameliorate these design challenges.

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