

Long-term Labor Market Adjustment to Transitory Shocks: Worker Impact and Firm Channels

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Motivation

- ▶ **Economic crises can lead to firm closure and job displacement resulting in worker scarring effects (Jacobson et al., 1993)**

- ▶ **Yet, their magnitude and duration depend on:**
 - Underlying firm-level mechanisms
 - Cushioning effects of income support programs (e.g., unemployment insurance)

- ▶ **The literature has focused on short-run effects of crises and shocks on employment but has missed the path into the long-run**

This paper

- ▶ Estimates long-run impacts of economic crises on workers and their firm-level driving mechanisms
- ▶ Exploits quasi-experimental variation in firms' foreign demand resulting from the 2008-2009 Global Financial Crisis (GFC)
- ▶ Addresses key questions:
 - What are workers' margins of adjustment to firms' foreign shocks? Do labor market factors mediate shock severity?
 - Mechanisms: Are adjustments taking place in initial firm (scarring among continuing workers) or is there worker reallocation? How do firms adjust?
 - To which extent do income support policies buffer impact of foreign shocks?

Approach

Worker-level and firm-level analysis

- ▶ Identify causal impacts of firm GFC foreign shocks on workers and firms in Brazil and Ecuador
- ▶ Compare evolution of employment and wages in 2009-2017 for workers initially in firms facing larger vs. smaller GFC foreign shocks
 - Using longitudinal administrative data on formal workers matched with customs data for their firms
- ▶ Compare adjustment in firm labor and performance outcomes in 2009-2017 for firms initially facing large vs. smaller GFC foreign shocks
 - Using longitudinal data on firm outcomes matched with customs data

Main findings

- ▶ Worker effects of firm GFC foreign shocks:
 - Persistent reduction in employment in Brazil and Ecuador and real wages in Brazil, but scarring only for lower-skilled workers
 - Higher informality and lower competition mitigate adjustment
- ▶ Mechanisms:
 - Most adjustments for workers continuing at initial firm (reduction in hours)
 - Firm scarring: caused by selection (exit) in Brazil and (revenue, employment and productivity) downsizing in Brazil and Ecuador
 - Firm restructuring: replacing capital with labor in Ecuador and unskilled workers with skilled workers in Brazil
- ▶ Role of income support programs:
 - Increases in unemployment insurance and cash transfers, but they yield limited income loss replacement (6%)
- ▶ A temporary shock induces permanent effects: firm restructuring causes scars in continuing workers and increases long-run inequality

Related literature

- ▶ **(Worker-level) Dynamic labor market adjustment to trade shocks**
 - Autor, Dorn, Hanson, Song (2014), Hummels, Jorgensen, Munch, Xiang (2014), Dauth, Findeisen, Sudekum (2017, 2019), Utar (2018), Dix-Carneiro & Kovak (2019)
 - We estimate long-run effects of GFC foreign shocks on workers in different developing country settings and assess mediating role of informality and concentration
- ▶ **Reallocation across and within sectors vs. job destruction**
 - Verhoogen (2008), Harrigan & Reshef (2015), McCaig & Pavcnik (2018), Asquith, Goswami, Neumark, R.-Lopez (2018), Utar (2018), Harasztsosi & Lindner (2019)
 - We capture worker displacement and worker reallocation (or lack thereof)
- ▶ **Channels: trade shocks affect firms' sales and employment growth and volatility**
 - Brambilla, Lederman, Porto (2012), Utar (2014), Kurz & Senses (2016), Pierce & Schott (2016), di Giovanni, Levchenko, Mejean (2017), Asquith, Goswami, Neumark, R.-Lopez (2018), Branstetter, Kovak, Mauro, Venancio (2019), Garin & Silverio (2019)
 - We link firm-level adjustment to worker-level adjustment to foreign shocks
- ▶ **Recessions and mass layoffs: labor market scarring effects**
 - Jacobson, Lalonde, Sullivan (1993), Kletzer (1998), Davis & Von Wachter (2011), Krolukowski (2017), Flaaen, Shapiro, Sorkin (2019), Yagan (2019), Lachowska, Mas, Woodbury (2020), Schmieder, Heining, Von Wachter (2020)
 - We show for developing countries long-lasting effects of negative shocks even for non-displaced workers

Data

- ▶ Focus on Brazil and Ecuador over the last 2 decades
- ▶ Same core data for both countries
 - Administrative employer-employee longitudinal data on formal labor market
 - Firm panel constructed using the longitudinal data on workers for aggregate labor market outcomes
 - Firm panel from industrial survey and business registry for performance outcomes
 - Customs data covering universe of exporter and importer firms
 - Destination countries' GDP growth information

Core data for Brazil

- ▶ Relacao Annual de Informacoes Sociais (RAIS) from Brazilian Ministry of Labor for 2004-2017
 - Census of the Brazilian formal labor market - high-quality matched employer-employee database
 - Very detailed worker-level information on demographics, job characteristics (salary, days worked), occupation, employer firm ID, location, and sector
- ▶ Worker random sample
- ▶ Merged by firm ID in each year with customs export and import data from Secretariat of Foreign Trade (SECEX) for 2004-2017
 - ▶ Merged by firm ID in each year with industrial survey data (Pesquisa Industrial Anual) for 2009-2014

Core data for Ecuador

- ▶ Social security data from Instituto Ecuatoriano de Seguridad Social for 2006-2017
 - Census of Ecuadorian formal labor market
 - Very detailed worker-level information on demographics (education from Higher education registry), job characteristics (salary, days worked), employer firm ID, location, and sector
- ▶ Merged by firm ID in each year with customs export and import data from Servicio Nacional de Aduana for 2006-2017
- ▶ Merged by firm ID in each year with firm business registry from Sistema de Rentas Internas del Ecuador for 2009-2017

Additional data for Brazil

- ▶ Occupation data in RAIS worker database
 - Use Helpman et al. (2017) correspondence table to convert Brazilian occupations at 4-digit into 5 skill categories
- ▶ Brazilian Census in 2000
 - ▶ Informality by municipality
- ▶ Unemployment Insurance (UI) individual-level registry
 - Covers all workers that received unemployment insurance
 - Eligibility: being laid off from a private formal job with at least 6 months of job tenure
 - Number of months with UI, amount of UI received
- ▶ National registry of low-income households in Brazil linked to all payment records of Bolsa Familia program for 2007-2012
 - Number of months with Bolsa Familia, amount of cash transfer
- ▶ Merged by municipality or worker ID

Descriptive statistics: Worker-level

	BRAZIL		ECUADOR	
	Mean	Std. Dev.	Mean	Std. Dev.
A. WORKER PANEL				
<i>Outcomes</i>				
Months worked per year	8.0	5.0	9.2	4.7
Real wages	2,949.2	4,743.8	1,072.2	1,153.7
Average months worked (cumulative)	8.5	3.8	9.7	3.7
Average real wages (cumulative)	1.9	2.1	3.2	5.0
Average real wages pre-GFC	2.0	2.9	1.6	2.5
Average number of months in Bolsa Familia program	2.5	9.4	-	-
Average payments from Bolsa Familia program	28.0	221.0	-	-
Average number of months with unemployment insurance	0.5	0.9	-	-
Average payments from unemployment insurance	522.7	909.5	-	-
<i>Firm Shock</i>				
Export shock in 2008 (negative of GDP growth)	-3.1	2.0	-3.0	2.5
Total number of worker-year observations	3,046,074		794,948	
Total number of unique worker IDs	342,574		89,385	
Total number of unique firm IDs	11,453		887	
Share of observations with 0 months worked per year	19.0%		12.9%	

Note: the statistics are based on the samples of workers in firms with a non-missing GFC foreign shock measure in 2008. For unemployment insurance and Bolsa Familia program statistics are based only on beneficiaries.

Descriptive statistics: Firm-level

	BRAZIL		ECUADOR	
	Mean	Std. Dev.	Mean	Std. Dev.
B. FIRM PANEL				
<i>Outcomes</i>				
Total employment	91.7	109.0	128.9	221.3
Total employment (log)	3.6	1.5	3.8	1.6
Total wage bill (log)	10.7	1.5	10.5	1.8
Avg. wage (log)	7.7	0.4	6.7	0.6
Net revenue (log)	59.9	103.5	12.0	2.1
Materials (log)	2.4	1.5	14.3	1.9
Materials per worker (log)	-1.1	1.1	10.4	1.5
Capital (log)	3.5	1.0	13.7	2.1
Capital per worker (log)	0.0	0.6	9.3	1.4
TFP value added (log)	60.3	104.5	10.4	1.1
Value added per worker (log)	60.5	105.4	10.3	0.9
Profit rate	-1.5	1.6	0.3	0.2
Median of relative price	1.0	0.1	-	-
<i>Firm Shock</i>				
Export shock in 2008 (negative of GDP growth)	-3.2	2.7	-1.0	2.2
Total number of firm-year observations	119,189		24,094	
Total number of unique firm IDs	15,087		2,859	

Note: the statistics are based on the samples of workers in firms with a non-missing GFC foreign shock measure in 2008.

Empirical design: Firm GFC foreign shock measure

- ▶ Firm-specific export-weighted destination market GDP decline measure based on customs data and annual GDP growth data:

$$shock_{j2008} = - \sum_d GDPgr_{d2008} * w_{jd2007}$$

- ▶ $GDPgr_{d2008}$: growth in destination d 's GDP in 2007-2008
- ▶ w_{jd2007} : share of exports to destination d in total firm j exports in 2007
- ▶ Larger values mean firm faces a worse GFC foreign shock
 - ▶ $shock_{j2008}=1$ (destinations' GDP declined by 1%) is worse than $shock_{j2008}=-2$ (destinations' GDP increased by 2%)
- ▶ Shock is exogenous to firms and workers in Brazil and Ecuador
 - ▶ Quasi-experimental variation in foreign demand caused by sudden and unexpected GFC (Aghion et al., 2021)
 - ▶ Pre-GFC firm export portfolio weights (Garin and Silverio, 2019)

Empirical design: Main specification

- ▶ What are workers' margins of adjustment to GFC foreign shocks?
- ▶ Compare evolution of outcomes for **workers in firms facing larger vs. smaller GFC foreign shocks**

$$y_{ijt} = \theta_t shock_{j2008} + \gamma_1 X_{i2007} + \gamma_2 X_{j2007} + I^{st} + I^{rt} + \varepsilon_{ijt}$$

- ▶ i : worker, j : firm, t : year, s : sector, r : region
- ▶ y_{ijt} : worker employment or wage outcomes
- ▶ X_{i2007} worker controls as of 2007: gender, age, age squared, higher education, past formal sector attachment
- ▶ X_{j2007} firm controls as of 2007: firm size, importer status, past growth in firm total employment and average wages
- ▶ Sector*year fixed effects (I^{st}) region*year fixed effects (I^{rt}) (based on 2007 firm's 2-digit sector and region)
- ▶ Robust standard errors clustered by firm

Empirical design: Worker outcome variables

- ▶ Average months worked per year (cumulative until year t):

$$\frac{1}{t-2008} \sum_{s=2009}^t months_{is}$$

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

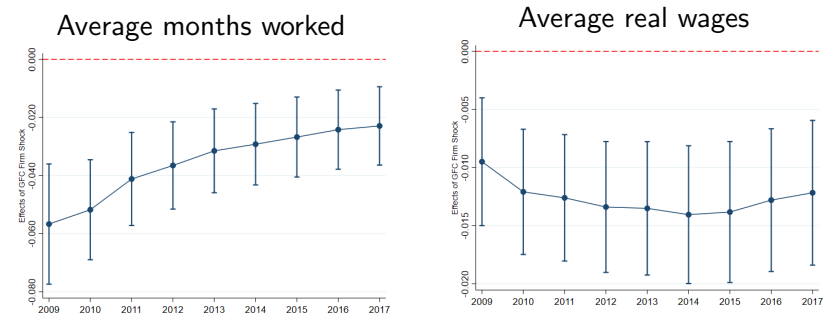
- ▶ Average real wages (cumulative until year t) as multiples of pre-GFC average wages:

$$\left(\frac{1}{t-2008}\right) \frac{\sum_{s=2009}^t wage_{is}}{avgwage_{i2004-07}}$$

where $wage_{is}$ is the monthly wage of worker i in year s deflated by a Consumer Price Index

Impact of GFC foreign shocks on workers in Brazil

Figure: Workers' adjustment to firms' decline in destination GDP - Brazil

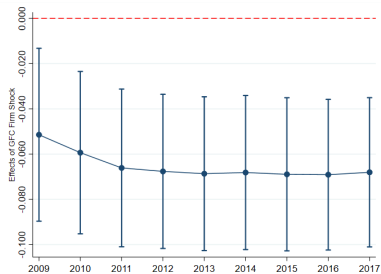


Note: Confidence intervals shown based on robust standard errors clustered by firm. The two regressions are based on a sample with about 3 million worker-year observations.

- ▶ Long-lasting negative effects of GFC foreign shocks on months worked and on real wages, but employment recovers

Impact of GFC foreign shocks on workers in Ecuador

Figure: Workers' adjustment to firms' decline in destination GDP - Ecuador
Average months worked
Average real wages



Notes: Confidence intervals shown based on robust standard errors clustered by firm. Each of the two regressions are based on a sample with about 800 thousand worker-year observations.

- ▶ Long-lasting negative effects of GFC foreign shocks on months worked but insignificant effect on real wages

Economic magnitude of impacts

- ▶ Focus on estimated coefficients for 2017
- ▶ Consider a worker whose initial firm faced a 10 percentage point worse GFC foreign shock

Impact between 2009 and 2017		
	Brazil	Ecuador
Months worked	2.1 fewer months (2.7%)	6.1 fewer months (7%)
Average real wage	1.1 times pre-GFC earnings (6%)	

Robustness of impacts on workers

- ▶ Estimate specification separately for each year
- ▶ Dropping sectors most affected by commodity price boom
- ▶ Dropping years 2015-2017 of major domestic recession
- ▶ Dropping vector of firm controls in 2007
- ▶ Including separate sector, state, and year fixed effects
- ▶ Using worker employment and wage measures as in Yagan (2019)
- ▶ Using alternative firm GFC foreign shock measures varying weights for export-weighted average for Brazil
- ▶ Using indicator variables for worker dismissal by employer for Brazil

Heterogeneity of impacts across worker characteristics

	Panel A: Brazil						Panel B: Ecuador					
	Average months worked			Average real wages			Average months worked			Average real wages		
	Overall	No Higher Education	Age	Overall	No Higher Education	Age	Overall	No Higher Education	Age	Overall	No Higher Education	Age
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
GFC Firm Shock	-0.0357*** (0.0073)	-0.0080 (0.0109)	-0.0266*** (0.0069)	-0.0116*** (0.0030)	-0.0090 (0.0061)	-0.0117*** (0.0039)	-0.0652*** (0.0170)	0.0092 (0.0185)	-0.0958*** (0.0199)	-0.0184 (0.0122)	-0.0106 (0.0158)	-0.0277*** (0.0113)
No higher education		-0.7421*** (0.0465)			-0.5084*** (0.0276)			-1.3183*** (0.0882)			-0.4874*** (0.0664)	
No higher education * GFC Firm Shock		-0.0321*** (0.0114)			-0.0031 (0.0065)			-0.0855*** (0.0185)			-0.0077 (0.0131)	
Middle-age			0.3830*** (0.0266)			-0.2595*** (0.0155)			0.5571*** (0.1081)			-0.0218 (0.0457)
Old			0.4606*** (0.0556)			-0.2958*** (0.0254)			0.0044 (0.3124)			-0.1401** (0.0707)
Middle-age * GFC Firm Shock			-0.0176*** (0.0060)			-0.0009 (0.0039)			0.0573*** (0.0220)			0.0207 (0.0147)
Old * GFC Firm Shock			-0.0309*** (0.0116)			-0.0060 (0.0063)			0.1471** (0.0615)			0.0326** (0.0156)
Observations	3,046,074	3,046,074	2,463,396	3,030,524	3,030,524	2,452,164	794,948	794,948	794,948	794,912	794,912	794,912
R-squared	0.1274	0.1275	0.1514	0.2757	0.2757	0.3388	0.1457	0.1496	0.1416	0.0892	0.0929	0.0894
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	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.

- ▶ Strong negative response of employment only for less-educated workers (and also of real wages for less-educated in Brazil)
- ▶ Stronger negative response of employment for older workers in Brazil but not in Ecuador
- ▶ No difference in adjustment across men and women
- ▶ Stronger negative response of wages for lower initial earnings quartiles

Mediating role of informality in Brazil

	Average months worked		Average real wages	
	(1)	(2)	(3)	(4)
GFC Firm Shock	-0.0448*** (0.0080)	-0.0166* (0.0085)	-0.0096*** (0.0034)	-0.0053 (0.0036)
High informality rate	-0.1167* (0.0662)		-0.0481*** (0.0186)	
GFC Firm Shock * High informality rate	0.0261** (0.0132)		-0.0047 (0.0045)	
High share of Agriculture		-0.3453*** (0.0666)		-0.1148*** (0.0202)
GFC Firm Shock * High share of Agriculture		-0.0421*** (0.0134)		-0.0159*** (0.0045)
Observations	3,046,092	2,412,173	3,030,542	2,401,074
R-squared	0.2090	0.1376	0.2890	0.3477
2-digit industry X Year FE	No	Yes	No	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.

- ▶ Smaller employment response in localities with higher informality
- ▶ Informality serves as a buffer providing de facto flexibility for firms and workers to cope with negative shocks

Mediating role of lack of competition in Brazil

	Average months worked			Average real wages		
	(1)	(2)	(3)	(4)	(5)	(6)
GFC Firm Shock	-0.0620*** (0.0095)	-0.0448*** (0.0074)	-0.058*** (0.010)	-0.0183*** (0.0038)	-0.0159*** (0.0035)	-0.020*** (0.004)
High sector concentration				-0.5412*** (0.0375)		
GFC Firm Shock * High sector concentration				0.0307*** (0.0080)		
State-owned		1.4540*** (0.2158)			0.1111 (0.2415)	
GFC Firm Shock * State-owned		0.2016*** (0.0410)			-0.1124 (0.0880)	
High wage premia			1.175*** (0.073)			0.333*** (0.019)
GFC Firm Shock * High wage premia			0.041*** (0.014)			0.012*** (0.004)
Observations	2,410,379	2,412,137	2,124,575	2,399,281	2,401,038	2,100,319
R-squared	0.1503	0.1507	0.168	0.3522	0.3523	0.412
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.

- ▶ Smaller response in more concentrated sectors, for protected firms and firms with market power (higher wage premia)
 - Reversal of normal economic mechanisms, extreme case of "capture" or connectedness

Reallocation of workers across firms & sectors in Brazil

	Average months worked				
	Baseline effect	Initial firm	Other firm in same sector	Other firm in tradable sector	Other firm in non-tradable sector
GFC Firm Shock*2009	-0.0586*** (0.0100)	-0.0733*** (0.0167)	0.0067 (0.0106)	0.0033 (0.0029)	0.0047 (0.0032)
GFC Firm Shock*2010	-0.0479*** (0.0082)	-0.0756*** (0.0178)	0.0160 (0.0111)	0.0064* (0.0034)	0.0055 (0.0039)
GFC Firm Shock*2011	-0.0350*** (0.0077)	-0.0686*** (0.0191)	0.0221* (0.0125)	0.0083** (0.0042)	0.0034 (0.0042)
GFC Firm Shock*2012	-0.0314*** (0.0071)	-0.0643*** (0.0195)	0.0219* (0.0131)	0.0094* (0.0049)	0.0016 (0.0047)
GFC Firm Shock*2013	-0.0284*** (0.0065)	-0.0593*** (0.0196)	0.0211 (0.0136)	0.0098* (0.0054)	0.0002 (0.0049)
GFC Firm Shock*2014	-0.0265*** (0.0063)	-0.0604*** (0.0199)	0.0235* (0.0139)	0.0104* (0.0059)	0.0001 (0.0051)
GFC Firm Shock*2015	-0.0250*** (0.0059)	-0.0587*** (0.0200)	0.0251* (0.0140)	0.0098 (0.0062)	-0.0012 (0.0054)
GFC Firm Shock*2016	-0.0233*** (0.0057)	-0.0589*** (0.0204)	0.0275* (0.0142)	0.0101 (0.0067)	-0.0019 (0.0056)
GFC Firm Shock*2017	-0.0214*** (0.0057)	-0.0576*** (0.0202)	0.0289** (0.0142)	0.0086 (0.0070)	-0.0011 (0.0058)
Observations	2,463,396	2,463,396	2,463,396	2,463,396	2,463,396
R-squared	0.153	0.174	0.046	0.049	0.076
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.

- ▶ Adjustment is mostly for continuing workers at initial firm
- ▶ Small counter-effect from reallocation to other firms in tradables

Reallocation of workers across firms & sectors in Ecuador

	Average months worked				
	Baseline effect	Initial firm	Other firm in same sector	Other firm in tradable sector	Other firm in non-tradable sector
GFC Firm Shock*2009	-0.0241** (0.0102)	-0.0480** (0.0192)	0.0101* (0.0057)	0.0042 (0.0052)	0.0096 (0.0071)
GFC Firm Shock*2010	-0.0183** (0.0088)	-0.0421* (0.0215)	0.0149** (0.0066)	0.0002 (0.0061)	0.0086 (0.0083)
GFC Firm Shock*2011	-0.0292*** (0.0088)	-0.0687** (0.0282)	0.0307** (0.0152)	0.0027 (0.0070)	0.0061 (0.0100)
GFC Firm Shock*2012	-0.0306*** (0.0095)	-0.0824** (0.0342)	0.0390* (0.0211)	0.0062 (0.0079)	0.0066 (0.0116)
GFC Firm Shock*2013	-0.0307*** (0.0094)	-0.0733* (0.0394)	0.0284 (0.0264)	0.0070 (0.0084)	0.0071 (0.0128)
GFC Firm Shock*2014	-0.0331*** (0.0093)	-0.0712* (0.0430)	0.0208 (0.0296)	0.0106 (0.0089)	0.0066 (0.0141)
GFC Firm Shock*2015	-0.0291*** (0.0084)	-0.0674 (0.0465)	0.0168 (0.0330)	0.0109 (0.0095)	0.0106 (0.0155)
GFC Firm Shock*2016	-0.0290*** (0.0086)	-0.0664 (0.0499)	0.0148 (0.0362)	0.0128 (0.0099)	0.0098 (0.0163)
GFC Firm Shock*2017	-0.0252*** (0.0082)	-0.0641 (0.0524)	0.0155 (0.0384)	0.0169* (0.0103)	0.0064 (0.0170)
Observations	661,060	661,060	661,060	661,060	661,060
R-squared	0.1365	0.1778	0.0790	0.0529	0.0727
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.

- ▶ Adjustment is mostly for continuing workers at initial firm
- ▶ Small counter-effect from reallocation to other firms in same sector

Hours worked and fixed-term contracts in Brazil

	Average hours worked	Indicator for not renewing fixed-term contract
	(1)	(2)
GFC firm shock*2009	-0.0048*** (0.0018)	0.0021** (0.0009)
GFC firm shock*2010	-0.0056*** (0.0019)	0.0008 (0.0011)
GFC firm shock*2011	-0.0052*** (0.0020)	0.0012 (0.0009)
GFC firm shock*2012	-0.0047** (0.0020)	0.0002 (0.0007)
GFC firm shock*2013	-0.0041** (0.0021)	0.0001 (0.0010)
GFC firm shock*2014	-0.0039* (0.0020)	0.0001 (0.0013)
GFC firm shock*2015	-0.0037* (0.0020)	-0.0008 (0.0018)
GFC firm shock*2016	-0.0032* (0.0020)	0.0001 (0.0015)
GFC firm shock*2017	-0.0031 (0.0019)	0.0005 (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. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. The estimating sample in column (2) includes only workers on fixed-term contracts.

- Persistent reduction in hours worked and lower probability of renewing fixed-term contracts

Empirical design: Firm specification

- ▶ What are mechanisms that drive persistent effects of GFC foreign shocks on labor market outcomes?
- ▶ Compare evolution of outcomes/responses for **firms facing larger vs. smaller GFC foreign shocks**

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

- ▶ j : firm, t : year, s : sector, r : region
- ▶ y_{it} : firm labor market aggregates or performance outcomes
- ▶ X_{i2007} firm controls as of 2007: firm size, importer status, pre-GFC growth in firm total employment and/or wages
- ▶ Sector*year fixed effects (I^{st}) and region*year fixed effects (I^{rt}) (based on 2007 firm's 2-digit sector and region)
- ▶ Robust standard errors clustered by firm

Empirical design: Firm outcome variables

- ▶ Revenues, profit rate, and exit
- ▶ Size in terms of employment and wages
 - ▶ Total employment: sum of workers employed by firm (based on worker database)
 - ▶ Total wages: sum of monthly real wages across all workers employed by firm (based on worker database)
- ▶ Firm occupational structure of workforce: skilled and unskilled workers' levels and shares
- ▶ Non-labor inputs (materials and capital) and productivity

Firms' adjustment in revenues, profits, exit & size

	Brazil					Ecuador				
	Net revenues	Profit rate	Exit	Total employment (log)	Total wage bill (log)	Net revenues	Profit rate	Exit	Total employment (log)	Total wage bill (log)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GFC Firm Shock*2009	-0.0315*** (0.0044)	-0.0014 (0.0010)	-0.0003 (0.0006)	-0.0162*** (0.0027)	-0.0221*** (0.0031)	-0.0293* (0.0150)	-0.0007 (0.0015)	-0.0010 (0.0010)	-0.0145** (0.0070)	-0.0454*** (0.0094)
GFC Firm Shock*2010	-0.0378*** (0.0047)	-0.0022** (0.0010)	0.0019*** (0.0006)	-0.0220*** (0.0033)	-0.0285*** (0.0034)	-0.0584*** (0.0147)	0.0006 (0.0016)	-0.0009 (0.0012)	-0.0148** (0.0075)	-0.0429*** (0.0098)
GFC Firm Shock*2011	-0.0393*** (0.0051)	-0.0035*** (0.0010)	0.0010* (0.0006)	-0.0263*** (0.0035)	-0.0292*** (0.0036)	-0.0526*** (0.0150)	0.0019 (0.0018)	0.0004 (0.0010)	-0.0114 (0.0088)	-0.0362*** (0.0103)
GFC Firm Shock*2012	-0.0372*** (0.0053)	-0.0019* (0.0010)	0.0001 (0.0006)	-0.0262*** (0.0039)	-0.0307*** (0.0039)	-0.0473*** (0.0146)	0.0001 (0.0016)	-0.0020 (0.0013)	-0.0025 (0.0097)	-0.0257** (0.0108)
GFC Firm Shock*2013	-0.0382*** (0.0055)	-0.0016 (0.0010)	0.0010 (0.0006)	-0.0289*** (0.0041)	-0.0315*** (0.0042)	-0.0548*** (0.0166)	-0.0002 (0.0016)	-0.0003 (0.0014)	-0.0052 (0.0097)	-0.0276** (0.0109)
GFC Firm Shock*2014	-0.0400*** (0.0053)	-0.0021* (0.0011)	-0.0004 (0.0007)	-0.0308*** (0.0044)	-0.0341*** (0.0043)	-0.0512*** (0.0172)	0.0015 (0.0017)	-0.0012 (0.0013)	0.0007 (0.0098)	-0.0182* (0.0110)
GFC Firm Shock*2015			0.0015** (0.0007)	-0.0322*** (0.0045)	-0.0319*** (0.0046)	-0.0453** (0.0195)	-0.0003 (0.0018)	0.0004 (0.0015)	0.0003 (0.0103)	-0.0218* (0.0116)
GFC Firm Shock*2016			0.0012* (0.0007)	-0.0244*** (0.0048)	-0.0295*** (0.0049)	-0.0250 (0.0196)	0.0011 (0.0022)	0.0008 (0.0011)	0.0042 (0.0103)	-0.0246** (0.0119)
GFC Firm Shock*2017				-0.0236*** (0.0051)	-0.0285*** (0.0051)	-0.0449** (0.0190)	-0.0007 (0.0022)		0.0102 (0.0114)	-0.0161 (0.0132)
Observations	30,825	32,125	107,541	91,971	82,313	18,216	21,894	21,640	23,702	23,731
R-squared	0.6787	0.0817	0.0168	0.532	0.5301	0.4922	0.3520	0.0618	0.6294	0.5809
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

- ▶ Persistent reduction in firm revenues in both countries and in profit rates in Brazil where exit increases in 2010-2011
- ▶ Downsizing is more long-lasting in Brazil than Ecuador

Firms' broad occupational restructuring

	Brazil			Ecuador		
	log total skilled based on education	log total unskilled based on education	share of skilled based on education	log total skilled based on education	log total unskilled based on education	share of skilled based on education
	(1)	(2)	(3)	(4)	(5)	(6)
GFC Firm Shock*2009	-0.0051* (0.0030)	-0.0191*** (0.0027)	0.0005 (0.0004)	-0.0186** (0.0079)	-0.0156** (0.0074)	0.0008 (0.0012)
GFC Firm Shock*2010	-0.0102*** (0.0032)	-0.0233*** (0.0032)	0.0006 (0.0004)	-0.0185** (0.0082)	-0.0154* (0.0079)	0.0008 (0.0011)
GFC Firm Shock*2011	-0.0119*** (0.0034)	-0.0260*** (0.0034)	0.0009** (0.0004)	-0.0157* (0.0087)	-0.0148* (0.0089)	-0.0000 (0.0012)
GFC Firm Shock*2012	-0.0111*** (0.0036)	-0.0271*** (0.0038)	0.0011*** (0.0004)	-0.0164* (0.0095)	-0.0129 (0.0089)	-0.0012 (0.0014)
GFC Firm Shock*2013	-0.0104*** (0.0037)	-0.0298*** (0.0040)	0.0013*** (0.0005)	-0.0148 (0.0095)	-0.0139 (0.0091)	-0.0017 (0.0015)
GFC Firm Shock*2014	-0.0133*** (0.0038)	-0.0313*** (0.0042)	0.0016*** (0.0005)	-0.0109 (0.0098)	-0.0051 (0.0096)	-0.0001 (0.0013)
GFC Firm Shock*2015	-0.0145*** (0.0040)	-0.0343*** (0.0043)	0.0014*** (0.0005)	-0.0123 (0.0099)	-0.0048 (0.0103)	-0.0009 (0.0014)
GFC Firm Shock*2016	-0.0147*** (0.0041)	-0.0304*** (0.0045)	0.0013** (0.0006)	-0.0142 (0.0101)	-0.0035 (0.0101)	-0.0022 (0.0017)
GFC Firm Shock*2017	-0.0150*** (0.0043)	-0.0295*** (0.0046)	0.0013** (0.001)	-0.0058 (0.0104)	0.0007 (0.0105)	-0.0020 (0.0018)
Observations	88,549	91,537	119,189	21,175	23,512	24,094
R-squared	0.6052	0.4983	0.4823	0.5995	0.6327	0.3464
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.

- ▶ Firms reduce employment of both skilled and unskilled workers but adjust occupational structure towards skilled workers in Brazil

Firms' detailed occupational restructuring in Brazil

	Brazil						
	share of skilled based on occupations	share of professional, managerial	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*** (0.000709)	0.00110*** (0.000361)	-0.000606 (0.000611)	0.00164** (0.000779)	-0.00345*** (0.000666)	-0.000983*** (0.000377)	-0.00247*** (0.000597)
GFC Firm Shock*2010	0.00281*** (0.000694)	0.00138*** (0.000441)	-0.000171 (0.000635)	0.00160** (0.000796)	-0.00335*** (0.000693)	-0.000764** (0.000382)	-0.00258*** (0.000630)
GFC Firm Shock*2011	0.00317*** (0.000692)	0.00164*** (0.000444)	0.000212 (0.000638)	0.00132 (0.000809)	-0.00364*** (0.000692)	-0.000874** (0.000390)	-0.00277*** (0.000622)
GFC Firm Shock*2012	0.00285*** (0.000705)	0.00174*** (0.000450)	0.000202 (0.000642)	0.000905 (0.000814)	-0.00346*** (0.000705)	-0.000936** (0.000396)	-0.00252*** (0.000638)
GFC Firm Shock*2013	0.00268*** (0.000710)	0.00157*** (0.000482)	0.000472 (0.000631)	0.000637 (0.000815)	-0.00349*** (0.000710)	-0.000994** (0.000396)	-0.00250*** (0.000643)
GFC Firm Shock*2014	0.00259*** (0.000718)	0.00143*** (0.000472)	0.000816 (0.000639)	0.000344 (0.000815)	-0.00340*** (0.000719)	-0.000935** (0.000400)	-0.00247*** (0.000652)
GFC Firm Shock*2015	0.00221*** (0.000724)	0.00143*** (0.000507)	0.00121* (0.000642)	-0.000422 (0.000814)	-0.00277*** (0.000722)	-0.00114*** (0.000424)	-0.00163** (0.000636)
GFC Firm Shock*2016	0.00154** (0.000723)	0.000904* (0.000539)	0.00114* (0.000653)	-0.000499 (0.000825)	-0.00214*** (0.000715)	-0.000929** (0.000408)	-0.00121* (0.000634)
GFC Firm Shock*2017	0.00120 (0.000739)	0.000635 (0.000565)	0.000869 (0.000665)	-0.000303 (0.000849)	-0.00196*** (0.000729)	-0.000356 (0.000414)	-0.00161** (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.

- ▶ Permanent expansion of share of professional & managerial workers and of skilled blue collar workers but reduction in shares of unskilled workers

Firms' productivity and technology responses

	Materials (log)	Materials per worker (log)	Capital (log)	Capital per worker (log)	TFP Value Added (log)	Value Added per worker (log)
	(1)	(2)	(3)	(4)	(5)	(6)
A. BRAZIL						
GFC Firm Shock*2009	-0.0490*** (0.0080)	-0.0397*** (0.0075)	0.0013 (0.0138)	0.0148 (0.0136)	-0.0190*** (0.0045)	-0.0152*** (0.0041)
GFC Firm Shock*2010	-0.0482*** (0.0067)	-0.0332*** (0.0061)	0.0003 (0.0125)	0.0155 (0.0122)	-0.0242*** (0.0046)	-0.0164*** (0.0043)
GFC Firm Shock*2011	-0.0587*** (0.0081)	-0.0449*** (0.0072)	-0.0015 (0.0133)	0.0143 (0.0131)	-0.0269*** (0.0045)	-0.0198*** (0.0042)
GFC Firm Shock*2012	-0.0465*** (0.0082)	-0.0343*** (0.0070)	-0.0063 (0.0109)	0.0093 (0.0106)	-0.0230*** (0.0048)	-0.0177*** (0.0043)
GFC Firm Shock*2013	-0.0500*** (0.0079)	-0.0351*** (0.0066)	-0.0100 (0.0093)	0.0054 (0.0091)	-0.0245*** (0.0050)	-0.0163*** (0.0043)
GFC Firm Shock*2014	-0.0586*** (0.0082)	-0.0425*** (0.0072)	-0.0164** (0.0081)	0.0019 (0.0079)	-0.0270*** (0.0050)	-0.0187*** (0.0045)
Observations	30,839	31,767	30,727	31,183	30,916	31,651
R-squared	0.4705	0.2653	0.5265	0.2849	0.5138	0.3789
2-digit industry X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
B. ECUADOR						
GFC Firm Shock*2009	-0.0408*** (0.0122)	-0.0243** (0.0112)	-0.0497*** (0.0168)	-0.0423*** (0.0147)	-0.0327*** (0.0088)	-0.0204*** (0.0069)
GFC Firm Shock*2010	-0.0519*** (0.0123)	-0.0335*** (0.0106)	-0.0535*** (0.0178)	-0.0376** (0.0159)	-0.0364*** (0.0083)	-0.0177** (0.0069)
GFC Firm Shock*2011	-0.0430*** (0.0133)	-0.0375*** (0.0116)	-0.0616*** (0.0190)	-0.0511*** (0.0162)	-0.0198** (0.0096)	-0.0158** (0.0069)
GFC Firm Shock*2012	-0.0376*** (0.0125)	-0.0384*** (0.0109)	-0.0530*** (0.0178)	-0.0346** (0.0161)	-0.0228*** (0.0081)	-0.0124* (0.0074)
GFC Firm Shock*2013	-0.0380*** (0.0130)	-0.0322*** (0.0110)	-0.0522*** (0.0169)	-0.0267* (0.0150)	-0.0280*** (0.0082)	-0.0153** (0.0073)
GFC Firm Shock*2014	-0.0440*** (0.0140)	-0.0462*** (0.0115)	-0.0467*** (0.0177)	-0.0211 (0.0143)	-0.0217*** (0.0080)	-0.0171*** (0.0064)
GFC Firm Shock*2015	-0.0226 (0.0145)	-0.0269** (0.0113)	-0.0485** (0.0192)	-0.0283* (0.0153)	-0.0220*** (0.0085)	-0.0153** (0.0065)
GFC Firm Shock*2016	-0.0179 (0.0152)	-0.0240** (0.0114)	-0.0408** (0.0196)	-0.0214 (0.0160)	-0.0206** (0.0095)	-0.0155** (0.0070)
GFC Firm Shock*2017	-0.0293* (0.0159)	-0.0312** (0.0124)	-0.0452** (0.0204)	-0.0260 (0.0164)	-0.0246** (0.0098)	-0.0150** (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.

- ▶ Materials and capital decline and so does capital per worker in Ecuador
- ▶ Persistent labor productivity and TFP declines

Effectiveness of Compensation Mechanisms in Brazil

	Average number of months in UI	Average earnings from UI	Average number of months in PBF	Average earnings from PBF
	(1)	(2)	(3)	(4)
GFC Firm Shock*2009	0.0104*** (0.0031)	12.6110*** (3.1702)	0.0073* (0.0045)	0.7037*** (0.2723)
GFC Firm Shock*2010	0.0005 (0.0020)	-0.6657 (2.0105)	0.0128*** (0.0046)	0.9880*** (0.2958)
GFC Firm Shock*2011	-0.0008 (0.0019)	-1.9912 (2.0108)	0.0148*** (0.0046)	1.2547*** (0.3350)
GFC Firm Shock*2012	0.0008 (0.0018)	0.2453 (2.0030)	0.0146*** (0.0046)	1.3997*** (0.3693)
GFC Firm Shock*2013	-0.0004 (0.0018)	-0.6452 (2.0402)		
GFC Firm Shock*2014	0.0002 (0.0016)	-1.0784 (1.9543)		
GFC Firm Shock*2015	-0.0002 (0.0016)	-1.1020 (1.9736)		
GFC Firm Shock*2016	0.0014 (0.0017)	1.2943 (2.1482)		
GFC Firm Shock*2017	0.0023* (0.0013)	2.0523 (1.7051)		
Observations	3,046,074	3,046,074	1,365,282	1,365,282
R-squared	0.0266	0.0186	0.1337	0.0637
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.

- ▶ Increase in access to both compensation mechanisms for workers in firms suffering worse GFC foreign shocks
- ▶ Transfer payments replaced 6% of lost earnings: UI 4.3% and PBF 1.7%

Conclusion

- ▶ Worker effects of firm GFC foreign shocks:
 - Persistent reduction in employment in Brazil and Ecuador and real wages in Brazil, but scarring only for lower-skilled workers
 - Higher informality and lower competition mitigate adjustment
- ▶ Mechanisms:
 - Most adjustments for workers continuing at initial firm
 - Firm scarring: caused by selection in Brazil and downsizing in Brazil and Ecuador
 - Firm restructuring: replacing capital with labor in Ecuador and unskilled workers with skilled workers in Brazil
- ▶ Role of income support programs:
 - Increases in unemployment insurance and cash transfers, but they yield limited income loss replacement (6%)
- ▶ A temporary shock induces permanent effects: firm restructuring causes scars in continuing workers and increases long-run inequality

Worker panel database and random sample

Brazil

- ▶ Starting database includes for individuals in cohort employed in tradables sector in 2004 or entrants into tradables sector after 2004 all their working lives until 2017
 - Working life may include employment in non-tradables sector
 - Highest paid job in December identifies wage, firm, and sector of worker
- ▶ Intermediate database selects from starting database workers 16-65 years old employed at least once in an exporting firm (in tradables sector)
- ▶ Final database is a 10% random sample of workers in intermediate database
 - If worker ID is selected for random sample entire working life is included
- ▶ Expanded final database is needed to construct worker cumulative employment and wages and it adds observations with 0 months worked and 0 wages:
 - to intervening years between first and last year an individual is observed
 - after an individual is last observed until 2017 if age is below 65
- ▶ Characteristics of workers in expanded final database are similar to those of workers in starting and intermediate databases