Adjusting to Transitory Shocks

Worker Impact, Firm Channels, and (Lack of) Income Support

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Abstract

This paper estimates worker, firm and assistance programs' responses to foreign shocks in Brazil exploiting quasi-experimental variation in firms' foreign demand resulting from the Global Financial Crisis. It shows these transitory shocks have permanent effects in a setting characterized by a large informal sector. While the informal sector provides a buffer mitigating long-term scarring, it is not sufficient to compensate worker and firm scarring. Scarring occurs for incumbent workers, not just displaced workers. Linking employer-employee data with the national registry of low-income households, unemployment insurance disbursement records, and worker-level training, the paper finds that assistance programs fail to mitigate adjustment. Training does not respond, unemployment insurance compensates 4 percent of workers' wage losses and welfare programs 2 percent. Firms in highly concentrated sectors or state-owned do not bear the burden of adjustment. Other firms bear the burden and either exit or restructure, downsizing employment and productivity, scarring incumbent workers and increasing long-run inequality.

Adjusting to Transitory Shocks: Worker Impact, Firm Channels, and (Lack of) Income Support

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I. Introduction

Economic crises can harm workers through earnings losses, job displacement, and firm closures (Jacobson et al., 1993). Despite the temporary nature of most crises, their effects can be long-lasting due to several factors. Firms may engage in restructuring with lasting negative impacts on productivity and employment that they are unwilling to reverse due to sunk costs. If firms' scarring occurs, worker scarring can occur even for workers who remain with the firm. Additionally, workers' adjustment depends on their outside labor market options (including the prevalence of informality) and on assistance programs in case of job displacement. While a well-established literature documents the long-run effects on workers and firms of permanent shocks, such as trade liberalization or the China import competition shock (e.g., Goldberg & Pavcnik (2003); Autor et al. (2014); Utar (2018); Dix-Carneiro & Kovak (2019); Utar (2014); Dix-Carneiro et al. (2021)), little is know about the long-run effects of temporary shocks. Moreover evidence on the compensatory role of assistance programs is limited to the United States (e.g., Autor et al. (2013, 2014); Yagan (2019)).

In this paper we tackle a key unexplored question: what persistent effects on workers and firms are to be expected from temporary shocks in a developing country context marked by informality and limited assistance programs? To do so, we examine the dynamic medium to long-run impacts of temporary foreign shocks ensuing from the 2008–2009 Global Financial Crisis (GFC), on workers and firms and the cushioning effects of assistance programs. We use fifteen years of administrative employer-employee data from Brazil over the period 2004-2017 covering the universe of formal workers linked with longitudinal firm census and customs data. We also link for the first time the employer-employee data with the national registry of low-income households, the worker registry of unemployment insurance and benefits disbursed, and beneficiary records of worker training from Brazil's main training provider.

We exploit quasi-experimental variation in firms' foreign demand resulting from the GFC – lower growth in destination markets' GDP – to measure firms' foreign shocks. To study the unequal distribution of effects across firms and pass-through to workers, our specifications examine how the evolution of incumbent worker or firm outcomes over the post-GFC period varies with the magnitude of the firm's foreign shock, while controlling for observable worker and firm characteristics and fixed effects that capture time-varying domestic shocks at the sector and location levels. [1]

Foreign shocks can affect economic outcomes differentially in the presence of informality and for highly concentrated sectors and state-owned firms (SOEs).[2] By leveraging spatial and

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[1]For identification purposes, our analysis focuses on a relatively homogeneous universe of firms, those that export, but they exhibit important variation in the intensity of the GFC-related foreign shock they experience.

[2]See Dix-Carneiro et al. (2021) and Ulyssea & Ponczek (2022) on trade and informality and Brugués et al. (2022) and Colonnelli et al. (2020) on how political connections of state-owned firms foster patronage and

sectoral variation in informality and market power, we examine the mediating role of these local labor market conditions for the severity of the shocks' effects on formal employment. To study the ability of assistance programs to buffer crises, we estimate the impact of firms' foreign shocks on their workers' access to assistance in the form of cash transfers, unemployment insurance or training, and the share of lost wages that are compensated.

We have five main sets of results. First, we show that transitory shocks have permanent effects. Foreign demand shocks due to the GFC, which are temporary, not permanent (like trade liberalization) shocks, lead to persistent declines in workers' employment in Brazil. While the negative impact on average months worked decreases over time, it is only close to rebounding in 2017. Regarding real wages, rebounding never occurs–they decrease upon impact and remain low thereafter. Labor scarring occurs only for low-skilled workers (adjustments are insignificant for high-skilled workers), exacerbating long-run inequality.

Second, we show that these permanent effects of transitory shocks occur in a setting characterized by a large informal sector. One might have thought that the informal sector would provide a buffer mitigating long-term scarring. We do find that local labor markets with higher informality do better. As such, informality may provide de facto flexibility for firms and workers to cope with adverse shocks, in line with the findings by Dix-Carneiro & Kovak (2019); Dix-Carneiro et al. (2021) and Ulyssea & Ponczek (2022). But this is not sufficient to compensate for the overall negative impact of the transitory shocks. Market concentration also matters. We find that adverse foreign shocks do not result in downward employment and real wage adjustment in sectors where few firms concentrate a large share of the market. Instead, such shocks increase employment in firms in those sectors and among SOEs: a reversal of normal economic mechanisms, which can be interpreted as an extreme case of "capture" or "connectedness". Although workers in these firms are better insulated from the crisis, this may be costly for the economy if it prevents a more agile response to the shocks.

Third, our evidence shows that employment losses due to firm foreign shocks arise mostly from a new concept of *scarring for incumbent workers*, not just displaced workers as in previous studies. The driving force behind worker employment and wage losses in response to foreign shocks are adjustments by the initial employing firm. The measured reallocation of employment to firms in non-tradable sectors is insufficient to offset the losses in the initial firm. We evaluate a variety of firm-level mechanisms that may account for the foreign shocks' effects on incumbent workers and differences in their persistence. A first natural mechanism for firms to adjust is through worker displacement, for example by not renewing fixed-term employment contracts. The costs of such displacement are lasting for workers if firms find ways to improve their efficiency, producing the same or more with fewer workers by replacing

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misallocation, for example, of procurement contracts.

labor with capital or unskilled workers with more productive skilled workers. Estimating effects on hours worked and wages, we uncover another mechanism for firms to adjust: they reduce hours worked and lower wages of their incumbent workers or of new workers. This mechanism implies that firms freeze their employment and it may be chosen to preserve valuable worker-firm links or by necessity in economies where worker displacement is costly and regulatorily difficult. In practice, these mechanisms can co-exist, and there is limited empirical evidence on their relative importance and implications to inform the policy debate. Our estimates suggest more frequent non-renewal of fixed-term contracts and a persistent reduction in hours worked for incumbent workers in Brazil in response to adverse foreign shocks. Other mechanisms relate to within-firm restructuring that takes the form of occupational adjustment in response to adverse foreign shocks, permanently replacing unskilled with skilled workers.

Fourth, underlying labor scarring our evidence shows firm scarring caused by selection (exit) and downsizing in firm revenues, employment, and productivity. While firm exit occurs just in the first year, negative effects on revenues and labor and total factor productivity are persistent. Firms reduce employment of both skilled and unskilled workers but adjust their occupational structure towards skilled workers. Firms' use of materials declines. Firm exit is higher among less productive firms.

Fifth, we show that income support programs mitigate the impacts of foreign shocks on workers' incomes but only to a limited extent. An adverse firm foreign shock leads to an increase in its workers' access to unemployment insurance and to payments from the Bolsa familia cash transfer program in Brazil. These programs replace 6 percent of lost earnings: 4.3 percent from unemployment insurance and 1.7 percent from Bolsa Familia. The income replacement of unemployment insurance is similar to that found by Yagan (2019) for the United States (US), while that of Bolsa Familia is lower than that of welfare programs in the US found by Autor et al. (2013, 2014).[3] Our estimates suggest that training programs do not help to mitigate the impacts of foreign shocks on workers.

The types of adjustment that we estimate require a certain degree of labor market flexibility. Using data from Ecuador (a less flexible labor market), we find qualitatively similar effects: persistent reductions in worker employment occurring only for the lower-skilled as a result of GFC-related foreign shocks to Ecuadorian firms. However, negative effects on worker average months worked are smaller in magnitude than those in Brazil and effects on wages

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[3]Autor et al. (2013, 2014) show that welfare programs compensate for 10 percent of earnings losses in the US in response to the China competition shock, with increases in the uptake of social security disability insurance being substantially larger than the uptake of unemployment insurance and trade adjustment assistance. Trade adjustment assistance differs from unemployment insurance and cash transfers in that its main benefit is the coverage of training costs for workers whose jobs are displaced by import competition or offshoring. Hyman (2018) shows a substantial positive impact of trade adjustment assistance on worker earnings in the US.

are not significant. Ecuadorian firms do not change workforce composition, nor do they exit as a result of foreign shocks. But their revenues fall, and they reduce capital permanently resulting in lower firm productivity and higher firm scarring.

Our evidence of persistent effects resulting from *temporary* foreign shocks on worker employment and wages may appear as a puzzle as such persistent effects have been estimated in the literature to result only from *permanent* trade shocks such as trade liberalization by Dix-Carneiro & Kovak (2019) and Dix-Carneiro et al. (2021) or the China import competition shock by Autor et al. (2022). One rationale for our persistent effects on workers lies in the firm-level mechanisms whereby firms adjust to the foreign shocks through enduring restructuring of their occupational structure. Another rationale lies in the features of the labor markets of Brazil with concentration, informality, and large frictions as in Artuç et al. (2010) preventing the labor mobility across sectors or regions that would be required for the effects to dissipate in the medium- to long-run.

The paper relates to five literatures. First, it builds on the literature on worker-level dynamic labor market adjustment to trade shocks including trade liberalization, offshoring, and the China import competition shock: Autor et al. (2014); Hummels et al. (2014); Krishna et al. (2014); Dauth et al. (2017, 2021); Utar (2018); Dix-Carneiro & Kovak (2019), and Keller & Utar (2023). We add to this literature by estimating both the short-run and the long-run effects (size and duration) of trade shocks due to the GFC on worker employment and wages in a developing country setting and showing the crucial mediating role of informality and sectoral concentration.[4]

Second, the paper relates to the literature examining reallocation across and within sectors and job destruction in response to trade shocks: Verhoogen (2008); Krishna et al. (2014); Harrigan & Reshef (2015); McCaig & Pavcnik (2018); Asquith et al. (2019); Utar (2018); Harasztosi & Lindner (2019), and Keller & Utar (2023). We identify short-run impacts of foreign shocks on worker displacement but also find that both in the short- and the long-run worker reallocation is relatively small and most effects of foreign shocks are felt by incumbent workers and firms, in the form of lower worked hours and a restructuring of the workforce skill distribution.

Third, we add to the literature on the micro-origins of worker-level adjustment that shows trade shocks affecting firm sales, employment growth and volatility: Brambilla et al. (2012); Utar (2014); Kurz & Senses (2016); Pierce & Schott (2016); Di Giovanni et al. (2018); Asquith et al. (2019); Branstetter et al. (2019), and Garin & Silvério (2022). While these studies focus only on firm-level adjustment, we link worker-level adjustment to a rich set of firm-level adjustment mechanisms in response to foreign shocks.

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[4]To our knowledge only two studies identify long-lasting impacts to trade shocks: Dix-Carneiro & Kovak (2019) for trade liberalization on worker outcomes locations in Brazil or Autor et al. (2022) for the China import competition shock on US manufacturing employment until 2019.

Fourth, we contribute to the literature on scarring effects of recessions, mass layoffs, and plant closures: Jacobson et al. (1993); Kletzer (1998); Davis & von Wachter (2011); Krolikowski (2017); Flaaen et al. (2019); Lachowska et al. (2020); Bertheau et al. (2023), and Schmieder et al. (2023). Instead of focusing on the variation of shocks across US regions, we directly link firm foreign shocks to their workers' outcomes. Also, we show, for a developing country, long-lasting effects of negative foreign shocks even for non-displaced workers.

Fifth, we add to the thin US-focused literature on the role that income support programs yield in mitigating worker adjustment to shocks: Autor et al. (2013, 2014) and Yagan (2019). We show only limited replacement for lost earnings for Brazil from unemployment insurance, complementing similar evidence obtained for the US by Yagan (2019), also as a result of the GFC. The income replacement of Bolsa Familia we estimate is lower than that of welfare programs in the US found by Autor et al. (2013, 2014).

The paper proceeds as follows. Section II describes the data and provides summary statistics. Section III presents the empirical design to study the long-run impacts of GFC foreign shocks on workers and the baseline results as well as results for heterogeneity across worker characteristics. Section IV identifies the driving mechanisms for the persistent effects on workers, studying the reallocation of workers across firms and sectors and estimating various margins of adjustment by firms in response to foreign shocks. Section V examines the mediating role of informality and lack of competition for the impacts of GFC foreign shocks. Section VI evaluates the ability of assistance programs to buffer workers' crisis-induced earnings losses. Section VII examines responses in a different labor market, using data from Ecuador. Section VIII concludes.

II.   Data and Summary Statistics

The analysis in this paper draws on rich administrative longitudinal worker-firm data for Brazil over the 2004-2017 period from several main sources. The first source is a longitudinal linked employer-employee database covering the universe of formal workers and firms. The second is a longitudinal manufacturing firm census. The third is firm customs data on exports and imports by firm-partner country. Importantly, we are able to link the employer-employee database with the worker registry of unemployment insurance, the national registry of low-income households providing data on payments from the cash transfer program Bolsa Familia, and the beneficiary records of training activity from Brazil's main training provider. Overall, our data cover the universe of formal workers in Brazil along with their firms' exposure to the GFC through their export market participation and also all the benefits disbursed to mitigate the worker-level impacts, including support received from income assistance and job training. We supplement these data with information from the Brazilian census. Next, we

provide more details on each of the data sources.

We use the administrative longitudinal employer-employee database collected by the Brazilian Ministry of Labor Relação Anual de Informações Sociais (RAIS) from 2004 to 2017. The RAIS database tracks every Brazilian formal worker and contains information of all firms with employees, identifying each worker's employing firm at any point in time. The RAIS database includes job records for each worker with worker and firm unique identifiers and all corresponding characteristics. We use information on worker demographic characteristics (gender, age, education), job characteristics (monthly earnings, date of hire and separation and motive for separation, occupation, hours worked), and on location, industry, and state ownership of the firm for which the individual works at each point in time.[5]

In order to construct the worker panel database needed for our analysis of the impact of firm foreign shocks on worker outcomes we take several steps. First, we identify in the RAIS database the complete cohort of individuals employed in the tradables sector in 2004 or entering the sector after 2004.[6] For each of these individuals we keep all their work histories until 2017 (including their employment in the non-tradables sector). For each worker, we select the highest paid job in December of each year to identify her/his wage, employing firm, and sector.[7] We designate this dataset as the starting RAIS worker panel database. Second, we construct an auxiliary database that restricts the sample to workers in the 16-65 age range and importantly to workers employed at least once by an exporting firm.[8] Third, we select a 10% random sample of workers from this auxiliary database due to the computational impossibility of using the entire RAIS database.[9] If a worker's unique identifier is selected for our random sample, her/his entire work history is included. Fourth, our final worker panel database consists of this 10% random sample expanded such that each worker has observations for all consecutive years between the first and last RAIS year (when the worker had a job record) and after the worker's last RAIS year before 2017 provided the worker's age does not surpass the retirement age of 65. This expansion of the database by adding observations with zero months worked and missing wages is necessary to construct the cumulative employment and wage measures we use as worker outcomes, described in Section III. Observations with zero

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[5]RAIS is a high-quality employer-employee administrative database which has been used extensively in research: e.g., Alvarez et al. (2018); Ulyssea (2018); Dix-Carneiro & Kovak (2019); Dix-Carneiro et al. (2021), and Gerard, Lagos, et al. (2021). As mentioned by Dix-Carneiro & Kovak (2019), firms have an incentive to accurately report to RAIS since they risk fines if they fail to report and workers face similar incentives since their access to government benefits depends on such reporting.

[6]The tradables sector is defined as the set of industries with 2-digit codes below 37 in the Brazilian National Classification of Economic Activities (CNAE) version 1.0 classification.

[7]The choice of the highest paid job in a given month follows that made by previous studies using RAIS (e.g., Dix-Carneiro & Kovak (2019)) as well as that made for similar employer-employee databases for other countries (e.g., Frías et al. (2022) for Mexico).

[8]The firm's exporting status is based on matching RAIS to the customs data as described below.

[9]Our selection of a random sample of workers is done for computational reasons and it follows the approach of Dix-Carneiro & Kovak (2019) for RAIS data and of Autor et al. (2014) for US social security data.

months worked correspond to the worker not having a formal job but we have no information as to whether the worker is unemployed, self-employed, working in an informal job, or out of the labor force, a caveat of the RAIS database also noted by Dix-Carneiro & Kovak (2019).

The RAIS database includes for each worker and job spell information on detailed occupation categories. Following Gerard, Naritomi, & Silva (2021) we use the correspondence table developed by Helpman et al. (2017) to convert the Brazilian classification of occupations at the 4-digit level into the following five occupation categories: Professional and Managerial, Skilled White Collar, Skilled Blue Collar, Unskilled White Collar, and Unskilled Blue Collar. Where necessary, we group the first three categories as skilled workers and the last two categories as unskilled workers.

To better capture worker unemployment in Brazil, we use unique data from the Brazilian Unemployment Insurance (UI) registry (Seguro de Desemprego) for the 2004-2017 period. This is a longitudinal individual-level database covering all Brazilian workers that have received unemployment insurance during this period. A worker is eligible to receive unemployment insurance if he/she is laid off from a private formal job and has at least six months of job tenure at layoff. The UI registry includes information on the amount paid, separation date, paid date, and the number of months each worker receives unemployment benefits. We link the RAIS database to the UI registry through the individual unique worker identifier which is included in all years for all workers. This data allows us to measure the duration of unemployment for each worker and the amount of UI received.[10]

To further assess compensation mechanisms for workers in Brazil, we link our worker panel database to longitudinal administrative data over the 2007-2012 period from the national registry of low-income households (Cadastro Unico), linked to all the payment records of the Bolsa Familia cash transfer program (PBF) (Folhas de Pagamento) through the individual unique identifier as in RAIS. This administrative database is collected by the Brazilian Ministry of Social Development. The database covers the universe of PBF recipients along with all the benefits disbursed through the program. We use information on the amount and number of months each worker received cash from the PBF program.[11]

To capture the potential role of worker training, we link our worker panel database to longitudinal administrative data over the 2009–2012 period on training provision collected by Brazil's main training provider of training for the manufacturing sector—Servico Nacional de Aprendizagem Industrial (SENAI)—the training arm of the national confederation of Industry (CNI). This provider is financed by a tax charged to all Brazilian firms equal to 1% of their wage bill. SENAI is the fifth largest training provider in the world (Silva et al. (2015), Bastos et al. (2016)). From these data, we extracted information on the set of workers trained in

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[10]Gerard & Gonzaga (2021) for details on unemployment insurance in Brazil.

[11]See Gerard, Naritomi, & Silva (2021) for further details on the PBF program and the interaction between the program and formal labor markets.

each year. The data covers around 270,000 trainees per year.

To compute GFC-induced foreign demand shocks for firms, we rely on customs data covering the universe of firm-level export and import transactions collected by the Brazilian Secretariat of Foreign Trade (SECEX). We merge the customs data to the worker panel database based on a common unique firm identifier. We derive a firm panel database from the starting RAIS worker panel database where, for each firm, labor market outcome variables are constructed by aggregating across all its workers in a given year. This firm panel database includes all firms that export at least once during the 2004-2017 period.[12]

In addition, we use the Annual Industrial Survey (Pesquisa Industrial Anual (PIA)) collected by the Brazilian Institute of Geography and Statistics (IBGE) for the 2003-2014 period to augment the set of firm-level outcomes considered. This is a longitudinal manufacturing census database with information on firm financial characteristics that we use to construct measures of productivity, profits and non-labor inputs.[13] We link this firm panel database with the RAIS firm panel database and the customs data based on a common unique firm identifier.

Finally, we supplement the worker panel database with data from the Brazilian Census in 2000 to measure characteristics of the worker's municipality. We construct a measure of informality as the ratio between the sum of informal salaried and self-employed workers and the total number of workers (formal, informal and self-employed) in a municipality. We follow Dix-Carneiro & Kovak (2019) in defining informal workers as those without a signed work card based on information in RAIS.

Table 1 shows the sample sizes as well summary statistics for the main worker variables (Panel A) and firm variables (Panel B). Our worker analysis relies on more than 342,000 workers (about 3 million worker-year observations). On average workers are employed 10 months per year. This lower than full-year (12 months) work average can be rationalized by the fact that the sample includes 19% of observations with zero months worked (added to the worker panel database as described earlier). The average monthly real wages are 2,725 in 2010 Reais (about 831 USD at the 2015 exchange rate).[14] Our firm analysis relies on 15 thousand firms (about 119 thousand firm-year observations).[15]

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[12]For these firms the panel includes all years of data (even years when the firm is not exporting).

[13]The PIA survey is mandatory for firms with either more than 30 employees or above a revenue cutoff and also for an annual random sample of smaller firms, as described by Alvarez et al. (2018). Estimation based on the PIA firm panel database was conducted in a secure room at the IBGE premises in Rio de Janeiro.

[14]Summary statistics on worker controls in Appendix Table A1 show the workers in the sample average 33 years of age, a quarter are female and only 16% have higher education. Workers were employed in the formal sector about 67% of the time before the GFC.

[15]Appendix Table A1 shows almost 60% of firms are importers, a finding that is not surprising as the sample covers firms that export and the phenomenon of importing-to-export is common. Firms experience on average substantial annual growth in employment prior to the GFC of 11%, but annual growth in total wages is only 2% higher, resulting in moderate growth in average wages that is smaller than inflation rates.

We ensure representativeness of our worker panel database by showing that the demographics and job characteristics of workers in the 10% worker random sample are close to those of workers in the complete RAIS database (see Panels A and C in Appendix Table A1).[16]

III. Impact of Firms' GFC Foreign Shocks on Workers

A. Empirical Design

Our analysis tracks workers over time after the GFC, comparing the evolution of labor market outcomes for workers in firms that experience a larger versus a smaller adverse foreign shock due to the GFC. Our measures of firm foreign shocks due to the GFC - henceforth designated as 'GFC firm shocks' - are constructed as a combination of aggregate shocks with measures of firms' shock exposure. For the aggregate shocks we exploit quasi-experimental variation in foreign demand across destination countries due to lower GDP growth caused by the GFC. For the firms' shock exposure, we consider pre-GFC firm export portfolio weights across destinations built from customs data.[17] We define GFC firm shocks as firm-specific export-weighted destination market GDP decline given by:

$$shock_{j2008} = -\sum_{d} GDPgr_{d2008} * w_{jd2007} \tag{1}$$

where j is a firm, d an export destination, $GDPgr_{d2008t}$ corresponds to the real GDP growth rate in destination d between 2007 and 2008, and w_{jd2007} is the share of firm j exports to destination d in total firm j exports in 2007.[18] The minus sign included in Equation (1) eases interpretation by allowing to capture the impact of a *decline* in GDP in the firm's destinations as a result of the GFC. Higher values of the GFC firm shock indicate that the firm experienced a more adverse demand shock induced by the GFC. For example, a firm with a shock equal to 1 (i.e., its destinations' GDP declined on average by 1%) is more adversely affected by the GFC than a firm with a shock equal to -2 (i.e., its destinations' GDP grew on average by 2%).

From the point of view of a firm or a worker in Brazil, a country that did not contribute

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[16]To further probe the worker database quality we estimate Mincer regressions for monthly real wages including a polynomial on worker age following Frías et al. (2022), worker tenure at the firm, 4-digit industry and year fixed effects and either dummies for males and for higher education or worker fixed effects. The estimates show expected patterns: e.g., a male wage premium of 26% and a higher education premium of 85% (see Appendix Table A2).

[17]Brazil's customs agency is not authorized to share its customs data, but counterparts in that agency constructed our GFC firm shocks using code we provided and we merged those to our worker and firm panel databases based on unique firm identifiers.

[18]The 2007-2008 real GDP growth rates are taken from the World Development Indicators.

meaningfully to the GFC but just felt its consequences, the GFC shock in destination markets is sudden and unexpected, and thus arguably exogenous. Aghion et al. (2021) argue that the GFC was unexpected even for a sample covering the United Kingdom and the US which contributed importantly to the GFC. The use of firm pre-determined export destination portfolio weights before the GFC allows us to further stress that the GFC firm shock measure is exogenous from the point of view of the firm and its workers. As argued by Garin & Silvério (2022), this firm shock measure is akin to the shift-share export shocks of Hummels et al. (2014) and others with the advantage of exploiting only quasi-experimental variation in demand due to the GFC experienced in destination markets.[19] This demand shock due to the GFC was transitory, as is clear from the large decline but fast subsequent recovery in average GDP growth of Brazil's firms' export destination markets after 2009 shown in Appendix Figure C1.

The empirical specification that we use to assess the effect of GFC firm shocks on the evolution of worker labor market outcomes follows closely Dix-Carneiro & Kovak (2019) and is given by:

$$y_{ijt} = \beta_t \, shock_{j2008} + \gamma_1 \, X_{i2007} + \gamma_2 \, X_{j2007} + I^{st} + I^{rt} + \epsilon_{ijt} \tag{2}$$

where i is a worker, t a year, j is the firm employing the worker in 2007, X_{i2007} is a vector of worker characteristics before the GFC (an indicator for being a female, age and age squared, an indicator for having completed higher education, and a measure of previous formal sector attachment as of 2007), X_{j2007} denotes a vector of firm controls before the GFC (the logarithm of firm total employment and an indicator for being an importer as of 2007 as well as average annual growth in firm total employment and wages in 2004-2007 before the GFC), I^{st} stands for 2-digit sector(s)-year fixed effects, I^{rt} stands for region(r)-year fixed effects, and ϵ_{ijt} is an error term.[20] The worker's sector and region are fixed at those of their 2007 firm.[21]

Equation (2) compares an outcome for two observationally equivalent workers who in 2007 worked in different firms facing different demand shocks due to the GFC. The coefficient β_t on the GFC firm shock variable (fixed at its 2008 value) is allowed to vary by year to depict the dynamic impacts of the shock on the worker outcome from 2009 onward. Our identification assumption in Equation (2) is that the GFC firm shocks are unexpected and as good as

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[19]In focusing on firm negative export demand shocks due to the GFC our paper differs from Almunia et al. (2021) who present exports as a "vent-for-surplus" or an opportunity to counteract severe negative domestic shocks due to the GFC in Spain. Our specifications will also allow firms to face negative domestic shocks due to the GFC (or other domestic economic forces) through the inclusion of a rich set of industry-year and region-year fixed effects.

[20]All variable definitions are provided in Appendix A.

[21]Our approach follows Dix-Carneiro & Kovak (2019) who study Brazilian workers' outcomes over time after trade liberalization fixing the workers' region at their region in 1989 the year just before liberalization started. We fix the firm, sector, and region at the initial year (2007), even if workers subsequently move to other firms, sectors, or regions.

randomly assigned given workers' baseline characteristics. In our specification all workers are 'treated' but they differ in the intensity of treatment, that is, their firm's exposure to the GFC impact on GDP in destination markets. It is not possible to consider a control group of non-tradable firms since for them the firm GFC shock is not defined. The inclusion of sector-year and region-year fixed effects allows to isolate the effect of the GFC firm shocks from other domestic or international factors, namely those related to the credit crisis ensuing from the GFC. We estimate Equation (2) by ordinary least squares (OLS), obtaining robust standard errors clustered by firm. These standard errors allow for a correlation in the unobserved components in the outcomes of workers that were employed by the same firm in 2007.

A potential concern with Equation (2) is that the estimated β_t could reflect differential pre-GFC trends across firms with different shocks even in the absence of the GFC shock and even after controlling for firm controls pre-GFC in X_{j2007} (e.g., a downward trend in employment of severely shocked firms). The data however shows similar trends in firm employment and wages between 2004 and 2008 across firms experiencing shocks of different sizes (see Appendix Figure C2). This evidence suggests that we can interpret the β_t as causal effects of the GFC shock.[22]

As dependent variable in Equation (2) our first worker outcome is a measure of average months worked per year from 2009 until the current year t defined exactly as in Dix-Carneiro & Kovak (2019):

$$l_{it} = \left(\frac{1}{t-2008}\right) \sum_{s=2009}^{t} months_{is} \tag{3}$$

where $months_{is}$ is the number of months worker i is formally employed in year s.[23] Our second worker outcome is a measure of average real wages from 2009 until the current year t as multiples of pre-GFC wages, also defined exactly as in Dix-Carneiro & Kovak (2019):

$$w_{it} = \left(\frac{1}{t-2008}\right) \frac{\sum_{s=2009}^{t} wage_{is}}{avgwage_{ipre}} \tag{4}$$

where $wage_{is}$ is the monthly real wage of worker i in year s obtained as the monthly nominal wage deflated by a consumer price index and $avgwage_{ipre}$ is the average monthly real wage of worker i in 2004-2007 before the GFC.[24] Table 1 shows that in the post-2009 period, workers are employed on average 8.5 months per year and average real wages are 1.9 times the average real wages before the GFC.

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[22]Appendix Figure C2 plots the evolution of pre-GFC firm employment and total wages averaged for firms in different quartiles of the distribution of the firm GFC foreign shock.

[23]The firm subscript j is not included in the worker outcomes since their construction does not rely on information pertaining to the employing firm as of 2007.

[24]Consumer price indexes (with base year 2015) from Brazil's statistical office are used as deflators.

B.   Main Results

This section presents the results from estimating Equation (2) to answer one of the key questions in the paper, i.e., what are workers' margins of adjustment to foreign shocks: jobs, wages or both? Figure 1 depicts the impacts of GDP decline in firms' destinations as a result of the GFC on worker average employment and wages from 2009 until 2017. Each point represents the coefficient β_t for the shock impact on the worker outcome in year t and the 95% robust confidence interval around the point is based on standard errors clustered by firm. The negative coefficients in Panels (a) and (b) of Figure 1 show that Brazilian workers initially employed by harder-hit firms (with a larger GDP decline in their destinations) experience a persistent reduction in their months worked and real wages until 2017, relative to workers in less hard-hit firms.[25]

In terms of persistence of the effects, worker months worked recover to some extent over the period following the GFC, as seen by the shrinking negative impacts across the years. In fact, the hypothesis that all effects on months worked are similar across years is rejected based on an F-statistic test. For Brazilian workers' average real wages, the magnitude of the effects appears to be fairly constant throughout the post-GFC period, but the hypothesis that all effects are similar is actually rejected based on an F-statistic test.

The point estimates in Panel (a) of Figure 1 imply that a worker whose initial firm faced a 10 percentage-point worse shock, worked in the formal sector between 2009 and 2017 for a total of 2.1 fewer total months (2.7% fewer months).[26] The point estimates in Panel (b) of Figure 1 imply that a worker whose initial firm faced a 10 percentage-point worse shock lost 1.1 times their pre-GFC earnings. On average, Brazilian workers accumulated 18 times their initial earnings over the entire 2009-2017 period, so a loss of 1.1 times initial earnings represents a loss of about 6% relative to the average.[27] The larger wage loss relative to employment loss indicates that earnings conditional on employment also fell for workers initially employed by harder-hit firms in Brazil. This is a fact for which further evidence will be provided through the worker reallocation analysis in Section IV.A.

While our baseline results focus on tracking the impacts of a shock in a given year (2008) on the outcomes of workers from that year onward, following closely the specification in Dix-Carneiro & Kovak (2019), and all firms in our sample experience the shock with varying intensity (hence there is no control group), it is useful to examine whether there were any dynamics in the pre-GFC years. For this placebo-type exercise, we estimate a variant of

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[25]The estimates presented in Figure 1 are also shown in Appendix Table C1.

[26]This calculation uses the point estimate for 2017 in the months worked regression of -0.023 and the average number of months worked per year by worker of 8.5 from Table 1. A difference of 10 percentage points across firms in the shock corresponds to the bottom and top percentiles of the firm shock distribution.

[27]This calculation uses the point estimate for 2017 in the real wage regression of -0.011.

Equation (2) for worker employment and wages from 2006 until 2017.[28] The estimates in Appendix Figure C3 show an insignificant impact of the GFC shock on worker employment and wages in 2006 and 2007 before the GFC, which supports the causality of the impacts we estimate from 2009 onward. The significant negative impact that is estimated in 2008 is not surprising as the GFC was already unfolding.

C. Robustness Checks

We subject our main results in Figure 1 to a series of robustness checks. First, as an alternative to the use of the worker panel database, we estimate Equation (2) separately for each worker cross-section from 2009 onward. The corresponding point estimates shown in Appendix Figure C4 are very close to those in Figure 1. Second, given the important commodity boom experienced by Latin America during the 2003–2013 period, we estimate Equation (2) excluding commodity-related sectors from the sample.[29] Third, Brazil experienced a domestic economic recession from 2014 onward. While the sector-year and region-year fixed effects included in our specifications go a long way towards accounting for domestic economic cycles, we also estimate Equation (2) excluding the period of domestic recession from our sample. Fourth, we estimate two variants of Equation (2): dropping the vector of firm covariates and including separate 2-digit sector, region, and year fixed effects. The results from these estimations presented in Appendix Table C2 show that the impact of firm GFC shocks on workers' months worked and real wages is qualitatively unchanged, relative to the main results.

As alternatives to the worker outcome variables described in Section III.A we consider as dependent variables in Equation (2) employment and wage measures defined following Yagan (2019).[30] The estimates in Appendix Table C3 are qualitatively similar to those in Figure 1. Moreover, we estimate the impact of GFC firm shocks on worker job displacement by constructing two indicator variables for a worker being displaced from a job based on the motives for the end of a worker's employment spell at a firm from the RAIS database.[31] The first variable is based on either of two possible motives: (1) justified dismissal by the employer or (2) unjustified dismissal by the employer. The second variable is based on the second motive only. The results in Appendix Table C3 show that regardless of the variable used, the firing of workers increases significantly in 2009 in firms harder-hit by shocks.

Finally, we conduct further robustness checks estimating Equation (2) using two alternative shock measures that modify the export portfolio weights in Equation (1) to be either average weights in the entire pre-GFC period (2004-2007) or in the previous two years (2006-

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[28]We redefine the vectors of worker characteristics and firm controls pre-GFC to be based on 2005.

[29]Commodity-related sectors are animal, forestry, fishing, mining, oil and petroleum, and tobacco.

[30]See Appendix A for the definitions.

[31]See GC Britto et al. (2022) and Gerard & Naritomi (2021) for studies linking similar worker displacement data for Brazil to crime and consumption smoothing, respectively.

2007). The impacts of these measures on workers' average months and real wages after the GFC presented in Appendix Table C4 are similar to those in Figure 1.

D. *Heterogeneity across Worker Characteristics*

Our main results are obtained controlling for a rich set of worker characteristics; thus, they reflect adjustments to GFC firm shocks *within* worker categories. In this section, we allow the impacts of GFC firm shocks to differ *across* worker categories. To conduct this heterogeneity analysis, we modify Equation (2) to include the GFC firm shock interacted with indicator variables for different categories of workers:

$$
y_{ijt} = \sum_{m=1}^{M} \beta_m \, shock_{j2008} \, categ_i^m + \gamma_1 \, X_{i2007} \, categ_i^m + \gamma_2 \, X_{j2007} \, categ_i^m + I^{st} \, categ_i^m + I^{rt} \, categ_i^m + \epsilon_{ijt}
$$
(5)

where all variables are defined as above and $categ_i^m$ identifies the $m = 1, \, ... \, , M$ worker categories considered: males versus females, workers with higher education versus no higher education, young (under 50) versus old (50-65) workers, workers with high versus low previous formal sector attachment, and workers with different ability given by the terciles of estimated worker fixed effects from an Abowd et al. (1999) decomposition of worker wages into worker and firm components (described in Appendix B).[32] Equation (5) is a highly flexible specification given that all variables, including controls and fixed effects, are interacted with the worker categories.

Equation (5) does not allow for dynamic effects of the GFC firm shock for the focus to be on effects across worker categories. Hence it is useful to first examine the average effect of the GFC firm shock over the post-GFC period across all workers (thus ignoring all interactions). The estimates at the top of Table 2 indicate that a larger GDP decline in firms' export destinations results in a significant decline in average months worked and average real wages in Brazil as an average in the post-2009 period.

Table 2 shows that a strong negative adjustment of employment and wages to GFC firm shocks is found only for less educated workers whereas for highly educated workers there is no adjustment. Older workers see a significantly larger decline of their months worked in face of more adverse GFC firm shocks. Appendix Table C5 shows that Brazilian workers with lower ability (in the first two terciles of the estimated worker fixed effects distribution) see a significantly more negative adjustment of their employment than workers with higher ability. Gender and previous formal sector labor attachment do not matter significantly for worker adjustment.

Taken as a whole, the findings on worker heterogeneity suggest that the more "fragile"

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[32]The worker characteristics are defined as of 2007.

workers - the less skilled, the older and less able - are more adversely affected by GFC firm shocks. This finding suggests that the GFC through its induced adverse firm shocks plays a role in exacerbating long-run inequality.

IV. Mechanisms for Long-Run Effects

A. *Worker Reallocation across Firms and Sectors*

An important set of questions concerning the employment and wage losses from GFC firm shocks identified in Section III is whether they result from adjustments at the initial employing firm or whether worker movement to other firms or sectors counteracts such adjustments. Our rich worker panel database allows us to study the employment and wage reallocation margins for workers in response to their firm's shock. We consider a set of mutually exclusive channels of adjustment for the workers, including change at the initial firm (for incumbent workers, i.e., those that remain employed by that firm), reallocation to other firms in the 2-digit sector of the initial firm, reallocation to firms in another tradable sector, and reallocation to firms in a non-tradable sector. This decomposition follows that proposed by Utar (2014) and captures both the direct impact of the shock on workers' employment and wages at the initial firm but also subsequent worker movements that may offset such direct impact.

The results from this decomposition are presented in Table 3 for employment (panel A) and wages (panel B).[33] The negative and significant coefficient in column (2) in panel A - and its larger magnitude relative to that in column (1) - shows that the adjustment to GFC firm shocks is driven by incumbent workers that remain at the initial firm. Columns (3) and (4) in panel A show a weak countervailing effect of increased employment in other firms in the same sector or in another tradables sector.[34] Column (5) in panel A shows a significant countervailing effect of increased employment in other firms in non-tradable sectors but insufficient to offset the changes at the initial firm. The reallocation to other firms or sectors plays no countervailing effect for wages. This evidence suggests that our main finding of employment losses due to firm foreign shocks in Section III.B comes mostly from a new concept of *scarring for incumbent workers*, not just displaced workers as in previous literature.

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[33]Column (1) in each panel shows a baseline effect as that shown in Table 2 but estimated on a sample that does not include workers' unemployment years. It is technically not feasible to use this decomposition for the filled-in worker panel database including observations when the worker is unemployed.

[34]For an incumbent worker who does not move from the initial firm, the values of the dependent variables employment or wages in other firms or other sectors in columns (3)-(5) are all 0.

B. Effects on Hours Worked and Renewal of Fixed-Term Contracts

Adjustment for incumbent workers can occur at the intensive or extensive margin i.e., in terms of hours worked or employment. Using the richness of our data, we investigate whether workers of firms with more adverse GFC firm shocks experience a downward adjustment in their hours worked and a lower probability of seeing their fixed-term contracts renewed. To do so, we estimate Equation (2) using as worker outcome variables either the logarithm of the number of hours worked per week by worker or an indicator variable for a fixed-term contract not being renewed and the worker having zero months worked in the year that follows.[35] Table 4 presents the results. Workers of firms with more adverse shocks work significantly fewer hours than workers of firms with less adverse shocks for seven years after the GFC shock, as shown in column (1). The probability of a worker with a fixed-term contract seeing his contract ending and becoming unemployed is higher for workers of firms with larger GFC foreign shocks, as per the estimates in column (2). This impact is, however, only significant in the year after the crisis, 2009. These effects are two potential mechanisms for scarring effects for incumbent workers induced by the GFC firm shocks.

C. Firm-Level Adjustment

Given the importance of employment and wage adjustments for workers in the initial firm identified above, the rest of this section addresses the mechanisms that drive that persistent adjustment, by focusing on how firms are affected by GFC foreign shocks and how they respond to those shocks. Our analysis tracks firms over time after the GFC, comparing the evolution of labor market and performance variables for firms that experience a larger versus a smaller negative GFC foreign shock.

Empirical Design

To estimate firm-level adjustment, we use the following specification:

$$y_{jt} = \theta_t shock_{j2008} + \gamma Z_{j2007} + I^{st} + I^{rt} + \epsilon_{jt} \tag{6}$$

where j a firm, t a year, Z_{j2007} denotes a vector of firm controls before the GFC (importing dummy as of 2007, and average annual growth in firm total employment and wages in 2004-2007 before the GFC), I^{st} and I^{rt} stand for, respectively, 2-digit sector-year and region-year fixed effects, and ϵ_{jt} is an error term.[36]

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[35]For this indicator variable, the much smaller sample used for estimation includes only workers with fixed-term contracts.

[36]When considering firm outcomes other than firm size, we also include the logarithm of firm size as of 2007 in the vector of firm controls.

Equation (6) compares a firm outcome for two observationally equivalent firms facing a larger versus a smaller GFC foreign shock. As in the case of our worker specifications, we allow the coefficient θ_t on the GFC firm shock variable (fixed at its 2008 value) to vary over time and hence depict the dynamic impacts on the firms in each year from 2009 onward. We estimate Equation (6) by OLS and obtain robust standard errors clustered by firm.

Effects on Firms' Revenues, Exit and Size

The estimates in Table 5 allow us to understand how incumbent firms are affected by GFC foreign shocks in terms of their revenues and profit rates - the first line of impact of a demand shock - as well as exit and size (in terms of employment and wages).[37] Firms harder-hit by GFC foreign shocks experience a persistent reduction in firm revenues and profit rates until 2014, as seen in columns (1) and (2). Column (3) shows that firms suffer a higher probability of exit in 2010 and 2011 and in 2015 and 2016 as a result of a GDP decline in their destinations.

Large economic disruptions can be important moments of restructuring whereby workers and other inputs of production are freed from low-productivity firms, allowing them to move to higher-productivity firms as the economy recovers. Such disruptions can have positive cleansing effects that increase (aggregate) productivity if poor-performing firms actually exit and the reallocation of resources towards more productive firms takes place (Caballero & Hammour, 1994; Osotimehin & Pappadà, 2017; Dix-Carneiro et al., 2021; Dias & Robalo Marques, 2021). However, the evidence is not clear-cut that markets select the most productive firms, as past crises resulted in the exit of both stronger as well as weaker firms (Foster et al., 2016; Hallward-Driemeier & Rijkers, 2013). If there were cleansing effects from GFC foreign shocks, we would expect the increases in exit estimated in Brazil to be higher for less efficient firms. To test this hypothesis, we estimate a variant of Equation (6) where, in addition to allowing the firm shock variable in 2008 to have a coefficient that varies over time, we allow the firm shock variable in 2008 to be interacted additionally with one of three proxies for firm efficiency: firm size in 2007, firm labor productivity or one of three firm total factor productivity (TFP) measures obtained either by Levinsohn & Petrin (2003), Ackerberg et al. (2015) or Wooldridge (2009) estimation.[38] The probability of exit due to the GFC firm shocks is significantly lower for larger firms and for more productive firms (see Appendix Table D1).

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[37]Net revenues and profit rates are based on Brazil's PIA manufacturing survey. Exit, the logarithm of firm size defined as the total number of workers employed by the firm in each year and the logarithm of the firm total wages defined as the sum of monthly real wages across all workers employed by the firm in each year are based on Brazil's RAIS starting worker-level database. The definitions of these variables are provided in Appendix A. Our regressions rely on firm samples where the top and bottom 1 percent of the distribution of the continuous outcome variables are dropped.

[38]The estimates using labor productivity or TFP are based on the the PIA survey and were thus obtained in the secure room at IBGE premises in Rio de Janeiro.

Hence there is some evidence of a cleansing effect from the GFC foreign shocks.

The burden of the crisis is shared across firms and workers in Brazil as not only do firm profit rates decline but so do firm total employment and wages. The negative and significant coefficients in columns (4) and (5) of Table 5 show that harder-hit firms adjust by persistently reducing their total employment and total wage bill until 2017, relative to less hard-hit firms.

We conduct several robustness checks to the findings of persistent reductions in firms' labor market outcomes (with differences in the persistence of the effects) and increases in firm exit identified in Table 5. First, given the important commodity boom experienced by Latin America during the 2003–2013 period, we estimate Equation (6) excluding commodity-related sectors from the sample. Second, while the sector-year and region-year fixed effects included in our specifications go a long way towards accounting for domestic economic cycles, we also estimate Equation (6) excluding the period of domestic economic recession in Brazil from 2014 onward from our sample. Third, we estimate two variants of Equation (6): dropping the vector of firm covariates and including separate 2-digit sector, region, and year fixed effects. The results from these regressions provided in Appendix Table D2 show impacts of GFC foreign shocks on firms' employment, wages, and exit that are mostly unchanged relative to the baseline impacts. We conduct further robustness checks estimating Equation (6) considering the two alternative shock measures discussed in Section III.C. The impacts of these shock measures on firms' employment, wages, and exit in Appendix Table D3 are similar to those in Table 5.

To confirm the role of GFC foreign shocks for firm labor market outcomes and performance - even outside of financial crisis periods - we estimate an alternative specification that links time-varying firm foreign shocks to time-varying firm outcomes using data for the entire sample period before and after the GFC (2004-2017) controlling in some cases for firm fixed effects.[39] This specification captures firm-level adjustment in employment, wages and other performance measures during crises but also during growth and recovery periods. The results show that firms experiencing a negative foreign shock decrease significantly their total employment and wages (see Appendix Table D4) as well as their inputs and productivity (see Appendix Table D5). The impacts on firm employment and wages are also qualitatively similar when alternative time-varying shock measures are used (see Appendix Table D6).

Occupational Restructuring, Productivity, and Technological Change Effects

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[39]The specifications are described in Appendix D and control for time-varying measures of import shocks or real exchange rate shocks computed using the same formula as the firm foreign shocks. For the measure of import shocks, GDP growth in destination countries is replaced by GDP growth in countries from which imports are sourced. For the measure of real exchange rate shocks, GDP growth in destination countries is replaced by the change in the bilateral real exchange rate between Brazil and the destination countries. Bilateral real exchange rates are computed based on bilateral nominal exchanges rates from the International Monetary Fund's International Financial Statistics and consumer price index data from the World Development Indicators.

Firms that are harder-hit by GFC foreign shocks may, in addition to suffering a reduction in revenues and downsizing employment, adjust the occupational structure of their workforce. In turn, changes in the organization of the firm may imply changes in productivity. These adjustments made by firms can have far-reaching long-run consequences.

Tables 5 and 6 identify the effects of firm GFC foreign shocks on firm occupational restructuring: skilled versus unskilled workers and occupation categories.[40] Firms in Brazil respond to the GFC foreign shocks by reducing their total number of both skilled and unskilled workers, as shown by columns (6) and (7) of Table 5. A persistent increase in the share of skilled workers for the most negatively-hit firms in Brazil two years after the GFC onward is evident in column (8), reflecting a larger reduction in employment of unskilled workers than in employment of skilled workers. This finding indicates a firm response to the GFC foreign shock in the form of permanent occupational restructuring towards higher-skilled workers.

Detailed information on workers' occupations allows us to further decompose this change in firms' skill use into changes in different professional groups. We consider five occupation categories as described in Section II. Table 6 shows that GFC foreign shocks lead to a lasting expansion by firms of their share of professional and managerial workers and a temporary expansion (in the first two years after the GFC) of the share of skilled blue collar workers. In contrast, GFC foreign shocks lead firms to reduce their shares of both white and blue collar unskilled workers. These findings are in line with evidence from high-income countries, where low-earning workers are shown to exit the labor force in disproportionate numbers during economic downturns (e.g., Carneiro et al. (2012)). The rationale for such findings is that workers with lower levels of human capital are less costly for firms to replace when recovery from the downturn materializes.

Table 7 presents the impacts of GFC foreign shocks on non-labor inputs and productivity: materials, materials per worker, capital, capital per worker, labor productivity, and TFP.[41] Regarding non-labor input use, columns (1) and (2) show that materials and materials per worker decline as a result of the negative demand shock suffered by firms in Brazil whereas there is no evidence of capital-labor substitution in columns (3) and (4).

Finally, our estimates show clear evidence of a negative impact of GFC foreign shocks on firm productivity. The effects in columns (5)-(8) are persistent and consistent across productivity measures. Our TFP estimates are obtained as the part of firm revenues deflated by industry price indexes (to derive quantities produced) that cannot be explained by the contribution of labor, intermediates, and capital. Such estimates, referred to as revenue TFP

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[40]The measures are based on Brazil's RAIS starting worker-level database. Our regressions rely on a firm sample where the top and bottom 1 percent of the distribution of firms' continuous outcome variables (except firm worker composition shares) are dropped.

[41]The measures are based on Brazil's RAIS and PIA manufacturing survey. The definitions of these variables are provided in Appendix A. Our regressions rely on a firm sample where the top and bottom 1 percent of the distribution of firms' continuous performance variables are dropped.

(TFPR), conflate true firm efficiency with firm price effects that capture input costs, product quality, and market power (Cusolito & Maloney, 2018). Hence, our finding that firm shocks result in a decline in firm productivity does not necessarily imply a decline in firm efficiency, which might appear at odds with the evidence on the shocks also leading to occupational restructuring towards high-skilled workers, but may simply reflect a decline in firm market power. The decline in firm profits in Table 5 corroborates this interpretation.

V.   Mediating Role of Informality and Lack of Competition

The long-run severity of crisis-induced employment and earnings losses may vary with local labor market characteristics. For developing countries, a first-order issue is informality. A high degree of informality may lead to substantial misallocation of resources and hamper employment growth, but it may also provide de facto flexibility for firms and workers to cope with adverse shocks and more alternatives for displaced workers. We examine this issue exploiting the wide heterogeneity in local conditions across Brazil's vast territory and using a widely-used definition of informality. We estimate a modified version of Equation (5) replacing worker categories by indicator variables for higher than median (high) versus lower than median (low) informality rate in the worker's 2007 employing firm's municipality. The results in Table 8 point to a significantly smaller decline in formal worker employment due to GFC firm shocks in Brazilian localities with a higher informality rate. In highly informal localities, even formal firms are likely to employ many informal workers and it is for those workers (rather than for formal ones that we capture in our RAIS employer-employee database) that the firm adjusts the months worked and the wages when facing a negative shock. This finding supports the idea that informality provides de facto flexibility for firms and workers to cope with negative demand shocks, in line with the findings on the effects of trade liberalization in Brazil by Dix-Carneiro & Kovak (2019); Dix-Carneiro et al. (2021) and Ulyssea & Ponczek (2022).

The evidence in Section IV points to potential cleansing resulting from the GFC-induced foreign shocks as larger and more productive firms are more likely to exit in Brazil. But low-productivity firms may have a "way out" moving to the informal sector, in which case the competition effects behind cleansing effects would not be present. For example, if protected firms, defined as those facing less competition, adjust less during a crisis (as is shown below) and gain more market share, they may trap additional resources that could be used more efficiently elsewhere. The trade literature also shows the importance of reallocation across sectors for the productivity and inequality effects of trade liberalization (McCaig & Pavcnik,

2018; Dix-Carneiro et al., 2021). Yet, these effects operate through competition. Our hypothesis is that an environment with low competition and protected firms is likely to hamper these effects. We test this hypothesis by estimating a modified version of Equation (5) using several proxies for the degree of competition or protection: indicator variables for higher than median versus lower than median Herfindahl index of concentration at the 3-digit sector level (based on firm employment shares) and indicator variables for state-owned firms (identified in the RAIS database) versus non-state-owned firms.[42]

Table 8 shows that GFC firm shocks do not result in any downward employment or real wage adjustment for workers in sectors where few firms hold a large percentage of the market share nor for workers in state-owned firms, whereas significant negative impacts are found for workers in less concentrated sectors and in non-state-owned firms.[43]

All in all, Brazilian workers employed by firms facing less competition are more insulated from the GFC than workers employed by less protected firms. An alternative interpretation might be that this heterogeneity analysis reflects productivity rather than lack of competition. Indeed, higher concentration may reflect the existence of one or a few large firms and such firms tend to be more productive and have better access to credit which may enable them to better cope with negative shocks. In that case, our findings would suggest that more productive firms cope better with shocks and protect employment to a greater extent. This would imply that more productive firms capture larger shares of employment, which in turn could improve productivity in a cleansing sense. However, two elements dismiss this alternative interpretation. One the one hand, there is strong evidence that state-owned firms, while large, have lower rather than higher productivity compared to other firms (Shleifer, 1998; Harrison et al., 2019) and they are connected firms aiming to shield their market position (Colonnelli & Prem, 2022). On the other hand, unreported results show no employment insulation for non-state-owned large firms, suggesting that the connectedness and lack of competition felt by state-owned firms is what drives the results rather than their large size.

VI. Effectiveness of Compensatory Mechanisms

Workers may adjust to changes in employment and earnings by seeking government support. This support normally takes the form of unemployment insurance, need-based cash transfer programs and/or job training. While the Brazilian government provides unemployment insur-

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[42]It would be preferable to measure the Herfindahl index of concentration based on firm output shares since heavily concentrated sectors in terms of employment may simply reflect one large and highly productive firm rather than the lack of competition. Unfortunately due to restrictions in access to the Brazilian firm-level PIA data, we can only use firm employment shares. The competition variables are measured based on the worker's firm and sector as of 2008.

[43]The result for state-owned firms is weak statistically but that is expected given the very small percentage of the sample that is accounted for by workers in state-owned firms (1.5%).

ance (UI), many developing countries lack this type of compensation mechanism - two-thirds of countries in Latin America do not offer UI (Silva et al., 2021) - and rely solely on welfare programs that mainly consist of cash transfer programs. Brazil has a large-scale program of this type – Programa Bolsa Familia (PBF). In addition to income support, several countries offer job training as a form of adjustment assistance. Yet, often these type of programs are not well aligned with firms' labor demands. Brazil's unique feature is that most training for the manufacturing sector is concentrated in a sole provider: SENAI, the training arm of the confederation of industry. Providing evidence on the role played by these three types of support programs (UI, PBF, and job training) in response to crises in a developing country context is a unique feature of our paper.

Effects on UI and access to Bolsa Familia

We assess the extent to which the existing compensatory mechanisms are able to mitigate the impacts of the GFC-induced negative foreign shocks on worker employment and wages. We estimate Equation (2) using as outcomes the average number of months the worker receives unemployment insurance, average monthly earnings from unemployment insurance, the average number of months the worker is a beneficiary of the Bolsa Familia cash transfer program, and average monthly payments from the Bolsa Familia program, all defined following Yagan (2019), as described in Appendix A.

The estimates presented in columns (2) and (3) of Table 9 show a significant increase in access to unemployment insurance for Brazilian workers in firms suffering a worse GFC foreign shock. Importantly, this increased access to UI benefits is significant only in the first post-GFC year, 2009. The estimates in columns (4) and (5) of Table 9 show significant increases in access to and earnings from the Bolsa Familia program for workers in firms suffering a worse GFC foreign shock. These increases last until 2012 (the last year for which we have data on the Bolsa Familia program). Hence, workers in firms subject to more adverse GFC foreign shocks accumulated rising welfare benefits relative to those in firms subject to smaller GFC foreign shocks.

To measure the degree to which these compensatory mechanisms provide a replacement for earnings losses for workers in the post-GFC period, we compare the sum of the 2009–2017 UI earnings coefficients in column (3) and the sum of the 2009-2012 PBF earnings coefficients in column (5) to the sum of the worker earnings coefficients in column (1). This comparison suggests that UI and PBF transfer payments replaced 6% of lost earnings: 4.3% from UI and 1.7% from Bolsa Familia.

The magnitude of the UI income replacement is similar to that found by Yagan (2019) for workers affected by the GFC in the US, while the Bolsa Familia income replacement is significantly higher than that of welfare programs in the US. In the case of the China competition shock, Autor et al. (2013, 2014) find that such programs compensated for 10% of

the income loss in regions that were adversely hit by trade. In that case, the uptake of social security disability insurance was substantially larger than the uptake of unemployment and trade adjustment assistance support.

__Effects on job training__ We assess whether workers of firms suffering more adverse GFC foreign shocks were more likely to receive job training. The individual training records contain information on different training categories. Technical upgrading courses are aimed at workers seeking to update, deepen, or complement the professional skills they have acquired in a specific occupation or field or work. Their duration varies between 40 and 120 hours. Other training categories (Habitation, Qualification, initiation courses and Apprenticeships) are aimed at training a new generation of practitioners of a given occupation or profession.

We estimate Equation (2) using as outcomes the workers' probability of receiving any type job training and the probability of receiving technical upgrading courses. The estimates presented in columns (6) and (7) of Table 9 do not show significant increases in the likelihood of receiving training for workers in firms suffering a worse GFC foreign shock.

VII.   Responses in a Different Labor Market

Our evidence so far shows persistent effects of foreign shocks on workers' employment and wages in Brazil, firm restructuring through occupational changes and firm scarring in terms of exit as well as a contraction in revenues, employment, and productivity. One may be concerned about the external validity of these results, in particular whether the responses to foreign shocks would be similar in a labor market with (even) less flexibility than that of Brazil. To address this concern, we consider the case of Ecuador, a developing country in Latin America with a more rigid labor market de jure and de facto than Brazil.[44]

We compiled a rich administrative data set from Ecuador that merges employer-employee matched data with education census, firm registry data, and firm-level customs data for the 2006-2017 period (details are provided in Appendix E). Similar data have recently been used by Adão et al. (2022). We replicate the analysis of the impact of firms' GFC foreign shocks and of the mechanisms driving long-run effects using these data.

The worker responses to firms' foreign shocks due to the GFC in Ecuador are qualitatively similar to those in Brazil: persistent reductions in worker employment occurring only for the

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[44]Ecuador's labor market is more rigid than that of Brazil in areas related to firing costs according to recent Doing Business indicators. When dismissing a redundant worker, a firm in Ecuador must notify or consult a third party whereas that is not necessary in Brazil and it also must pay substantially larger severance payments. For example for workers employed for 10 years (or more) at the firm such payments consist in more than 50 weeks of salary in Ecuador but only 17 weeks of salary in Brazil. Measures of job turnover (creation and destruction) based on the employer-employee data sets show a substantially larger de facto job turnover for Brazil than Ecuador prior to the GFC. As of 2007, job creation and destruction rates in Brazil were 16% and 3%, while they were 4% and 2.6%, respectively, in Ecuador.

lower-skilled (see Appendix Figure E1 and Table E5). But the estimated negative effects on worker months worked are much smaller in magnitude than those in Brazil, possibly due to the lower labor market flexibility in Ecuador. This also helps to understand the negative but insignificant response of real wages of Ecuadorian workers to foreign firm shocks.

The driving force behind worker employment and wage losses in response to foreign shocks are adjustments by the initial firm in Ecuador, as was the case in Brazil (see Appendix Table E6). The type of within-firm restructuring underlying such adjustments in Ecuador, replacing capital with labor, differs from that in Brazil, replacing unskilled with skilled labor. Ecuadorian firms respond to adverse foreign shocks by reducing total employment in the short-run (effects are significant only in 2009-2010) but also capital permanently and by more, resulting in lower capital per worker (Appendix Table E7). This is then reflected in significant declines in firm productivity in Ecuador and results in heavier scarring (Appendix Table E8). These firm-level mechanisms are consistent with the differences in the persistence of worker effects documented across Brazil and Ecuador.

VIII.   Conclusion

Economic crises have long-run impacts on workers, whose magnitude and duration depend on underlying firm mechanisms and income support programs. This paper examines the consequences of transitory demand shocks for workers and firms. It estimates worker and firm adjustment to foreign shocks exploiting quasi-experimental variation in firms' foreign demand resulting from the Global Financial Crisis for Brazil. It also focuses on the extent to which existing public policies are mitigating the negative consequences of the initial shock.

The results show that workers suffer long-lasting impacts of firms' foreign shocks on employment and wages. This sheds light on the lasting impact of temporary shocks on the medium to long-run careers of workers. Notably, labor scarring occurs only for lower-skilled workers, increasing long-run inequality. These changes are important as workers care about income security. In surveys, workers tend to value stable wages and job security above the level of pay. Informality and sectoral concentration mitigate the employment and wage losses due to foreign shocks. Negative employment effects dissipate over a decade and firm restructuring involves occupational adjustment, increasing permanently the share of skilled workers while reducing unskilled workers. Underlying labor scarring is firm scarring caused by selection (exit) and revenue, employment and productivity downsizing. But these effects require labor market flexibility. Replicating the analysis for Ecuador, a country characterized by a relatively more rigid labor market, we find that firms do not adjust workforce composition, but they reduce capital permanently which increases scarring.

In light of these effects, assistance in the form of income support or job training would

be in order. Yet, using unique data for Brazil we find that negatively affected workers lacked support. Despite an immediate increase in access to unemployment insurance and a lasting increase in access to Bolsa Familia cash transfers for workers in firms suffering worse GFC foreign shocks, these programs yielded limited earnings loss replacement. Assistance in the form of job training did not increase.

The evidence shows that a temporary foreign shock due to the GFC induces persistent effects on firms and workers: firm restructuring scars incumbent workers and increases long-run inequality.

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Figure 1: Workers' Adjustment to GDP Decline in Firms' Destinations
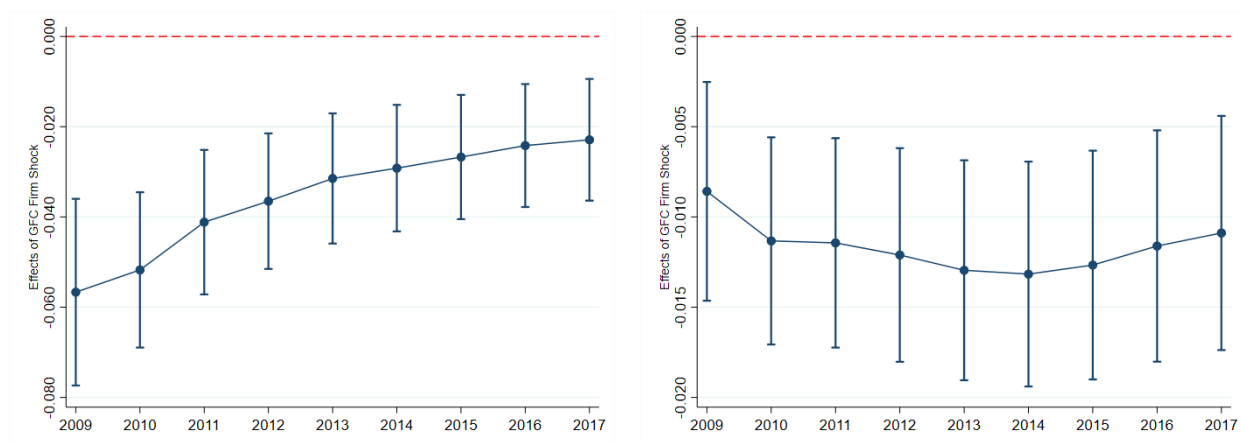
(a) Average months worked

(b) Average real wages

Note: The graphs show the coefficients obtained from estimating Equation (2) by OLS based on a sample of about 3 million worker-year observations controlling for vectors of worker and firm characteristics as of 2007 described in Section III as well as 2-digit sector-year and region-year fixed effects. Confidence intervals at the 95 percent level shown are based on robust standard errors clustered by firm. The F-statistic test for the null hypothesis that all coefficients are similar is 3.52 for months worked and 2.36 for real wages, and the corresponding p-values are, respectively, 0.0005 and 0.0154.

Table 1: Descriptive Statistics

	Mean	Std. Dev.
	Panel A: Worker panel	
Outcomes		
Months worked per year (2004-2007)	9.96	3.53
Monthly real wages (2004-2007)	2724.7	3,817.9
Average months worked per year (2009 onward)	8.5	3.8
Average monthly real wages (2009 onward)	1.9	2.1
Average number of months in Bolsa Familia program (2009-2012)	0.75	2.83
Average payments from Bolsa Familia program (2009-2012)	28.0	221.0
Average number of months with unemployment insurance	0.43	1.27
Average payments from unemployment insurance (in local currency)	479.4	1,439.7
Share of workers trained (2009-2012)		3.22%
Share of workers in technical upgrading training (2009-2012)		1.84%
Number of workers trained (2009-2012)		59,672
Number of workers in technical upgrading training (2009-2012)		34,128
Firm shock		
Firm shock in 2008 (negative of growth in GDP of destinations)	-3.1	2.0
Total number of worker-year observations		3,046,074
Total number of unique worker IDs		342,574
Total number of unique firm IDs		11,453
Share of observations with 0 months worked per year		19.0%
	Panel B: Firm panel	
Outcomes		
Total employment (log)	4.6	2.4
Total real wages (log)	11.8	2.1
Avg. wages (log)	7.8	0.6
Net revenue (log) (2009-2014)	59.9	103.5
Materials (log) (2009-2014)	2.4	1.5
Materials per worker (2009-2014)	-1.1	1.1
Capital (log) (2009-2014)	3.5	1.0
Capital per worker (2009-2014)	0.0	0.6
Labor productivity (2009-2014)	60.5	105.4
Profit rate (2009-2014)	-1.5	1.6
Firm shock		
Firm shock in 2008 (negative of growth in GDP of destinations)	-3.2	2.7
Total number of firm-year observations		119,189
Total number of unique firm IDs		15,087

Note: The worker-level statistics are based on the sample of workers in firms with a non-missing GFC firm shock measure in 2008 used in the main regressions. For Bolsa Familia, unemployment insurance, and training programs the statistics are based only on beneficiaries. Real wages are expressed in local currency in 2010 prices. The firm-level statistics are based on all firms with non-missing GFC shock measure in 2008 used in the main regressions. All statistics for which a time period is not shown in parentheses cover the 2009-2017 period.

Table 2: Heterogeneous Impacts of GDP Decline in Firms' Destinations by Worker Characteristics

	Average months worked		Average real wages	
	Coefficient	Test eq. of coeff t-test p-value	Coefficient	Test eq. of coeff t-test p-value
	(1)	(2)	(3)	(4)
GFC firm shock	-0.0357***		-0.0116***	
	(0.0073)		(0.0030)	
Observations	3,046,074		3,030,524	
R-squared	0.1274		0.2757	
GFC firm shock*Female	-0.0454***		-0.0105***	
	(0.0098)		(0.0039)	
GFC firm shock*Male	-0.0328***	1.250	-0.0114***	-0.194
	(0.0080)	(0.2114)	(0.0033)	(0.8459)
Observations	3,046,074		3,030,524	
R-squared	0.8543		0.6046	
GFC firm shock*Higher education	-0.0128		-0.0005	
	(0.0111)		(0.0061)	
GFC firm shock*No higher education	-0.0378***	-2.142	-0.0126***	-1.890
	(0.0077)	(0.0322)**	(0.0031)	(0.0588)*
Observations	3,046,074		3,030,524	
R-squared	0.8547		0.6089	
GFC firm shock*Young	-0.0334***		-0.0123***	
	(0.0073)		(0.0031)	
GFC firm shock*Old	-0.0762***	2.460	-0.0158***	0.7257
	(0.0182)	(0.0139)***	(0.0050)	(0.4680)
Observations	3,046,074		3,030,524	
R-squared	0.8546		0.5974	
2-digit industry X Year FE	Yes		Yes	
State X Year FE	Yes		Yes	

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table 3: Reallocation of Workers across Firms and Sectors due to GDP Decline in Firms' Destinations

	Baseline effect	Initial firm	Other firm in same sector	Other firm in tradable sector	Other firm in non-tradable sector
	(1)	(2)	(3)	(4)	(5)
Panel A: Average months worked					
GFC firm shock	-0.0226***	-0.0535**	0.0187	0.0085	0.0036**
	(0.0054)	(0.0210)	(0.0152)	(0.0053)	(0.0018)
Observations	921,977	921,977	921,977	921,977	921,977
R-squared	0.0423	0.0452	0.0144	0.0259	0.0165
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes
Panel B: Average real wages					
GFC firm shock	-0.0089**	-0.0194***	0.0066	0.0030	0.0009
	(0.0036)	(0.0056)	(0.0040)	(0.0025)	(0.0012)
Observations	916,397	916,397	916,397	916,397	916,397
R-squared	0.4518	0.2404	0.0284	0.0508	0.0299
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. FE stands for fixed effects.

Table 4: Hours Worked and Renewal of Fixed-Term Contracts

	Average hours worked	Indicator for not renewing fixed-term contract
	(1)	(2)
GFC firm shock*2009	-0.0048***	0.0021**
	(0.0018)	(0.0009)
GFC firm shock*2010	-0.0056***	0.0008
	(0.0019)	(0.0011)
GFC firm shock*2011	-0.0052***	0.0012
	(0.0020)	(0.0009)
GFC firm shock*2012	-0.0047**	0.0002
	(0.0020)	(0.0007)
GFC firm shock*2013	-0.0041**	0.0001
	(0.0021)	(0.0010)
GFC firm shock*2014	-0.0039*	0.0001
	(0.0020)	(0.0013)
GFC firm shock*2015	-0.0037*	-0.0008
	(0.0020)	(0.0018)
GFC firm shock*2016	-0.0032*	0.0001
	(0.0020)	(0.0015)
GFC firm shock*2017	-0.0031	0.0005
	(0.0019)	(0.0019)
Observations	3,046,065	42,807
R-squared	0.3213	0.0371
2-digit industry X Year FE	Yes	Yes
State X Year FE	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, a d * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects. The estimating sample in column (2) includes only workers with fixed-term contracts.

Table 5: Firm Revenues, Exit, and Size Impacts of GDP Decline in Firms' Destinations

	Net revenues	Profit rate	Firm exit	Firm size (log)	Total wages (log)	Total skilled based on education (log)	Total unskilled based on education (log)	Share of skilled based on education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GFC firm shock*2009	-0.0315***	-0.0014	-0.0003	-0.0162***	-0.0221***	-0.0051*	-0.0191***	0.0005
	(0.0044)	(0.0010)	(0.0006)	(0.0027)	(0.0031)	(0.0030)	(0.0027)	(0.0004)
GFC firm shock*2010	-0.0378***	-0.0022**	0.0019***	-0.0220***	-0.0285***	-0.0102***	-0.0233***	0.0006
	(0.0047)	(0.0010)	(0.0006)	(0.0033)	(0.0034)	(0.0032)	(0.0032)	(0.0004)
GFC firm shock*2011	-0.0393***	-0.0035***	0.0010*	-0.0263***	-0.0292***	-0.0119***	-0.0260***	0.0009**
	(0.0051)	(0.0010)	(0.0006)	(0.0035)	(0.0036)	(0.0034)	(0.0034)	(0.0004)
GFC firm shock*2012	-0.0372***	-0.0019*	0.0001	-0.0262***	-0.0307***	-0.0111***	-0.0271***	0.0011***
	(0.0053)	(0.0010)	(0.0006)	(0.0039)	(0.0039)	(0.0036)	(0.0038)	(0.0004)
GFC firm shock*2013	-0.0382***	-0.0016	0.0010	-0.0289***	-0.0315***	-0.0104***	-0.0298***	0.0013***
	(0.0055)	(0.0010)	(0.0006)	(0.0041)	(0.0042)	(0.0037)	(0.0040)	(0.0005)
GFC firm shock*2014	-0.0400***	-0.0021*	-0.0004	-0.0308***	-0.0341***	-0.0133***	-0.0313***	0.0016***
	(0.0053)	(0.0011)	(0.0007)	(0.0044)	(0.0043)	(0.0038)	(0.0042)	(0.0005)
GFC firm shock*2015			0.0015**	-0.0322***	-0.0319***	-0.0145***	-0.0343***	0.0014***
			(0.0007)	(0.0045)	(0.0046)	(0.0040)	(0.0043)	(0.0005)
GFC firm shock*2016			0.0012*	-0.0244***	-0.0295***	-0.0147***	-0.0304***	0.0013**
			(0.0007)	(0.0048)	(0.0049)	(0.0041)	(0.0045)	(0.0006)
GFC firm shock*2017				-0.0236***	-0.0285***	-0.0150***	-0.0295***	0.0013**
				(0.0051)	(0.0051)	(0.0043)	(0.0046)	(0.001)
Observations	30,825	32,125	107,541	91,971	82,313	88,549	91,537	119,189
R-squared	0.6787	0.0817	0.0168	0.532	0.5301	0.6052	0.4983	0.4823
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Section IV.*C*. FE stands for fixed effects.

Table 6: Firm Occupational Restructuring in Response to GDP Decline in Firms' Destinations

	Share of skilled based on occupations	Share of professional, managerial, skilled	Share of skilled white collar	Share of skilled blue collar	Share of unskilled based on occupations	Share of unskilled white collar	Share of unskilled blue collar
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GFC firm shock*2009	0.00212***	0.00110***	-0.000606	0.00164**	-0.00345***	-0.000983***	-0.00247***
	(0.000709)	(0.000361)	(0.000611)	(0.000779)	(0.000666)	(0.000377)	(0.000597)
GFC firm shock*2010	0.00281***	0.00138***	-0.000171	0.00160**	-0.00335***	-0.000764**	-0.00258***
	(0.000694)	(0.000441)	(0.000635)	(0.000796)	(0.000693)	(0.000382)	(0.000630)
GFC firm shock*2011	0.00317***	0.00164***	0.000212	0.00132	-0.00364***	-0.000874**	-0.00277***
	(0.000692)	(0.000444)	(0.000638)	(0.000809)	(0.000692)	(0.000390)	(0.000622)
GFC firm shock*2012	0.00285***	0.00174***	0.000202	0.000905	-0.00346***	-0.000936**	-0.00252***
	(0.000705)	(0.000450)	(0.000642)	(0.000814)	(0.000705)	(0.000396)	(0.000638)
GFC firm shock*2013	0.00268***	0.00157***	0.000472	0.000637	-0.00349***	-0.000994**	-0.00250***
	(0.000710)	(0.000482)	(0.000631)	(0.000815)	(0.000710)	(0.000396)	(0.000643)
GFC firm shock*2014	0.00259***	0.00143***	0.000816	0.000344	-0.00340***	-0.000935**	-0.00247***
	(0.000718)	(0.000472)	(0.000639)	(0.000815)	(0.000719)	(0.000400)	(0.000652)
GFC firm shock*2015	0.00221***	0.00143***	0.00121*	-0.000422	-0.00277***	-0.00114***	-0.00163**
	(0.000724)	(0.000507)	(0.000642)	(0.000814)	(0.000722)	(0.000424)	(0.000636)
GFC firm shock*2016	0.00154**	0.000904*	0.00114*	-0.000499	-0.00214***	-0.000929**	-0.00121*
	(0.000723)	(0.000539)	(0.000653)	(0.000825)	(0.000715)	(0.000408)	(0.000634)
GFC firm shock*2017	0.00120	0.000635	0.000869	-0.000303	-0.00196***	-0.000356	-0.00161**
	(0.000739)	(0.000565)	(0.000665)	(0.000849)	(0.000729)	(0.000414)	(0.000644)
Observations	119,189	119,189	119,189	119,189	119,189	119,189	119,189
R-squared	0.090	0.130	0.275	0.311	0.093	0.086	0.122
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Section IV.*C*. FE stands for fixed effects.

Table 7: Firm Performance Adjustment in Response to GDP Decline in Firms' Destinations

	Materials (log) (1)	Materials per worker (log) (2)	Capital (log) (3)	Capital per worker (log) (4)	Labor productivity (log) (5)	TFP L-P (log) (6)	TFP ACF (log) (7)	TFP Wooldridge (log) (8)
GFC firm shock*2009	-0.0490***	-0.0397***	0.0013	0.0148	-0.0152***	-0.0190***	-0.0140***	-0.0205***
	(0.0080)	(0.0075)	(0.0138)	(0.0136)	(0.0041)	(0.0045)	(0.0020)	(0.0046)
GFC firm shock*2010	-0.0482***	-0.0332***	0.0003	0.0155	-0.0164***	-0.0242***	-0.0165***	-0.0241***
	(0.0067)	(0.0061)	(0.0125)	(0.0122)	(0.0043)	(0.0046)	(0.0021)	(0.0046)
GFC firm shock*2011	-0.0587***	-0.0449***	-0.0015	0.0143	-0.0198***	-0.0269***	-0.0148***	-0.0267***
	(0.0081)	(0.0072)	(0.0133)	(0.0131)	(0.0042)	(0.0045)	(0.0022)	(0.0045)
GFC firm shock*2012	-0.0465***	-0.0343***	-0.0063	0.0093	-0.0177***	-0.0230***	-0.0159***	-0.0241***
	(0.0082)	(0.0070)	(0.0109)	(0.0106)	(0.0043)	(0.0048)	(0.0021)	(0.0046)
GFC firm shock*2013	-0.0500***	-0.0351***	-0.0100	0.0054	-0.0163***	-0.0245***	-0.0163***	-0.0254***
	(0.0079)	(0.0066)	(0.0093)	(0.0091)	(0.0043)	(0.0050)	(0.0022)	(0.0047)
GFC firm shock*2014	-0.0586***	-0.0425***	-0.0164**	0.0019	-0.0187***	-0.0270***	-0.0157***	-0.0274***
	(0.0082)	(0.0072)	(0.0081)	(0.0079)	(0.0045)	(0.0050)	(0.0022)	(0.0049)
Observations	30,839	31,767	30,727	31,183	31,651	30,916	30,682	30,997
R-squared	0.4705	0.2653	0.5265	0.2849	0.3789	0.5138	0.6779	0.5201
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Section IV.*C*. L-P refers to Levinsohn & Petrin (2003). ACF refers to Ackerberg et al. (2015). Wooldridge refers to Wooldridge (2009). All total factor productivity measures are in logarithms. FE stands for fixed effects.

Table 8: Heterogeneous Impacts of GDP Decline in Firms' Destinations by Informality and Protection

	Average months worked		Average real wages	
	Coefficient (1)	Test eq. of coeff t-test p-value (2)	Coefficient (3)	Test eq. of coeff t-test p-value (4)
GFC firm shock*Low informality rate	-0.0446***		-0.0122***	
	(0.0087)		(0.0035)	
GFC firm shock*High informality rate	-0.0154	2.0427	-0.0109**	0.2304
	(0.0112)	(0.0411)**	(0.0044)	(0.8178)
Observations		3,016,941		2,982,180
R-squared		0.8546		0.6508
GFC firm shock*Low sector concentration	-0.0344***		-0.0116***	
	(0.0079)		(0.0031)	
GFC firm shock*High sector concentration	0.0157	2.9506	0.0026	1.9968
	(0.0152)	(0.0032)***	(0.0066)	(0.0459)**
Observations		3,046,074		3,011,056
R-squared		0.8549		0.6512
GFC firm shock*Not state-owned	-0.0344***		-0.0124***	
	(0.0072)		(0.0028)	
GFC firm shock*State-owned	0.0650	1.4069	0.0503	1.2154
	(0.0707)	(0.1595)	(0.0519)	(0.2242)
Observations		3,019,199		2,984,438
R-squared		0.8543		0.6505
2-digit industry X Year FE		Yes		Yes
State X Year FE		Yes		Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table 9: Bolsa Familia, Unemployment Insurance and Training Responses to GDP Decline in Firms' Destinations

	Average real wages	Average number of months in UI	Average earnings from UI	Average number of months in PBF	Average earnings from PBF	Indicator for receiving training	Indicator for receiving technical training
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GFC firm shock*2009	-28.6391***	0.0104***	12.6110***	0.0073*	0.7037***	-0.0001	-0.0001
	(6.3102)	(0.0031)	(3.1702)	(0.0045)	(0.2723)	(0.0004)	(0.0003)
GFC firm shock*2010	-28.4306***	0.0005	-0.6657	0.0128***	0.9880***	0.0004	0.0005
	(6.3088)	(0.0020)	(2.0105)	(0.0046)	(0.2958)	(0.0004)	(0.0003)
GFC firm shock*2011	-28.3811***	-0.0008	-1.9912	0.0148***	1.2547***	0.0002	0.0003
	(6.2924)	(0.0019)	(2.0108)	(0.0046)	(0.3350)	(0.0003)	(0.0003)
GFC firm shock*2012	-28.2186***	0.0008	0.2453	0.0146***	1.3997***	0.0001	0.0002
	(6.2794)	(0.0018)	(2.0030)	(0.0046)	(0.3693)	(0.0004)	(0.0003)
GFC firm shock*2013	-27.9682***	-0.0004	-0.6452				
	(6.2490)	(0.0018)	(2.0402)				
GFC firm shock*2014	-27.6736***	0.0002	-1.0784				
	(6.1863)	(0.0016)	(1.9543)				
GFC firm shock*2015	-27.0546***	-0.0002	-1.1020				
	(6.1000)	(0.0016)	(1.9736)				
GFC firm shock*2016	-26.9920***	0.0014	1.2943				
	(6.0603)	(0.0017)	(2.1482)				
GFC firm shock*2017	-26.2731***	0.0023*	2.0523				
	(5.9758)	(0.0013)	(1.7051)				
Observations	3,046,074	3,046,074	3,046,074	1,365,282	1,365,282	3,046,074	3,046,074
R-squared	0.4228	0.0266	0.0186	0.1337	0.0637	0.0367	0.0262
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Online Appendix

A. Data: Summary Statistics, Sample Quality, and Variable Definitions

Table A1: Additional Descriptive Statistics

	Mean	Std. Dev.	N
Panel A: Worker panel			
Controls (pre-global financial crisis)			
Male	75.2%	43.2%	
Age	32.98	9.62	
Higher education or more	16.1%	36.8%	
Previous formal sector attachment	67.3%	32.8%	
Other			
Young (16-49)	95.0%	37.62%	
Old (50-65)	5.0%	37.62%	
Low informality rate	57.8%	49.4%	
High informality rate	42.2%	49.4%	
Low sector concentration	76.5%	42.4%	
High sector concentration	23.5%	42.4%	
Not-State owned	98.5%	12.2%	
State-owned	1.5%	12.2%	
Panel B: Firm panel			
Controls (pre-global financial crisis)			
Importer dummy	59.6%	49.1%	
Firm avg. growth in total employment	10.7%	30.8%	
Firm avg. growth in total wages	13.1%	32.3%	
Panel C: Worker panel - full RAIS			
Male	72%	45%	240 669 880
Age	33.9	10.4	241 057 542
Higher education	10%	30%	241 057 542
Previous formal sector attachment	37%	37%	241 057 542
Average months worked per year	6.9	3.8	177 895 587
Average monthly real wages	2.3	2.1	98 146 366

Note: The worker-level statistics in panel A are based on the sample of workers in firms with a non-missing GFC firm shock measure in 2008 used in the main regressions. The firm-level statistics in panel B are based on all firms with non-missing GFC shock measure in 2008 used in the main regressions. The worker-level statistics in panel C are based on all workers in the RAIS database.

Table A2: Mincer Regressions for Wages

	Log monthly real wages	
	(1)	(2)
Male	0.2730***	
	(0.001)	
$(Age - 40)^2$	-0.0004***	-0.0008***
	(0.000)	(0.000)
$(Age - 40)^4$	0.0000***	0.0000***
	(0.000)	(0.000)
Higher education or more	0.9081***	
	(0.001)	
Tenure firm (log)	0.1316***	0.0752***
	(0.000)	(0.000)
Observations	4,823,417	4,873,093
R-squared	0.619	0.895
Worker FE	No	Yes
4-digit industry FE	Yes	Yes
Year FE	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. The dependent variable is the workers' log monthly real wage in each year. FE stands for fixed effects.

Table A3: Additional Variable Definitions

Variable name	Variable definition
Worker covariates	
Previous formal sector attachment	Share of months worked between 2004 and 2007 (number of months worked between 2004 and 2007 / 48).
Firm performance	
Net revenue	Logarithm of net revenue defined as total revenues minus taxes.
Materials [per worker]	Logarithm of intermediate input expenses [divided by number of workers].
Capital [per worker]	Logarithm of capital computed using the perpetual inventory method [divided by number of workers].
Labor productivity	Log of value added per worker with value added defined as the difference between gross value from production and intermediate input expenses.
TFP	Log of TFP estimated using a value added production function with labor and capital as inputs following either Levinsohn & Petrin (2003), Ackerberg et al. (2015) or Wooldridge (2009) estimation. For each methodology a different production function is estimated for each 2-digit sector.
Profit rate	Profits defined as revenues minus cost of inputs minus labor costs divided by total revenues.

We define two additional worker outcomes following Yagan (2019). First we define a measure of relative months worked:

$$l'_{it} = \ months_{it} - (\frac{1}{4}) \sum_{s=2004}^{2007} months_{is} \tag{A1}$$

where $months_{is}$ is the number of months that worker i is formally employed in year s.

Second, we define a measure of relative wages:

$$w'_{it} = \ wages_{it} - (\frac{1}{4}) \sum_{4}^{2007} wages_{is} \tag{A2}$$

where $wage_{is}$ is the monthly real wage of worker i in year s.

The sample used to construct the Yagan wage measures excludes the observations of workers with the maximum monthly wage in each year.

B.   Estimation of Firm Wage Premia

We follow Abowd et al. (1999) to decompose worker wages into a worker component and a firm component, focusing on Brazil's worker panel dataset over the pre-GFC period (2004-2007). The specification we estimate is given by:

$$w_{ijt} = \alpha_i + \phi_{j(i,t)} + \gamma_t + \beta X_{it} + u_{ijt} \tag{B1}$$

where w is the real monthly wage for worker i employed by firm j in year t, α_i is a worker fixed effect that reflects unobserved efficiency and other worker capabilities that are transferable across employer firms, $\phi_{j(i,t)}$ is a firm fixed effect that captures a premium or discount paid by the firm to all its workers (above or below average wages), γ_t are year fixed effects, X_{it} is a vector of time-varying worker characteristics (age and age squared), and u_{ijt} is an error term. The firm fixed effects in this equation are identified based on workers that transition across employer firms. Worker mobility is thus crucial for identification of these firm fixed effects.

The estimation of the equation above by OLS results in estimated worker fixed effects that we use as a proxy for the worker unobserved ability. We split the worker sample into workers that are in the first, second and third deciles of the estimated worker effects.

C. Additional Worker Results

Figure C1: Average GDP Growth in Firms' Destinations
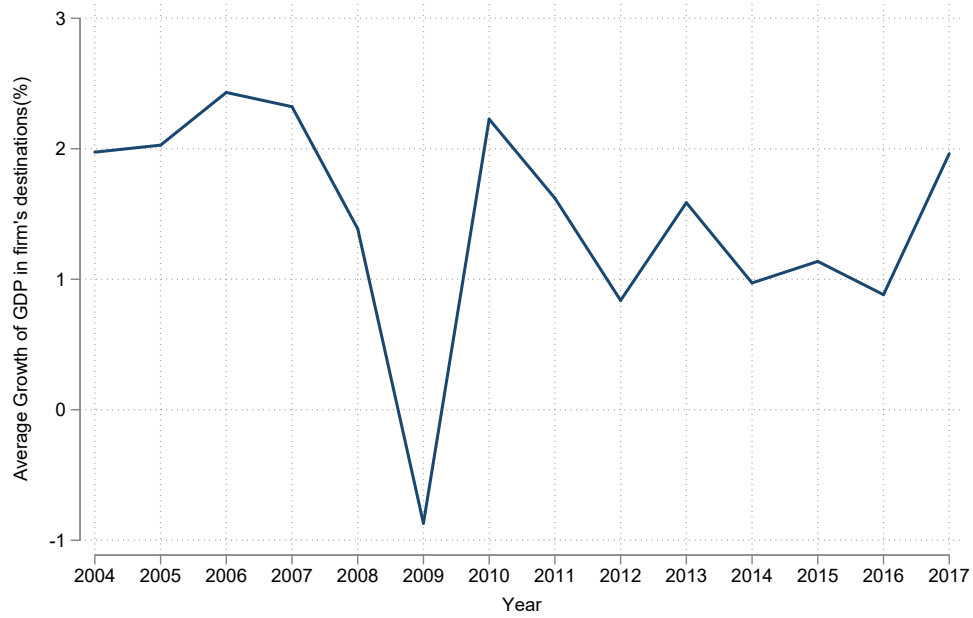
Note: The graph shows the average of the growth of GDP in firms' destinations in each sample year.

Figure C2: Pre-GFC Trends in Firm Employment and Wages Depending on Firm GFC Foreign Shock

(a) Firm total employment

(b) Firm total real wages
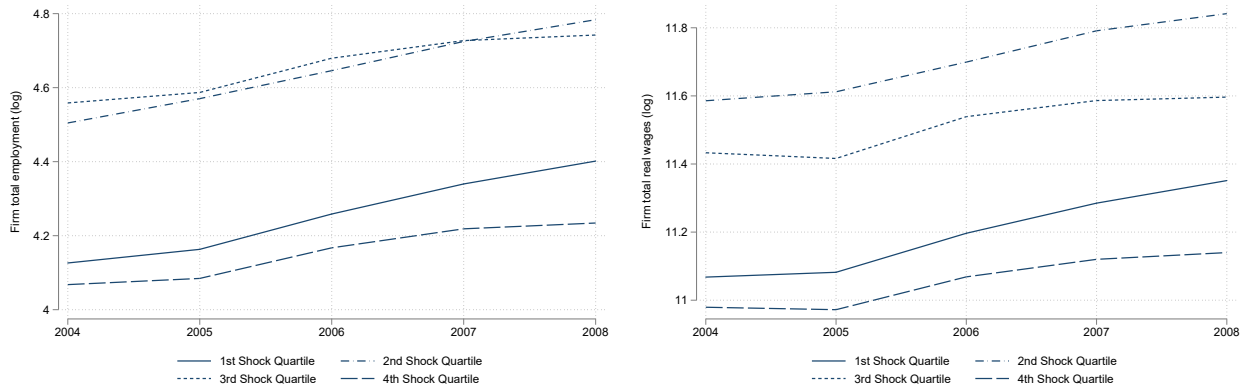
Note: The graphs plot the evolution of firm total employment (log) (in panel a) and firm total real wages (log) (in panel b) before the GFC in 2004-2007 for four groups of firms defined by the quartiles of the distribution of firm GFC foreign shocks.

Figure C3: Workers' Adjustment to GDP Decline in Firms' Destinations
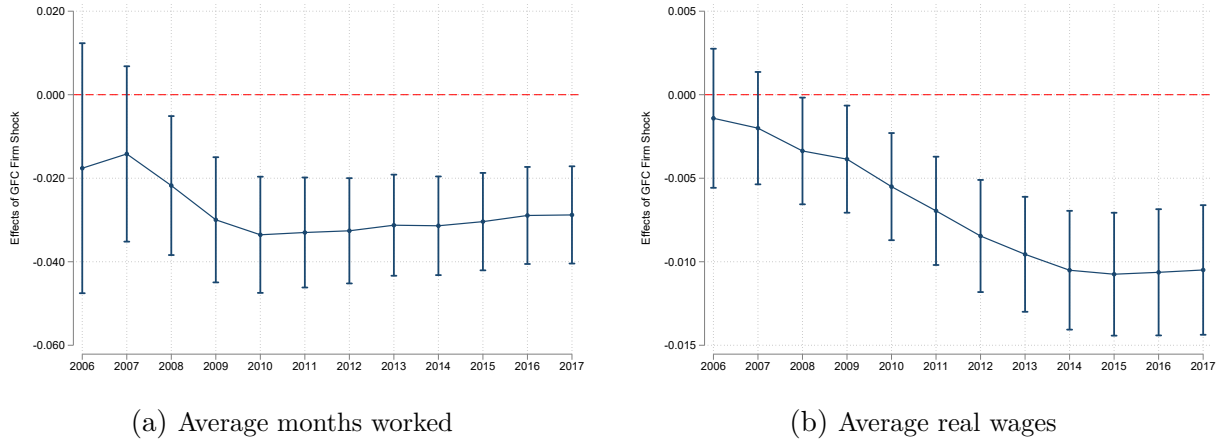
(a) Average months worked

(b) Average real wages

Note: The graphs show the coefficients obtained from estimating Equation (2) by OLS based on a sample of about 3 million worker-year observations controlling for vectors of worker and firm characteristics as of 2005 described in Section III as well as 2-digit sector-year and region-year fixed effects. Confidence intervals at the 95 percent level shown are based on robust standard errors clustered by firm.

Figure C4: Workers' Adjustment to GDP Decline in Firms' Destinations (Yearly Regressions)

(a) Average months worked

(b) Average real wages
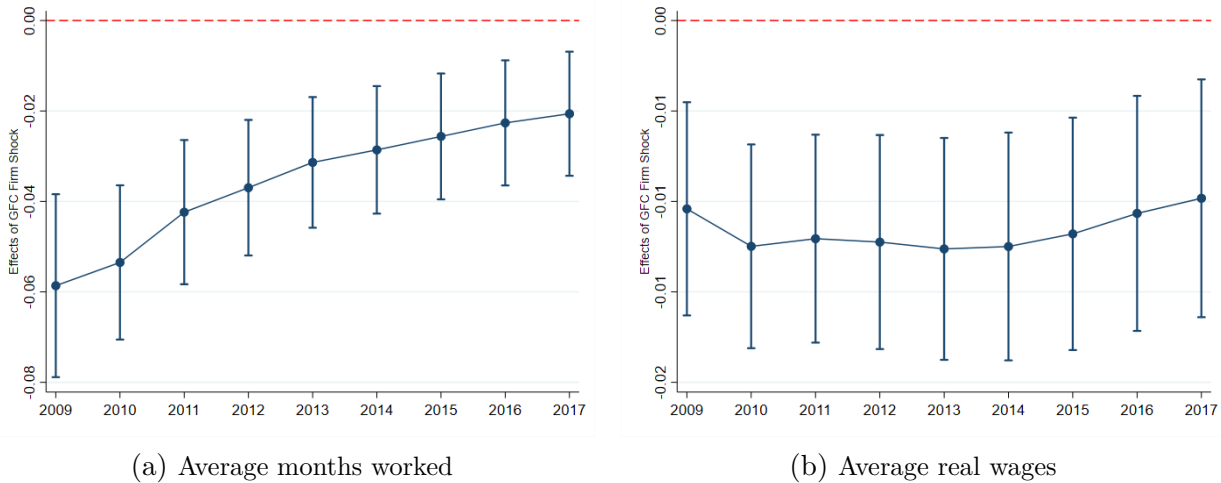
Note: The graphs show the coefficients obtained from estimating a variant of Equation (2) separately for each year by OLS based on a sample averaging 340 thousand worker-year observations controlling for vectors of worker and firm characteristics as of 2007 described in Section III as well as 2-digit sector and region fixed effects. Confidence intervals at the 95 percent level shown are based on robust standard errors clustered by firm.

Table C1: Workers' Adjustment to GDP Decline in Firms' Destinations - All Coefficients

	Average months worked	Average real wages
	(1)	(2)
GFC firm shock * 2009	-0.0567***	-0.0086***
	(0.0106)	(0.0031)
GFC firm shock * 2010	-0.0517***	-0.0113***
	(0.0088)	(0.0029)
GFC firm shock * 2011	-0.0411***	-0.0114***
	(0.0082)	(0.0030)
GFC firm shock * 2012	-0.0365***	-0.0121***
	(0.0077)	(0.0030)
GFC firm shock * 2013	-0.0315***	-0.0130***
	(0.0074)	(0.0031)
GFC firm shock * 2014	-0.0292***	-0.0132***
	(0.0072)	(0.0032)
GFC firm shock * 2015	-0.0267***	-0.0127***
	(0.0070)	(0.0032)
GFC firm shock * 2016	-0.0242***	-0.0116***
	(0.0070)	(0.0033)
GFC firm shock * 2017	-0.0229***	-0.0109***
	(0.0069)	(0.0033)
Age base (2007)	0.2268***	-0.1239***
	(0.0108)	(0.0050)
Age sq. base (2007)	-0.0034***	0.0014***
	(0.0002)	(0.0001)
Higher education or more	0.6409***	0.4986***
	(0.0281)	(0.0183)
Male	0.5600***	0.2655***
	(0.0247)	(0.0104)
Previous labor force attachment	2.5960***	-2.9123***
	(0.0676)	(0.0345)
Total employment base (log 2007)	0.0304	-0.0010
	(0.0237)	(0.0067)
Importer base (2007)	0.3814***	0.1493***
	(0.0534)	(0.0227)
Firm avg. growth in total employment	-0.1230	-0.0570
	(0.2042)	(0.1026)
Firm avg. growth in total wages	0.0561	-0.0744
	(0.1962)	(0.0772)
Observations	3,046,074	3,030,524
R-squared	0.1275	0.2757
2-digit industry X Year FE	Yes	Yes
State X Year FE	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. FE stands for fixed effects.

Table C2: Robustness of Workers' Adjustment to GDP Decline in Firms' Destinations

	Average months worked				Average real wages			
	Dropping commodity boom-affected sectors	Dropping recent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	Dropping commodity boom-affected sectors	Dropping recent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GFC firm shock*2009	-0.0464***	-0.0575***	-0.0504***	-0.0512***	-0.0038	-0.0090***	-0.0076**	-0.0024
	(0.0110)	(0.0105)	(0.0107)	(0.0112)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
GFC firm shock*2010	-0.0415***	-0.0525***	-0.0462***	-0.0426***	-0.0064**	-0.0118***	-0.0103***	-0.0056*
	(0.0088)	(0.0087)	(0.0088)	(0.0089)	(0.0029)	(0.0029)	(0.0030)	(0.0029)
GFC firm shock*2011	-0.0311***	-0.0419***	-0.0359***	-0.0300***	-0.0065**	-0.0119***	-0.0103***	-0.0060**
	(0.0081)	(0.0081)	(0.0082)	(0.0081)	(0.0029)	(0.0029)	(0.0030)	(0.0029)
GFC firm shock*2012	-0.0267***	-0.0373***	-0.0313***	-0.0244***	-0.0074**	-0.0126***	-0.0109***	-0.0070**
	(0.0075)	(0.0076)	(0.0077)	(0.0075)	(0.0030)	(0.0030)	(0.0030)	(0.0030)
GFC firm shock*2013	-0.0219***	-0.0323***	-0.0263***	-0.0200***	-0.0084***	-0.0134***	-0.0118***	-0.0082***
	(0.0072)	(0.0073)	(0.0074)	(0.0071)	(0.0031)	(0.0031)	(0.0031)	(0.0031)
GFC firm shock*2014	-0.0202***	-0.0300***	-0.0239***	-0.0188***	-0.0086***	-0.0136***	-0.0119***	-0.0088***
	(0.0070)	(0.0071)	(0.0072)	(0.0069)	(0.0031)	(0.0032)	(0.0032)	(0.0031)
GFC firm shock*2015	-0.0177**		-0.0214***	-0.0170**	-0.0082***		-0.0114***	-0.0088***
	(0.0069)		(0.0070)	(0.0069)	(0.0032)		(0.0033)	(0.0032)
GFC firm shock*2016	-0.0151**		-0.0189***	-0.0153**	-0.0074**		-0.0104***	-0.0085***
	(0.0068)		(0.0070)	(0.0069)	(0.0032)		(0.0033)	(0.0032)
GFC firm shock*2017	-0.0141**		-0.0177**	-0.0152**	-0.0067**		-0.0096***	-0.0083**
	(0.0068)		(0.0069)	(0.0069)	(0.0033)		(0.0033)	(0.0033)
Observations	2,753,645	2,042,335	3,076,506	2,753,663	2,739,082	2,031,597	3,060,819	2,739,100
R-squared	0.105	0.123	0.126	0.104	0.2946	0.2714	0.2748	0.2944
2-digit industry X Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	No
State X Year FE	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Municipality X Year FE	No	No	No	No	No	No	No	No
4-digit industry X Year FE	No	No	No	No	No	No	No	No
2-digit industry FE	No	No	No	Yes	No	No	No	Yes
State FE	No	No	No	Yes	No	No	No	Yes
Year FE	No	No	No	Yes	No	No	No	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table C3: Workers' Adjustment to GDP Decline in Firms' Destinations using Alternative Worker Outcomes

	Average months worked following Yagan (2019)	Average real wages following Yagan (2019)	Indicator for being fired (Definition 1)	Indicator for being fired (Definition 2)
	(1)	(2)	(3)	(4)
GFC firm shock*2009	-0.0544***	-28.6391***	0.0003*	0.0003*
	(0.0108)	(6.3102)	(0.0002)	(0.0002)
GFC firm shock*2010	-0.0441***	-28.4306***	0.0000	0.0000
	(0.0104)	(6.3088)	(0.0002)	(0.0002)
GFC firm shock*2011	-0.0186*	-28.3811***	-0.0002	-0.0002
	(0.0098)	(6.2924)	(0.0002)	(0.0002)
GFC firm shock*2012	-0.0192**	-28.2186***	-0.0003	-0.0003
	(0.0089)	(6.2794)	(0.0002)	(0.0002)
GFC firm shock*2013	-0.0089	-27.9682***	0.0001	0.0001
	(0.0084)	(6.2490)	(0.0002)	(0.0002)
GFC firm shock*2014	-0.0163**	-27.6736***	-0.0000	0.0000
	(0.0083)	(6.1863)	(0.0002)	(0.0002)
GFC firm shock*2015	-0.0088	-27.0546***	0.0002	0.0002
	(0.0088)	(6.1000)	(0.0003)	(0.0003)
GFC firm shock*2016	-0.0081	-26.9920***	0.0000	0.0000
	(0.0089)	(6.0603)	(0.0003)	(0.0003)
GFC firm shock*2017	-0.0121	-26.2731***	0.0002	0.0002
	(0.0087)	(5.9758)	(0.0003)	(0.0003)
Observations	3,046,074	3,046,074	2,463,396	2,463,396
R-squared	0.3118	0.4228	0.0161	0.0162
2-digit industry X Year FE	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table C4: Robustness of Workers' Adjustment to GDP Decline in Firms' Destinations using Alternative Shocks

	Average months worked		Average real wages	
	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations fixing weights to 2006-2007	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations fixing weights to 2006-2007
	(1)	(2)	(3)	(4)
GFC firm shock*2009	-0.0534***	-0.0565***	-0.0067**	-0.0075***
	(0.0099)	(0.0103)	(0.0029)	(0.0029)
GFC firm shock*2010	-0.0514***	-0.0504***	-0.0101***	-0.0106***
	(0.0084)	(0.0085)	(0.0027)	(0.0027)
GFC firm shock*2011	-0.0431***	-0.0413***	-0.0106***	-0.0110***
	(0.0078)	(0.0079)	(0.0027)	(0.0028)
GFC firm shock*2012	-0.0390***	-0.0373***	-0.0113***	-0.0120***
	(0.0073)	(0.0074)	(0.0027)	(0.0029)
GFC firm shock*2013	-0.0340***	-0.0329***	-0.0125***	-0.0132***
	(0.0070)	(0.0071)	(0.0028)	(0.0030)
GFC firm shock*2014	-0.0310***	-0.0309***	-0.0132***	-0.0138***
	(0.0068)	(0.0069)	(0.0029)	(0.0031)
GFC firm shock*2015	-0.0287***	-0.0285***	-0.0131***	-0.0137***
	(0.0067)	(0.0068)	(0.0030)	(0.0031)
GFC firm shock*2016	-0.0267***	-0.0261***	-0.0127***	-0.0130***
	(0.0067)	(0.0067)	(0.0030)	(0.0032)
GFC firm shock*2017	-0.0252***	-0.0249***	-0.0122***	-0.0126***
	(0.0066)	(0.0067)	(0.0031)	(0.0032)
Observations	3,349,256	3,163,251	3,332,057	3,147,149
R-squared	0.1254	0.1272	0.2784	0.2765
2-digit industry X Year FE	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table C5: Heterogeneous Impacts of GDP Decline in Firms' Destinations by Worker Characteristics

	Average months worked		Average real wage	
	Coefficient	Test eq. of coeff. t-test p-value	Coefficient	Test eq. of coeff. t-test p-value
	(1)	(2)	(3)	(4)
GFC firm shock*Low previous formal sector attach.	-0.0270***		-0.0146***	
	(0.0097)		(0.0051)	
GFC firm shock*High previous formal sector attach.	-0.0377***	-1.0231	-0.0082***	1.2577
	(0.0082)	(0.3063)	(0.0017)	(0.2085)
Observations	3,046,074		3,030,524	
R-squared	0.8541		0.5698	
GFC firm shock*AKM below median	-0.0444***		-0.0077***	
	(0.0084)		(0.0027)	
GFC firm shock*AKM above median	-0.0260***	-2.2585	-0.0078***	0.0105
	(0.0077)	(0.0239)**	(0.0029)	(0.9916)
Observations	2,298,119		2,297,958	
R-squared	0.8729		0.7082	
2-digit industry X Year FE	Yes		Yes	
State X Year FE	Yes		Yes	

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. AKM stands for worker fixed effects estimated following Abowd et al. (1999) as described in Appendix Section B. FE stands for fixed effects.

D. Additional Firm Results

Table D1: Adjustment in Firm Exit to GDP Decline in Firms' Destinations Mediated by Firm Characteristics in 2007

	RAIS	PIA				
				Firm exit		
Firm characteristic base	Firm size (log)	Firm size (log)	Firm labor productivity (log)	Firm TFP L-P (log)	Firm TFP ACF (log)	Firm TFP Wooldridge (log)
GFC firm shock*2009	-0.0001	0.0023	0.0170**	0.0107	0.0088**	0.0106*
	(0.0012)	(0.0020)	(0.0080)	(0.0061)	(0.0038)	(0.0060)
GFC firm shock*2010	0.0032**	0.0035**	0.0061	0.0119***	0.0096**	0.0044**
	(0.0010)	(0.0015)	(0.0046)	(0.0045)	(0.0039)	(0.0044)
GFC firm shock*2011	0.0010	0.0038**	0.0171	0.0197*	0.0114*	0.0100*
	(0.0012)	(0.0017)	(0.0095)	(0.0102)	(0.0061)	(0.0100)
GFC firm shock*2012	0.0003	0.0038	0.0074*	0.0101*	0.0075**	0.0052*
	(0.0013)	(0.0019)	(0.0042)	(0.0053)	(0.0034)	(0.0052)
GFC firm shock*2013	0.0027**	0.0019	0.0201**	0.0232**	0.0103**	0.0055***
	(0.0011)	(0.0019)	(0.0087)	(0.0084)	(0.0050)	(0.0055)
GFC firm shock*2014	-0.0014					
	(0.0013)					
GFC firm shock*2015	0.0005					
	(0.0013)					
GFC firm shock*2016	0.0019					
	(0.0012)					
GFC firm shock*2009*Firm characteristic base 2007	-0.0000	-0.0002	-0.0014**	-0.0007	-0.0013**	-0.0008*
	(0.0002)	(0.0004)	(0.0007)	(0.0005)	(0.0006)	(0.0005)
GFC firm shock*2010*Firm characteristic base 2007	-0.0003	-0.0007***	-0.0006	-0.0009***	-0.0016**	-0.0009***
	(0.0002)	(0.0003)	(0.0004)	(0.0003)	(0.0006)	(0.0003)
GFC firm shock*2011*Firm characteristic base 2007	0.0000	-0.0007***	-0.0015*	-0.0015**	-0.0018**	-0.0015*
	(0.0002)	(0.0003)	(0.0008)	(0.0008)	(0.0009)	(0.0008)
GFC firm shock*2012*Firm characteristic base 2007	-0.0000	-0.0008**	-0.0007*	-0.0008**	-0.0013***	-0.0008*
	(0.0002)	(0.0003)	(0.0004)	(0.0004)	(0.0005)	(0.0004)
GFC firm shock*2013*Firm characteristic base 2007	-0.0004**	-0.0005	-0.0019**	-0.0018***	-0.0018**	-0.0013***
	(0.0002)	(0.0003)	(0.0008)	(0.0006)	(0.0008)	(0.0004)
GFC firm shock*2014*Firm characteristic base 2007	0.0002					
	(0.0002)					
GFC firm shock*2015*Firm characteristic base 2007	0.0002					
	(0.0002)					
GFC firm shock*2016*Firm characteristic base 2007	-0.0002					
	(0.0002)					
Observations	107,541	26,054	26,787	26,178	25,981	26,244
R-squared	0.0169	0.0129	0.0144	0.0148	0.0120	0.0139
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All firm characteristics in base year 2007 enter in logarithms. The specification controls for a vector of firm characteristics as of 2007 described in Section C.. L-P refers to Levinsohn & Petrin (2003). ACF refers to Ackerberg et al. (2015). Wooldridge refers to Wooldridge (2009). FE stands for fixed effects.

Table D2: Robustness of Firms' Adjustment to GDP Decline in Firms' Destinations

	Panel A: Firm size					Panel B: Firm total real wages				
	Dropping commodity boom-affected sectors	Dropping resent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	More disaggregated fixed effects	Dropping commodity boom-affected sectors	Dropping recent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	More disaggregated fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GFC firm shock*2009	-0.0157***	-0.0152***	-0.0230***	-0.0107***	-0.0113***	-0.0161***	-0.0173***	-0.0308***	-0.0189***	-0.0119***
	(0.0028)	(0.0026)	(0.0050)	(0.0028)	(0.0029)	(0.0035)	(0.0033)	(0.0051)	(0.0034)	(0.0038)
GFC firm shock*2010	-0.0214***	-0.0210***	-0.0295***	-0.0197***	-0.0174***	-0.0231***	-0.0244***	-0.0376***	-0.0260***	-0.0197***
	(0.0033)	(0.0032)	(0.0052)	(0.0033)	(0.0036)	(0.0037)	(0.0036)	(0.0053)	(0.0036)	(0.0041)
GFC firm shock*2011	-0.0253***	-0.0254***	-0.0314***	-0.0250***	-0.0213***	-0.0243***	-0.0257***	-0.0376***	-0.0274***	-0.0205***
	(0.0036)	(0.0035)	(0.0053)	(0.0035)	(0.0039)	(0.0039)	(0.0039)	(0.0054)	(0.0038)	(0.0044)
GFC firm shock*2012	-0.0254***	-0.0253***	-0.0315***	-0.0241***	-0.0201***	-0.0265***	-0.0280***	-0.0378***	-0.0285***	-0.0228***
	(0.0040)	(0.0039)	(0.0056)	(0.0038)	(0.0044)	(0.0042)	(0.0041)	(0.0056)	(0.0040)	(0.0048)
GFC firm shock*2013	-0.0276***	-0.0280***	-0.0344***	-0.0284***	-0.0240***	-0.0267***	-0.0282***	-0.0370***	-0.0282***	-0.0257***
	(0.0042)	(0.0041)	(0.0056)	(0.0040)	(0.0046)	(0.0045)	(0.0044)	(0.0057)	(0.0043)	(0.0050)
GFC firm shock*2014	-0.0297***	-0.0300***	-0.0350***	-0.0300***	-0.0273***	-0.0284***	-0.0304***	-0.0394***	-0.0279***	-0.0298***
	(0.0044)	(0.0044)	(0.0057)	(0.0042)	(0.0049)	(0.0046)	(0.0045)	(0.0057)	(0.0044)	(0.0051)
GFC firm shock*2015	-0.0300***		-0.0390***	-0.0305***	-0.0281***	-0.0275***		-0.0407***	-0.0255***	-0.0295***
	(0.0045)		(0.0058)	(0.0043)	(0.0050)	(0.0048)		(0.0058)	(0.0045)	(0.0054)
GFC firm shock*2016	-0.0226***		-0.0328***	-0.0244***	-0.0224***	-0.0238***		-0.0385***	-0.0246***	-0.0269***
	(0.0048)		(0.0059)	(0.0046)	(0.0053)	(0.0051)		(0.0059)	(0.0048)	(0.0057)
GFC firm shock*2017	-0.0215***		-0.0322***	-0.0252***	-0.0229***	-0.0233***		-0.0380***	-0.0228***	-0.0255***
	(0.0051)		(0.0061)	(0.0049)	(0.0056)	(0.0053)		(0.0062)	(0.0050)	(0.0058)
Observations	89,161	64,541	91,971	92,003	86,858	79,312	58,146	82,313	82,338	77,049
R-squared	0.5413	0.5915	0.1211	0.5293	0.6124	0.4797	0.5196	0.1306	0.4692	0.5638

	Panel C: Firm exit					Panel D: Firm share of skilled workers				
	Dropping commodity boom-affected sectors	Dropping resent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	More disaggregated fixed effects	Dropping commodity boom-affected sectors	Dropping resent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	More disaggregated fixed effects
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
GFC firm shock*2009	-0.0004	-0.0003	-0.0002	-0.0002	-0.0007	0.0005	0.0006	0.0024***	0.0010**	0.0009*
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)
GFC firm shock*2010	0.0020***	0.0019***	0.0020***	0.0021***	0.0019***	0.0006	0.0007	0.0025***	0.0010**	0.0010**
	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)
GFC firm shock*2011	0.0009	0.0010*	0.0011*	0.0012*	0.0012	0.0010**	0.0010**	0.0028***	0.0012***	0.0013***
	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)
GFC firm shock*2012	0.0001	0.0001	0.0002	-0.0003	0.0002	0.0012***	0.0012***	0.0031***	0.0013***	0.0017***
	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)
GFC firm shock*2013	0.0009	0.0010	0.0010*	0.0010*	0.0009	0.0014***	0.0014***	0.0033***	0.0013***	0.0018***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0005)
GFC firm shock*2014	-0.0003	-0.0004	-0.0004	-0.0004	-0.0004	0.0017***	0.0016***	0.0037***	0.0014***	0.0023***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0005)
GFC firm shock*2015	0.0017**		0.0016**	0.0014**	0.0017**	0.0015***		0.0036***	0.0011**	0.0020***
	(0.0007)		(0.0007)	(0.0007)	(0.0008)	(0.0005)		(0.0006)	(0.0005)	(0.0006)
GFC firm shock*2016	0.0012*		0.0012*	0.0010	0.0013	0.0014**		0.0036***	0.0010*	0.0022***
	(0.0007)		(0.0007)	(0.0007)	(0.0008)	(0.0006)		(0.0006)	(0.0005)	(0.0006)
GFC firm shock*2017						0.0014**		0.0034***	0.0007	0.0022***
						(0.0006)		(0.0007)	(0.0006)	(0.0007)
Observations	103,325	83,085	107,541	107,554	102,303	114,510	83,085	119,189	119,204	113,341
R-squared	0.0162	0.0162	0.0123	0.0104	0.1037	0.4843	0.4899	0.2121	0.4807	0.5540

Year FE	No	No	No	Yes	No	No	No	No	Yes	No
2-digit industry FE	No	No	No	Yes	No	No	No	No	Yes	No
State FE	No	No	No	Yes	No	No	No	No	Yes	No
2-digit industry X Year FE	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No
State X Year FE	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No
Municipality X Year FE	No	No	No	No	Yes	No	No	No	No	Yes
4-digit industry FE	No	No	No	No	No	No	No	No	No	No
4-digit industry X Year FE	No	No	No	No	Yes	No	No	No	No	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Section *C.*. FE stands for fixed effects.

Table D3: Robustness of Firms' Adjustment to GDP Decline in Firms' Destinations using Alternative Shocks

	Panel A: Firm size		Panel B: Firm total real wages	
	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations using weights in t-1 and t-2	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations using weights in t-1 and t-2
	(1)	(2)	(3)	(4)
GFC firm shock*2009	-0.0130***	-0.0164***	-0.0165***	-0.0206***
	(0.0021)	(0.0024)	(0.0026)	(0.0030)
GFC firm shock*2010	-0.0138***	-0.0206***	-0.0173***	-0.0255***
	(0.0025)	(0.0029)	(0.0028)	(0.0032)
GFC firm shock*2011	-0.0157***	-0.0243***	-0.0183***	-0.0271***
	(0.0027)	(0.0031)	(0.0030)	(0.0035)
GFC firm shock*2012	-0.0144***	-0.0242***	-0.0192***	-0.0293***
	(0.0030)	(0.0035)	(0.0032)	(0.0037)
GFC firm shock*2013	-0.0173***	-0.0267***	-0.0195***	-0.0297***
	(0.0032)	(0.0037)	(0.0034)	(0.0039)
GFC firm shock*2014	-0.0175***	-0.0270***	-0.0207***	-0.0309***
	(0.0035)	(0.0040)	(0.0036)	(0.0041)
GFC firm shock*2015	-0.0196***	-0.0284***	-0.0183***	-0.0281***
	(0.0036)	(0.0041)	(0.0037)	(0.0042)
GFC firm shock*2016	-0.0130***	-0.0219***	-0.0171***	-0.0255***
	(0.0038)	(0.0044)	(0.0039)	(0.0046)
GFC firm shock*2017	-0.0117***	-0.0211***	-0.0153***	-0.0234***
	(0.0040)	(0.0046)	(0.0041)	(0.0048)
Observations	144,464	108,960	132,562	98,686
R-squared	0.5358	0.5366	0.4796	0.4807

	Panel C: Firm exit		Panel D: Firm share of skilled workers	
	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations using weights in t-1 and t-2	Shock GDP growth export destinations fixing weights to 2004-2007	Shock GDP growth export destinations using weights in t-1 and t-2
	(5)	(6)	(7)	(8)
GFC firm shock*2009	0.0002	0.0003	0.0018***	0.0013***
	(0.0005)	(0.0006)	(0.0003)	(0.0004)
GFC firm shock*2010	0.0018***	0.0020***	0.0016***	0.0012***
	(0.0005)	(0.0005)	(0.0003)	(0.0004)
GFC firm shock*2011	0.0008	0.0013**	0.0018***	0.0016***
	(0.0005)	(0.0006)	(0.0003)	(0.0004)
GFC firm shock*2012	0.0000	0.0005	0.0017***	0.0017***
	(0.0005)	(0.0006)	(0.0004)	(0.0004)
GFC firm shock*2013	0.0007	0.0016***	0.0019***	0.0016***
	(0.0005)	(0.0006)	(0.0004)	(0.0004)
GFC firm shock*2014	0.0004	0.0000	0.0021***	0.0017***
	(0.0006)	(0.0006)	(0.0004)	(0.0004)
GFC firm shock*2015	0.0007	0.0014**	0.0021***	0.0014***
	(0.0006)	(0.0006)	(0.0004)	(0.0005)
GFC firm shock*2016	0.0018***	0.0014**	0.0022***	0.0016***
	(0.0006)	(0.0007)	(0.0004)	(0.0005)
GFC firm shock*2017			0.0018***	0.0014**
			(0.0005)	(0.0006)
Observations	161,077	124,806	178,188	138,216
R-squared	0.0148	0.0159	0.4761	0.4757
2-digit industry X Year FE	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Section *C.*. FE stands for fixed effects.

We estimate an alternative specification that links time-varying firm shocks, GDP growth in the firm's destinations, to time-varying firm outcomes given by:

$$y_{jt} = \beta shock_{jt-1} + \gamma_1 Z_{jt} + \gamma_2 Z_{s4t} + I^{st} + I^{rt} + I^j + \upsilon_{jt} \tag{D1}$$

where Z_{jt} is a vector of firm covariates, Z_{s4t} corresponds to 4-digit sector s "pre-trends" (past growth in 4-digit sector outcome), I^{st} and I^{rt} stand for, respectively, 2-digit sector-year and region-year fixed effects, I^j stands for firm fixed effects that are included in some of the specifications, and υ_{jt} is an error term. This specification is estimated using data for the entire sample period before and after the GFC (2004-2017). Note that the main regressor is minus the time-varying average GDP growth in the firm's export destinations in the same way that the multiplication by minus 1 is used in Section II for the firm shock fixed at its 2008 value. The specifications control also for time-varying firm shocks based on imports, GDP growth in the firm's origins.

Table D4: Firm Labor Market Outcomes' Adjustment to Time-Varying Shock

	Firm size		Total real wage		Firm Exit		Share of skilled workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged firm shock GDP growth export dest.	-0.1057***	-0.0203***	-0.1069***	-0.0172***	-0.0008***	0.0003**	-0.0013***	0.0001
	(0.0012)	(0.0005)	(0.0011)	(0.0004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Lagged firm shock GDP growth import sources	-0.1273***	-0.0232***	-0.1228***	-0.0182***	0.0013***	0.0007***	-0.0017***	0.0001
	(0.0012)	(0.0006)	(0.0011)	(0.0005)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	467,114	464,907	458,657	456,352	436,714	434,453	332,779	330,622
R-squared	0.1565	0.8926	0.1924	0.9069	0.0098	0.2189	0.2142	0.8564
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. FE stands for fixed effects.

Table D5: Firm Performance Outcomes' Adjustment to Time-Varying Shock

	Net revenues	Materials (log)	Materials per worker (log)	Capital (log)	Capital per worker (log)	TFP L-P (log)	Labor productivity (log)	Profit rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged firm shock GDP growth export destination	-0.0078***	-0.0079***	-0.0024***	-0.0158***	-0.0082***	-0.0051***	-0.0027***	-0.0005**
	(0.0006)	(0.0009)	(0.0008)	(0.0016)	(0.0008)	(0.0007)	(0.0007)	(0.0002)
Lagged firm shock GDP growth import sources	-0.0072***	-0.0071***	-0.0023**	-0.0124***	-0.0073***	-0.0054***	-0.0036***	-0.0007***
	(0.0006)	(0.0010)	(0.0009)	(0.0017)	(0.0016)	(0.0009)	(0.0008)	(0.0002)
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. L-P refers to Levinsohn & Petrin (2003). FE stands for fixed effects.

Table D6: Robustness of Adjustment of Firm Labor Market Outcomes to Time-Varying Shock Using Alternative Shocks

	Firm size		Firm total real wages		Firm exit		Firm share of skilled workers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged firm shock GDP growth export dest.	-0.1288***	-0.0230***	-0.1293***	-0.0193***	-0.0005***	0.0004***	-0.0016***	0.0001*
	(0.0012)	(0.0005)	(0.0012)	(0.0004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Lagged firm shock real exchange rate export dest.	-0.0442***	-0.0041***	-0.0483***	-0.0022***	0.0004***	0.0003**	-0.0019***	0.0000
	(0.0017)	(0.0005)	(0.0016)	(0.0005)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Lagged firm shock real exchange rate import sources	-0.0385***	-0.0047***	-0.0319***	-0.0030***	0.0006*	0.0007***	-0.0006*	0.0000
	(0.0040)	(0.0012)	(0.0035)	(0.0010)	(0.0003)	(0.0003)	(0.0003)	(0.0001)
Observations	467,114	464,907	458,657	456,352	436,714	434,453	332,779	330,622
R-squared	0.1341	0.8921	0.1692	0.9066	0.0095	0.2189	0.2141	0.8564
Lagged firm shock GDP growth export dest. fixing weights to 2004-2007	-0.0716***	0.0140***	-0.0747***	0.0137***	-0.0005***	-0.0006***	0.0005***	0.0001
	(0.0015)	(0.0006)	(0.0014)	(0.0006)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Observations	467,114	464,907	458,657	456,352	436,714	434,453	332,779	330,622
R-squared	0.1256	0.8917	0.1584	0.9063	0.0095	0.2189	0.2138	0.8564
Lagged firm shock GDP growth export dest. using weights in t-1 and t-2	-0.0916***	-0.0190***	-0.0933***	-0.0163***	-0.0010***	0.0001	-0.0010***	0.0001
	(0.0011)	(0.0005)	(0.0011)	(0.0004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	467,114	464,907	458,657	456,352	436,714	434,453	332,779	330,622
R-squared	0.1515	0.8925	0.1867	0.9068	0.0098	0.2189	0.2139	0.8564
2-digit industry*year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. FE stands for fixed effects.

E. Evidence for Ecuador

To examine the impact of foreign shocks on workers and firms in Ecuador we use the Instituto Ecuatoriano de Seguridad Social (IESS) database for the 2006-2017 period, an administrative longitudinal employer-employee database similar to Brazil's RAIS covering all formal workers and their employing firms from Ecuador's social security records.[45] IESS data includes job records for each worker with worker and firm unique identifiers and many demographic characteristics and it is merged with a census of higher education degrees from Ecuador's higher education registry based on a common unique identifier for individuals to obtain education information. In order to construct the worker panel database needed for our analysis of the impact of foreign shocks on worker outcomes we follow the steps described for Brazil, that is, (i) to define a starting worker panel database with the cohort of individuals employed in the tradables sector in 2006 (and entrants after 2006) keeping their entire work histories and selecting for each the highest paid job in April of each year to identify her/his wage, employer firm, and sector, (ii) to construct an auxiliary database with workers in the 16-65 age range employed at least once by an exporting firm, and (iii) to expand the database such that each worker has observations for all consecutive years between the first and last IESS years and after the worker's last IESS year until 2017 provided the worker's age does not surpass 65.[46] While IESS contains information on each firm's industry and sales, it does not contain information on location but we obtain it from the firm registry described below.

To compute GFC-induced foreign demand shocks for firms, we rely on customs data covering the universe of firm-level export and import transactions from Servicio Nacional de Aduana. We merge the customs data with the worker panel database based on a common firm identifier. We derive a firm panel database from the IESS worker panel database where, for each firm, labor market outcome variables are constructed by aggregating across all of its workers in a given year. This firm panel database includes all firms that export at least once during the 2006-2017 period.[47]

In addition, we use the Ecuadorian firm registry (Sistema de Rentas Internas del Ecuador (SRI)) collected by the Superintendence of Companies for the 2007-2017 period merged with

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[45]Access to the IESS employer-employee database is possible only in the National Statistical Institute's premises in Quito hence research based on this database is rare. To our knowledge the only other paper using this database is Muñoz S et al. (2018)

[46]The tradables sector is defined as the set of industries with 2-digit codes less than equal to 33 in ISIC revision 4 classification. Observations with zero months worked correspond to the worker in Ecuador not having a formal job but we have no information as to whether the worker is unemployed, self-employed, working in an informal job, or out of the labor force, a caveat of the IESS data. Given the much smaller size of the labor force in Ecuador than Brazil there is no need to conduct the analysis for a random sample of workers. We exclude from the final sample for Ecuador outliers defined as workers whose monthly wages are higher than 50,000 USD.

[47]For these firms the panel includes all years of data (even years when the firm is not exporting).

firm financial statements to augment the set of firm-level outcomes considered. This is a longitudinal database covering all private formal firms and including information on firm financial characteristics that we use to construct measures of productivity, profits, and non-labor inputs. We link this firm panel database with the IESS firm panel database based on a common unique firm identifier. We merge the location information in the firm registry to the worker panel database. A couple of definitions of variables used for firm outcome measures differ slightly from Brazil are: capital is defined as purchases of capital goods minus sales and disposals for any purpose, plus values registered by the assets constructed by the employees of the firm and value added defined as gross revenues minus intermediate input expenses.

Our analysis for Ecuador relies on more than 89 thousand observations (about 795 thousand worker-year observations) as seen in Appendix Table E1. On average workers are employed 9.2 months per year and the sample includes 13% of observations with zero months worked. Average monthly real earnings are 1,059 in 2010 USD. Appendix Table E2 shows the workers in the Ecuadorian sample average 33 years of age, with a third being female and 11% having a higher education degree. Workers were employed in the formal sector about 80% of the time before the GFC. Firms have on average 129 workers and 73% of firms are importers. Firms experience on average substantial annual growth in employment prior to the GFC. We ensure the representativeness of our IESS worker panel database by showing that the demographics and job characteristics of workers in the worker sample for Ecuador are similar to those of workers in the complete IESS database. In unreported estimates we find that estimates from standard Mincer wage regressions on the Ecuador worker panel show expected patterns: e.g., a male wage premium of 15% and a higher education premium of 75%.

We estimate Equation (2) using the Ecuador worker database and show the results in Appendix Figure E1 and Table E3. The negative coefficients in Panel A of Appendix Figure E1 show that Ecuadorian workers initially employed by harder-hit firms experience a persistent reduction in months worked until 2017, relative to workers in less hard-hit firms. The effects on worker months worked become more negative over time, although the hypothesis that all effects are similar across years cannot be rejected. The point estimates imply that an Ecuadorian worker whose initial firm faced a 10 percentage-point worse shock, worked in the formal sector between 2009 and 2017 for a total of 6.1 fewer total months (7% fewer months).[48]. But GFC firm shocks do not significantly affect workers' real wages in Ecuador. These baseline effects for workers in Ecuador are robust to a series of checks shown in Appendix Table E4.

Allowing for heterogeneity across worker types in the adjustments to GFC firm shocks through the estimation of Equation (5), we find a strong negative adjustment of employment

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[48]This calculation uses the point estimate for 2017 in the months worked regression of -0.068 and the average number of months worked of 9.2 from Appendix Table E1

only for less educated workers and no adjustment for highly educated workers in Appendix Table E5. The estimates also show that female workers in Ecuador are significantly more adversely affected by GFC firm shocks but worker age does not matter for adjustment to foreign shocks.

To understand whether the worker adjustments result from adjustments at the initial employing firm or whether worker movement to other firms or sectors counteracts such adjustments, we perform the decomposition described in Section IV.A. The results in Appendix Table E6 shows that the adjustment to GFC firms shocks is driven by incumbent workers that remain at the initial firm in Ecuador (columns (1)-(2)). There is no countervailing effect of increased employment in other firms in the same or another sector (columns (3)-(5)).

To understand the firm-level mechanisms that drive the persistent adjustments in Ecuador, we estimate Equation (6) for the firm responses to GFC foreign shocks. The results in Appendix Table E7 show a persistent decline in revenues for harder-hit firms in Ecuador, relative to less hard-hit firms (column (1)). However, profit rates are mostly unchanged and firm exit is not a margin of adjustment to GFC foreign shocks for Ecuadorian firms (columns (2)-(3)). GFC foreign shocks lead firms in Ecuador to downsize by reducing their total employment (significantly until 2010)) and total wages (for employment (columns (4)-(5)). Ecuadorian firms reduce both skilled as well as unskilled workers in response to the shock and in similar proportions (columns (6)-(7)). Hence, increasing the share of skilled workers is not a margin of adjustment to GFC foreign shocks in Ecuador (column (8)) in contrast to Brazil. Regarding non-labor input use, Appendix Table E8 shows that materials and materials per worker decline in face of the negative demand shock suffered by firms in Ecuador (columns (1)-(2)) and so does capital and capital per worker use (columns (3)-(4)). For Ecuador within-firm restructuring takes the form of production adjustment with capital-labor substitution for the hardest-hit firms whereas this mechanism is absent in Brazil. The estimates also show a strong negative impact of GFC foreign shocks on firm productivity in Ecuador (columns (5)-(6)).

Table E1: Descriptive Statistics - Ecuador

	Mean	Std. Dev.
	Panel A: Worker panel	
Outcomes		
Months worked per year (2004-2007)	10.9	2.6
Monthly real wages (2004-2007, in local currency)	957.1	2,132.7
Average months worked per year (2009 onward)	9.6	3.7
Average monthly real wages (2009 onward)	1.6	2.4
Firm shock		
Firm shock in 2008 (negative of growth in GDP of destinations)	-3.0	2.5
Total number of worker-year observations		794,948
Total number of unique worker IDs		89,385
Total number of unique firm IDs		887
Share of observations with 0 months worked per year		12.9%
	Panel B: Firm panel	
Outcomes		
Total employment (log)	3.8	1.6
Total real wages (log)	10.5	1.8
Avg. wages (log)	6.7	0.6
Net revenues (log)	12.0	2.1
Materials (log)	14.3	1.9
Materials per worker	10.4	1.5
Capital (log)	13.7	2.1
Capital per worker	9.3	1.4
Labor productivity	10.3	0.9
Profit rate	0.3	0.2
Firm shock		
Firm shock in 2008 (negative of growth in GDP of destinations)	-1.0	2.2
Total number of firm-year observations		24,094
Total number of unique firm IDs		2,859

Note: The worker-level statistics are based on the sample of workers in firms with a non-missing GFC firm shock measure in 2008 used in the regressions. Real wages are expressed in USD in 2010 prices. The firm-level statistics are based on all firms with non-missing GFC shock measure in 2008 used in the main regressions. All statistics for which a time period is not shown in parentheses cover the 2009-2017 period.

Table E2: Additional Descriptive Statistics - Ecuador

|	Mean	Std. Dev.	N
	Panel A: Worker Panel		
Controls (pre-global financial crisis)			
Male	66.6%	47.2%	
Age	33.25	9.61	
Higher education or more	10.8%	31.0%	
Previous formal sector attachment	79.5%	29.2%	
Other			
Young (16-34)	61.5%	48.7%	
Middle age (35-49)	31.3%	46.4%	
Old (50-65)	7.1%	25.7%	
	Panel B: Firm Panel		
Controls (pre-global financial crisis)			
Importer dummy	72.5%	44.7%	
Firm Avg. Growth in total employment	20.7%	55.3%	
Firm Avg. Growth in total wage	26.3%	59.0%	
	Panel C: Worker Panel - Full sample		
Male	68%	47%	15,882,150
Age	33.1	10.3	15,882,150
Higher education	14%	35%	15,882,150
Previous formal sector attachment	39%	43%	15,964,933
Average months worked (cumulative)	5.9	4.6	15,021,274
Average real wages (cumulative)	1.7	12.4	8,368,115

Note: The worker-level statistics in panel A are based on the sample of workers in firms with a non-missing GFC firm shock measure in 2008 used in the regressions. The firm-level statistics in panel B are based on all firms with non-missing GFC shock measure in 2008 used in the main regressions. The worker-level statistics in panel C are based on all workers in the IESS database. Real wages are expressed in local currency in 2010 prices.

Figure E1: Workers' Adjustment to GDP decline in Firms' Destinations - Ecuador
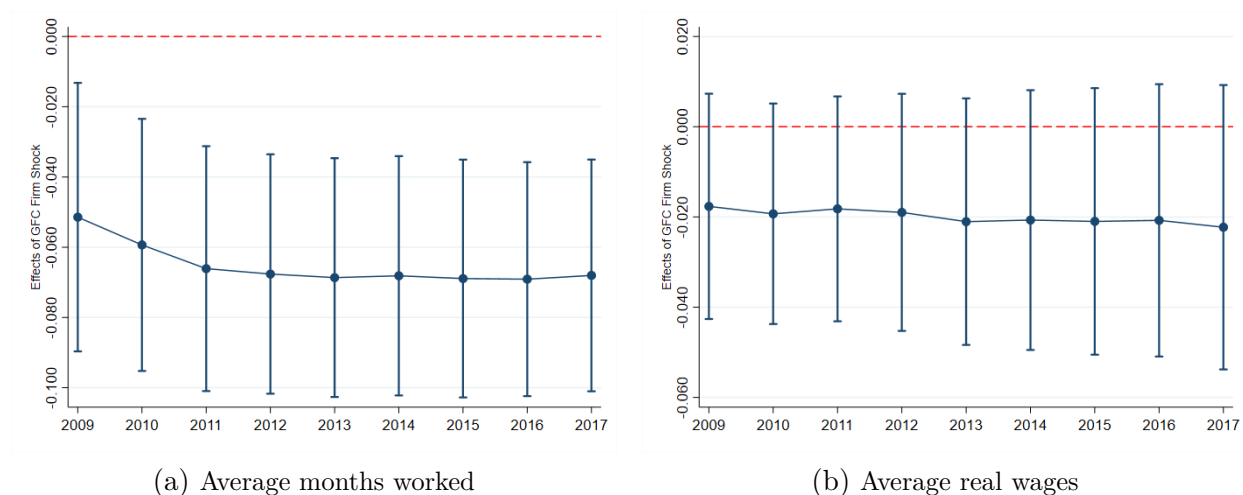
(a) Average months worked

(b) Average real wages

Note: The graphs show the coefficients obtained from estimating Equation (2) by OLS based on a sample of about 800 thousand worker-year observations controlling for vectors of worker and firm characteristics as of 2007 described in Section III as well as 2-digit sector-year and region-year fixed effects. Confidence intervals at the 95 percent level shown are based on robust standard errors clustered by firm. The F-statistic test for the null hypothesis that all coefficients are similar is 1.14 for months worked and 1.19 for real wages, and the corresponding p-values are, respectively, 0.3318 and 0.3017).

Table E3: Workers' Adjustment to GDP Decline in Firms' Destinations - All Coefficients - Ecuador

	Average months worked (cumulative)	Average real wage (cumulative)
	(1)	(2)
GFC Firm Shock * 2009	-0.0514***	-0.0176
	(0.0195)	(0.0127)
GFC Firm Shock * 2010	-0.0593***	-0.0193
	(0.0183)	(0.0125)
GFC Firm Shock * 2011	-0.0661***	-0.0182
	(0.0178)	(0.0127)
GFC Firm Shock * 2012	-0.0676***	-0.0190
	(0.0174)	(0.0134)
GFC Firm Shock * 2013	-0.0686***	-0.0210
	(0.0173)	(0.0139)
GFC Firm Shock * 2014	-0.0681***	-0.0207
	(0.0174)	(0.0147)
GFC Firm Shock * 2015	-0.0689***	-0.0210
	(0.0173)	(0.0151)
GFC Firm Shock * 2016	-0.0691***	-0.0207
	(0.0170)	(0.0154)
GFC Firm Shock * 2017	-0.0680***	-0.0223
	(0.0168)	(0.0161)
Observations	794,948	793,553
R-squared	0.1457	0.0752
2-digit industry X Year FE	Yes	Yes
State X Year FE	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Appendix E. FE stands for fixed effects.

Table E4: Robustness of Workers' Adjustment to GDP Decline in Firms' Destinations - Ecuador

	Average months worked				Average real wage			
	Dropping commodity boom-affected sectors	Dropping recent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects	Dropping commodity boom-affected sectors	Dropping recent domestic recession years	Dropping Firms controls	Separate sector, state and year fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GFC firm shock*2009	-0.0514**	-0.0532***	-0.0530***	-0.0394*	-0.0119	-0.0186	-0.0209*	-0.0093
	(0.0216)	(0.0194)	(0.0195)	(0.0209)	(0.0130)	(0.0127)	(0.0125)	(0.0141)
GFC firm shock*2010	-0.0603***	-0.0611***	-0.0609***	-0.0568***	-0.0113	-0.0202	-0.0226*	-0.0155
	(0.0211)	(0.0182)	(0.0183)	(0.0178)	(0.0120)	(0.0124)	(0.0123)	(0.0134)
GFC firm shock*2011	-0.0674***	-0.0678***	-0.0676***	-0.0667***	-0.0085	-0.0191	-0.0214*	-0.0169
	(0.0207)	(0.0178)	(0.0178)	(0.0175)	(0.0124)	(0.0127)	(0.0126)	(0.0134)
GFC firm shock*2012	-0.0688***	-0.0693***	-0.0692***	-0.0709***	-0.0073	-0.0199	-0.0222*	-0.0189
	(0.0204)	(0.0174)	(0.0175)	(0.0174)	(0.0130)	(0.0134)	(0.0133)	(0.0136)
GFC firm shock*2013	-0.0703***	-0.0702***	-0.0702***	-0.0733***	-0.0073	-0.0219	-0.0243*	-0.0226
	(0.0205)	(0.0174)	(0.0175)	(0.0175)	(0.0135)	(0.0139)	(0.0139)	(0.0139)
GFC firm shock*2014	-0.0700***	-0.0697***	-0.0697***	-0.0731***	-0.0055	-0.0216	-0.0240	-0.0237*
	(0.0207)	(0.0175)	(0.0175)	(0.0175)	(0.0145)	(0.0147)	(0.0147)	(0.0142)
GFC firm shock*2015	-0.0717***		-0.0705***	-0.0717***	-0.0055		-0.0243	-0.0237*
	(0.0206)		(0.0174)	(0.0175)	(0.0150)		(0.0151)	(0.0144)
GFC firm shock*2016	-0.0729***		-0.0707***	-0.0689***	-0.0050		-0.0241	-0.0238
	(0.0202)		(0.0172)	(0.0175)	(0.0155)		(0.0155)	(0.0145)
GFC firm shock*2017	-0.0728***		-0.0696***	-0.0664***	-0.0066		-0.0256	-0.0257*
	(0.0200)		(0.0170)	(0.0177)	(0.0165)		(0.0161)	(0.0149)
Observations	585,643	533,099	794,948	795,144	584,484	532,153	793,553	793,749
R-squared	0.0919	0.1454	0.1455	0.1451	0.1033	0.0722	0.0726	0.0748
2-digit industry X Year FE	Yes	Yes	Yes		Yes	Yes	Yes	
State X Year FE	Yes	Yes	Yes		Yes	Yes	Yes	
2-digit industry FE				Yes				Yes
State FE				Yes				Yes
Year FE				Yes				Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Appendix E. FE stands for fixed effects.

Table E5: Heterogeneous Impacts of GDP Decline in Firms' Destinations by Worker Characteristics - Ecuador

	Average months worked		Average real wage	
	Coefficient	Test eq. of coeff t-test p-value	Coefficient	Test eq. of coeff t-test p-value
	(1)	(2)	(3)	(4)
GFC firm shock	-0.0652***		-0.0200	
	(0.0170)		(0.0137)	
Observations		794,948		793,553
R-squared		0.1457		0.0752
GFC firm shock*Female	-0.1061***		-0.0292**	
	(0.0264)		(0.0116)	
GFC firm shock*Male	-0.0478***	2.5076	-0.0157	0.7927
	(0.0158)	(0.0122)**	(0.0170)	(0.4280)
Observations		794,948		793,553
R-squared		0.8902		0.3645
GFC firm shock*Higher education	0.0160		-0.0164	
	(0.0203)		(0.0225)	
GFC firm shock*No higher education	-0.0734***	-4.0187	-0.0180	-0.0786
	(0.0173)	(0.0001)***	(0.0134)	(0.9374)
Observations		794,948		793,553
R-squared		0.8905		0.3720
GFC firm shock*Young	-0.0698***		-0.0183	
	(0.0184)		(0.0127)	
GFC firm shock*Middle-aged	-0.0555***	-0.8344	-0.0186	0.0116
	(0.0201)	(0.4042)	(0.0269)	(0.9907)
GFC firm shock*Old	-0.0229	-1.3060	-0.0103	-0.4875
	(0.0344)	(0.1917)	(0.0153)	(0.6260)
Observations		545,738		545,144
R-squared		0.8759		0.4205
2-digit industry X Year FE		Yes		Yes
State X Year FE		Yes		Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for vectors of worker and firm characteristics as of 2007 described in Section III. FE stands for fixed effects.

Table E6: Reallocation of Workers across Firms and Sectors due to GDP Decline in Firms'
Destinations - Ecuador

	Baseline effect	Initial firm	Other firm in same sector	Other firm in tradable sector	Other firm in non-tradable sector
	(1)	(2)	(3)	(4)	(5)
Panel A: Average months worked					
GFC firm shock	-0.0276***	-0.0646*	0.0214	0.0076	0.0080
	(0.0085)	(0.0339)	(0.0211)	(0.0076)	(0.0116)
Observations	661,060	661,060	661,060	661,060	661,060
R-squared	0.1365	0.1778	0.0789	0.0528	0.0727
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes
Panel B: Average real wages					
GFC firm shock	-0.0138	-0.0164	0.0027	0.0010	-0.0011
	(0.0149)	(0.0118)	(0.0030)	(0.0025)	(0.0041)
Observations	659,870	659,870	659,870	659,870	659,870
R-squared	0.1004	0.0478	0.0504	0.0358	0.0576
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the firm level in parentheses. ***, **, and * indicate significance at
1%, 5%, and 10% levels, respectively. FE stands for fixed effects.

Table E7: Firm Revenues, Exit, and Size Impacts of GDP Decline in Firms' Destinations -
Ecuador

	Net revenues	Profit rate	Firm exit	Firm size (log)	Total wages (log)	Total skilled based on education (log)	Total unskilled based on education (log)	Share of skilled based on education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GFC Firm Shock*2009	-0.0293*	-0.0007	-0.0010	-0.0145**	-0.0183**	-0.0186**	-0.0156**	0.0008
	(0.0150)	(0.0015)	(0.0010)	(0.0070)	(0.0072)	(0.0079)	(0.0074)	(0.0012)
GFC Firm Shock*2010	-0.0584***	0.0006	-0.0009	-0.0148**	-0.0154**	-0.0185**	-0.0154*	0.0008
	(0.0147)	(0.0016)	(0.0012)	(0.0075)	(0.0075)	(0.0082)	(0.0079)	(0.0011)
GFC Firm Shock*2011	-0.0526***	0.0019	0.0004	-0.0114	-0.0094	-0.0157*	-0.0148*	-0.0000
	(0.0150)	(0.0018)	(0.0010)	(0.0088)	(0.0088)	(0.0087)	(0.0089)	(0.0012)
GFC Firm Shock*2012	-0.0473***	0.0001	-0.0020	-0.0025	0.0011	-0.0164*	-0.0129	-0.0012
	(0.0146)	(0.0016)	(0.0013)	(0.0097)	(0.0096)	(0.0095)	(0.0089)	(0.0014)
GFC Firm Shock*2013	-0.0548***	-0.0002	-0.0003	-0.0052	-0.0032	-0.0148	-0.0139	-0.0017
	(0.0166)	(0.0016)	(0.0014)	(0.0097)	(0.0095)	(0.0095)	(0.0091)	(0.0015)
GFC Firm Shock*2014	-0.0512***	0.0015	-0.0012	0.0007	0.0070	-0.0109	-0.0051	-0.0001
	(0.0172)	(0.0017)	(0.0013)	(0.0098)	(0.0102)	(0.0098)	(0.0096)	(0.0013)
GFC Firm Shock*2015	-0.0453**	-0.0003	0.0004	0.0003	0.0028	-0.0123	-0.0048	-0.0009
	(0.0195)	(0.0018)	(0.0015)	(0.0103)	(0.0106)	(0.0099)	(0.0103)	(0.0014)
GFC Firm Shock*2016	-0.0250	0.0011	0.0008	0.0042	0.0022	-0.0142	-0.0035	-0.0022
	(0.0196)	(0.0022)	(0.0011)	(0.0103)	(0.0107)	(0.0101)	(0.0101)	(0.0017)
GFC Firm Shock*2017	-0.0449**	-0.0007		0.0102	0.0104	-0.0058	0.0007	-0.0020
	(0.0190)	(0.0022)		(0.0114)	(0.0117)	(0.0104)	(0.0105)	(0.0018)
Observations	18,216	21,894	21,640	23,702	23,731	21,175	23,512	24,094
R-squared	0.4922	0.3520	0.0618	0.6294	0.6646	0.5995	0.6327	0.3464
++ 2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a
vector of firm characteristics as of 2007 described in Appendix E. FE stands for fixed effects.

Table E8: Firm Performance Impacts of GDP Decline in Firms' Destinations - Ecuador

	Materials (log) (1)	Materials per per worker (log) (2)	Capital (log) (3)	Capital per worker (log) (4)	TFP L-P (log) (5)	Labor productivity (log) (6)
GFC firm shock*2009	-0.0408***	-0.0243**	-0.0497***	-0.0423***	-0.0327***	-0.0204***
	(0.0122)	(0.0112)	(0.0168)	(0.0147)	(0.0088)	(0.0069)
GFC firm shock*2010	-0.0519***	-0.0335***	-0.0535***	-0.0376**	-0.0364***	-0.0177**
	(0.0123)	(0.0106)	(0.0178)	(0.0159)	(0.0083)	(0.0069)
GFC firm shock*2011	-0.0430***	-0.0375***	-0.0616***	-0.0511***	-0.0198**	-0.0158**
	(0.0133)	(0.0116)	(0.0190)	(0.0162)	(0.0096)	(0.0069)
GFC firm shock*2012	-0.0376***	-0.0384***	-0.0530***	-0.0346**	-0.0228***	-0.0124*
	(0.0125)	(0.0109)	(0.0178)	(0.0161)	(0.0081)	(0.0074)
GFC firm shock*2013	-0.0380***	-0.0322***	-0.0522***	-0.0267*	-0.0280***	-0.0153**
	(0.0130)	(0.0110)	(0.0169)	(0.0150)	(0.0082)	(0.0073)
GFC firm shock*2014	-0.0440***	-0.0462***	-0.0467***	-0.0211	-0.0217***	-0.0171***
	(0.0140)	(0.0115)	(0.0177)	(0.0143)	(0.0080)	(0.0064)
GFC firm shock*2015	-0.0226	-0.0269**	-0.0485**	-0.0283*	-0.0220***	-0.0153**
	(0.0145)	(0.0113)	(0.0192)	(0.0153)	(0.0085)	(0.0065)
GFC firm shock*2016	-0.0179	-0.0240**	-0.0408**	-0.0214	-0.0200**	-0.0155**
	(0.0152)	(0.0114)	(0.0196)	(0.0160)	(0.0095)	(0.0070)
GFC firm shock*2017	-0.0293*	-0.0312**	-0.0452**	-0.0260	-0.0246**	-0.0150**
	(0.0159)	(0.0124)	(0.0204)	(0.0164)	(0.0098)	(0.0072)
Observations	18,184	18,303	9,870	9,916	9,772	21,757
R-squared	0.5341	0.4691	0.5543	0.2855	0.6484	0.3925
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. All specifications control for a vector of firm characteristics as of 2007 described in Appendix E. L-P refers to Levinsohn & Petrin (2003). FE stands for fixed effects.