The sources of factor immobility among self-employed workers

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Abstract

Do trade shocks still displace workers when they are self-employed and thus have decision-making power over job exit? The answer matters for low-income countries, where self-employment rates are highest. In this paper, I study an import tariff shock affecting self-employed retailers in Rwanda using censuses of formal and informal establishments and job-level data. Workers exposed to the shock do not go into unemployment or even leave their affected job, despite sizable hourly earnings decreases. I develop a time allocation framework to explain this immobility. It predicts that two populations will be more immobile to an input cost shock: workers who have fewer outside employment options will substitute toward other jobs, and workers with intra-household insurance mechanisms will be less affected by the shock itself. I confirm these predictions by showing that low-opportunities populations - women and workers in low-opportunities areas regardless of gender - increase their labor supply at the very job whose earnings decrease. Additionally, the productivity of workers whose spouses can supply unpaid domestic and productive labor is protected from the shock, and they adapt less as a consequence. Although self-employment protects workers from trade-driven displacement, it keeps the most vulnerable groups stuck in declining sectors, making trade adjustment assistance crucial.

JEL: F13, F16, J22, J46, J62, O12

Keywords: Self-employment, Trade policy, Labor market power, Labor supply, Occupational mobility

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Sub-Saharan Africa is the region with the lowest share of salaried workers: 24.5% in 2019 (ILOSTAT). While trade policy is a strategic pillar of regional development, as shown by the African Continental Free Trade Area discussions, research on trade and labor markets has been focused on salaried workers' outcomes and little is known about the way that trade impacts the majority of workers: the self-employed. This paper offers to fill this gap. Using a tariff shock that weighed on self-employed retailers in Rwanda, and comprehensive data on formal and informal workers and establishments, I answer the following: How do the self-employed adjust to trade shocks in low-income countries? In particular, what self-employment-specific mechanisms change policy indicence in markets with prevalent self-employment?

Trade adjustment is more relevant than ever in a world where protectionist policies are on the rise, as in the case I study. In 2016, the East African Community (EAC) announced the implementation of prohibitive import tariffs on used clothing, a North-South trade that represents a sizable share of urban households' clothing consumption (around 75% for Tanzania (Foundation, 2017)). Faced with threats of exclusion from the African Growth Opportunity Act, a free trade agreement with the United States, all EAC countries abandoned the project, except for Rwanda which increased its tariffs tenfold in June 2016. The apparel sector's exclusion from AGOA followed in 2018. The measure aimed to recapture domestic demand and develop the apparel industry. Its most immediate effect, however, was to dramatically decrease used clothes imports and to increase their price for local wholesalers and ultimately retailers - a workforce almost entirely made up of self-employed workers[1].

Sub-Saharan Africa is the only region where self-employment does not shrink with time (Bandiera et al., 2022b), despite increased use of industrial and trade policy to foster the creation of good wage jobs[2]. However, research on the specific ways in which self-employed workers react to such policies has been scant. The impacts of policy shocks on self-employed labor markets cannot be easily predicted from existing works. Self-employed workers when they leave their jobs, their number of hours, which jobs they work on the side, and whether their family works at the firm - their adaptation strategies differ from salaried workers. Additionally, while research has covered the coping strategies of farm households in the face of temporary shocks, as non-farm self-employed workers persist even with structural transformation, operate in labor markets where there should be more external wage opportunities, and show immobility even to permanent productivity shocks, their reallocation holds a different significance for development.

To fill this gap, I leverage a shock that affected an overwhelmingly self-employed workforce from the service sector in Rwanda. Most works in the trade shocks and labor markets literature show evidence of displacement, and reallocation either from (McCaig and Pavcnik, 2018; Erten and Keskin, 2021) or to (Ponczek and Ulyssea, 2021; Dix-Carneiro and Kovak, 2019) informality and unemployment, using liberalization shock in middle-income countries. The documented results that trade-driven shocks entail reallocation are not as likely to happen when the concerned labor markets are entirely self-employed, as even though formal wages are more rigid than informal ones (Corbi et al., 2021; Dix-Carneiro et al., 2024), some downward

[1] 89% both pre-and post-shock (IHLCS)

[2] See Fernandes et al. (2019) for an analysis of the lack of long-term effects of duty-free export agreements in Africa and Bandiera et al. (2022a) for analyses of training, labor demand, and matching in SSA, that note a hard-to move low equilibrium with few wage jobs and many unproductive small firms.

rigidity remains (Kaur, 2019) which can get even informal wage workers to be laid off. Faced with the same wage-decreasing shock, self-employed workers are thus less likely to exit their jobs than even informal wage-earners. In line with this conceptual difference, I find no evidence of job exit, at the intensive and extensive margins, when self-employed retailers faced a permanent negative trade-driven productivity shock. This contrasts with studies showing that even the informally wage-employed experience decreases in employment rates following trade shocks (Ponczek and Ulyssea, 2021; Dix-Carneiro and Kovak, 2017, 2019; Bas and Bombarda, 2023). The setting is also novel in that the trade shock hits manufacturing and is in Sub-Saharan Africa, where evidence has been scarce due to data unavailability (McCaig and McMillan, 2020), and through a protectionist shock, providing timely insight on the effect of trade wars in low-income countries.

The data that I use allows me to exploit this setting, drop unrealistic assumptions, and dig deeper into workers' adaptation strategies. Importantly, I use of privately accessed establishment censuses for both formal and informal plants. In contrast to works using formal-only panels (Dix-Carneiro and Kovak (2017, 2019), although informality is explored as an adjustment margin at the regional level), I do not have to assume that informal workers and establishments are similar in their trajectories to formal ones. This assumption is also dropped in McCaig and Pavcnik (2018) or Dix-Carneiro et al. (2024), but such data has lacked thus far in Sub-Saharan Africa. Fine-grain licensed survey data allowed me to quantify workers' outcomes at the ISIC-3 digit level for all of their jobs throughout the year. Quantifying reallocation at a lower scale than the individual level matters, because a sizeable share of the Rwandan workforce - about 28% in 2016[3] and 36% of the self-employed - holds several jobs at once, shedding doubt on the assumption that time allocation across different jobs within the week stays constant in the face of a job-specific shock. Dropping this assumption allows me to shed new light on several novel patterns of substitution across jobs within the week. Finally, the data I use has comprehensive information on the role of each member of the household at the firm and at home, whether paid or unpaid: such data is absent from datasets describing only the best-paid job of the week, and such information on businesses is seldom combined with information on domestic work - through this, I am able to put forward a new coping mechanism and to show market-domestic labor porosity in that setting.

My empirical strategy combines pre-shock spatial exposure to used clothing trade from Census data on the universe of formal and informal firms with individual variation in having a job (job-level outcomes) or having had a job (individual-level) in self-employed retail starting before the shock, into a triple difference. I lay out a framework to understand the results, and in line with its predictions, I study three broad sets of outcomes - exposure, adaptation, and resilience to the policy. I run heterogeneity analyses on two dimensions that could affect reallocation patterns: outside options, which might increase job exit given a shock exposure level, and intra-household unpaid labor availability, which could decrease exposure to the shock itself.

The results on the exposure, adaptation, and resilience to the input tariff shock of self-employed retailers run contrary to the evidence of trade-driven displacement in other contexts (Dix-Carneiro and Kovak, 2017, 2019, 2023; Ponczek and Ulyssea, 2021; Erten and Keskin, 2021; McCaig and Pavcnik, 2018). Despite a)

[3] Source: Integrated Household Living Conditions Survey 2016

10% slower hourly earnings growth for retailers in affected areas compared to retailers in non-affected areas (up to 80% true effect size considering that only up to 1/8 of self-employed retailers sell used clothing) that is caused by turnover falling more than non-labor expenses, affected retailers b) do not leave their jobs, do not go into unemployment, migrate, or even decrease hours worked at their retail job in response to the shock. As a result of this immobility, and despite changes in hours allocated to other jobs, workers c) show limited resilience to the shock, and the retail income premium grows 6% slower in exposed areas up to 18 months after the shock. These results suggest that coping mechanisms that are specific to self-employed workers could change the impact of policy: self-employed workers suffer a cost shock that translates into a large hourly production shock, do not get displaced like salaried workers could, and adapt outside of the boundaries of their affected job.

I developed a framework to think about and test for the reasons why workers might not leave their self-employed jobs when a large shock hit their earnings permanently. Workers could leave more easily when they have outside employment options, especially in a context with no unemployment assurance and where self-employment might hold the assurance value of being a place in which workers can always put in their hours. Also, workers might be less likely to leave if they are able to implement strategies to mitigate the effect of the cost shocks on their firm's productivity: in our case, for example, productivity-enhancing domestic work, such as ironing clothing, might increase perceived product quality and mitigate impacts on productivity, while not counting as work at the firm. For self-employed workers, the extent to which they will benefit from this insurance will depend on the availability of other household members to undertake this domestic work.

I first show that lack of outside options exacerbates factor immobility among the self-employed, consistently with the framework. When isolating two categories of the population that have lower access to good jobs, women and workers in low-opportunity areas, I uncover i) negative own hourly earnings labor supply elasticity: even though women and workers in low-opportunity areas are the most exposed, they increase hours worked as a response to productivity decrease at the affected firm. I show that this is related to less take-up of additional jobs among women, consistent with lower labor market access than men.

Second, I check the framework's prediction that more availability of domestic and productive labor at the firm affects shock exposure and resilience. Through the use of comprehensive data on the organization of production at the firm and at home, I can distinguish between the income-preserving effect of having a spouse for earnings sources diversification and domestic work, the additional effect of having a spouse work at the firm, and the productivity-enhancing of spousal domestic labor. Assuming that there is a lower trade-off between domestic and productive labor for spouses who do not get a personal income from their productive work, I achieve this disentangling by comparing workers who work alone at the firm, those who work with their paid spouse, and workers whose unpaid spouse works at the firm. I first show evidence that A) married men are the only population that is protected from the cost shock's effect on their hourly earnings. Investigating the reasons why, I show that B) married men are much less likely to work alone at the firm than married women retailers, and that when they work with their spouse, they only pay them in 75% of cases, compared to 95% for women. Working with family workers who are unattached to the labor market matters for men, as C) non-participating wives and unpaid participating wives react to their husbands' firm shock by

increasing domestic work, which D) limits the effect of the cost shock on husbands' productivity, while this is not the case for husbands working with paid wives. As a result, husbands with collaborating unpaid wives, who conjugate lack of outside options by household members working at the firm, and insurance through domestic productivity-enhancing one, do not leave their firm following the shock, while all other married men do.
These results show that lessons from trade shocks in other contexts might not translate automatically to self-employment intensive low-opportunity settings, as workers both have mitigation strategies and an incentive to not seek other opportunities on the labor market.

This paper contributes to several strands of the literature. First, I contribute to the literature on local labor market effects of trade policy in developing countries. When workers were exposed to increased competition due to trade liberalization, like in Brazil (Dix-Carneiro and Kovak, 2017, 2019; Ponczek and Ulyssea, 2021) workers initially employed in the tradable sector became unemployed and reallocated to lower-paid jobs, often in the informal sector. Works have related informality to trade in two ways: the first approach studies the impact of trade on informality rates, for example through bigger export markets for formal firms (McCaig and Pavcnik, 2018), better access to inputs (Bas and Bombarda, 2023), or distress because of import competition (Wang et al., 2021). The second addresses how the effects of the trade itself are changed by the presence of informality (Dix-Carneiro et al., 2021), as "The effects of trade policy on labor market outcomes depend on relevant labor market frictions within a country" (Goldberg and Pavcnik, 2016). Informality acts as an "unemployment buffer" (Ponczek and Ulyssea, 2021), muting unemployment responses to a shock. I further these approaches by showing that the mechanisms put forward above linking displacement to trade policy are not automatic in settings with prevalent self-employment. These are novel results partly because of data constraints leading the existing literature to have focused on Latin America (Dix-Carneiro and Kovak, 2023)[4]
The data and setting that I exploit allow me to fill these gaps and to add evidence to the body of literature on retail (Atkin et al., 2018) and the textile supply chains (Boudreau et al., 2023; Grant and Startz, 2022; Mansour et al., 2022), for a protectionist shock (Kelishomi and Nisticò, 2023; Rotunno et al., 2023).
I make a second contribution to the trade and developing labor markets literature, namely to the literature concerned with factor immobility as a response to trade shocks. Reallocation following a shock is imperfect: exposed regions and individuals face earnings decreases and do not respond automatically through migration or sectoral reallocation (Topalova, 2010), leading to widening gaps between exposed and non-exposed regions as time passes (Dix-Carneiro and Kovak, 2019). Most empirical studies find that the most immobile segments of the population are the most vulnerable ones: those with the least resources (Topalova, 2010), older workers from less internationally integrated regions (McCaig and Pavcnik, 2018), women (Mansour et al., 2022; Roche Rodriguez et al., 2023) or less skilled workers (Bas and Bombarda, 2023; Keller and Utar, 2023; Kelishomi and Nisticò, 2023). This phenomenon is formalized in Adão (2016), in which different categories of the population have different comparative advantages schedules, influencing their resilience. Some works have linked turnover and development, finding higher turnover rates in developing countries

[4]as noted for sub-Saharan Africa in McCaig and McMillan (2020) in their study of Botswana, with their work and Erten et al. (2019) important exceptions

(Donovan et al., 2023) and addressing the usefulness of these transitions for workers to climb the job ladder McCaig and Pavcnik (2021); McKenzie and Paffhausen (2019). I add to this work by reinforcing the findings that most marginal workers have a lower elasticity to shocks. However, workers who are too comfortable, in that they have additional margins that mitigate shock effects on their productivity, also persist longer than optimal, as shown by male workers with unpaid women collaborators at their firms. My job-level data allows me to offer an explanation for this context to the documented of higher job exit and job finding in poorer countries combined with high cross-occupation gaps in Donovan et al. (2023): because workers can always fall back on self-employment in a fragile labor market, rapid switches in main job of the week in the context of multiple job holding would hide a persistence in survival self-employment if using Labor Force Surveys.

Third, this works adds value to the literature on frictions in developing labor markets, and how workers cope with shocks despite frictions. Deviations for perfect labor market functioning (Kaur, 2019; Amodio et al., 2022; Sharma, 2023; Breza et al., 2021; Hardy and Kagy, 2020) create involuntary unemployment, survival self-employment (Lewis et al., 1954; Gindling et al., 2016; Bandiera et al., 2022a; Breza et al., 2021; Amodio et al., 2022; Scarelli and Margolis, 2021), and more rigidity in wages and labor supply (Sharma, 2023; Hardy and Kagy, 2020; Caldwell and Oehlsen, 2022). To negotiate these environments and resist shocks, workers apply different sets of coping mechanisms, which depend on their margins of adaptation. This is the same for self-employed workers, whose firms tend to be more "survivalist", not have growth prospects and not be credit-constrained (Grimm et al., 2012) in such environments, in particular in labor markets with labor market segmentation for women's firms (Bandiera et al., 2022b; Hardy and Kagy, 2020). Dynamically, works on developing countries and self-employed workers' coping strategies have focused on farm households, including children's labor (Beegle et al., 2006; Dumas, 2020) or non-farm business creation (Adhvaryu et al., 2021). and norms and opportunities specific to women's labor participation (Jayachandran, 2021) for income smoothing through spousal labor participation (Erten and Keskin, 2021; Zhang, 2014). This paper corroborates the finding that women's firms tend to be survivalist and that because of these different constraints and opportunities, gender-neutral policy have a gendered effect, Erten and Keskin (2021); Sanin (2021). Additionally, I show coping mechanisms of urban non-farm households faced with permanent productivity shocks. I highlight a new mechanism: the use of productivity-enhancing spousal labor from unpaid non-farm collaborators as an insurance against productivity shocks. This novel mechanism sheds new light on findings that women's firms are always less productive than men's (Hardy and Kagy, 2020), as undocumented productivity-enhancing domestic work could explain a part of such gaps.

Finally, this paper makes contributions to the literature interested in spousal labor as insurance. Being married, or having a spouse, reduces wage variability (Zhang, 2014; Blundell et al., 2016). And as such, spouses' labor supply is substitutable to a disability insurance (Autor et al., 2019), unemployment insurance, survivors' pension (Persson, 2020), or unemployment insurance (Cullen and Gruber, 2000)., and more desirable when work becomes more unstable (Clark et al., 2023). The evidence that having a spouse protects against shocks has also been found in developing countries, mostly with added worker effects like in (Erten and Keskin, 2021) with trade shocks. In parallel, spouses' domestic labor – the production of a domestic good in collective household models – and its capacity to be concentrated in the hands of a singular individual within marriage allows couples to benefit from economies of scale and enjoy higher total income levels, in particular

in the case of jobs with increasing benefits like those outlined by Goldin, or when demand for childcare arises. This paper contributes to the literature about spousal labor as insurance by putting forward a new function of domestic and productive work, not only as a means to preserve consumption but as a way of protecting the productivity of family firms affected by a shock, through productivity-enhancing domestic work. This effect is measured in a market featuring rich heterogeneity in household and business structures, but the prevalence of family firms makes the insights applicable to many contexts.

1 Rwanda's 2016 tariff increase on used clothing imports

The used clothing sector in the trade landscape: share of domestic demand and imports

Used clothing, a sizeable and growing trade, flows from rich countries to poorer, mostly African ones. In 2020, 4 out of the 5 top importers of used clothes were Sub-Saharan African countries, each importing over 100 million dollars of these goods each year (Cobbing et al., 2022). Used clothes, or $caguwa$ in Kinyarwanda[5], have been blames by governments for the underdevelopment of the textile and garment sector, with Frazer (2008) attributing up to 40% of the decrease in the apparel sector's share of manufacturing and of jobs across most countries of the continent to that trade. Other issues, such as cultural ones, have also been raised by citizens and governments eager to curb these imports supposedly crowding out traditional clothing and from which a sizeable share immediately goes from bales to landfills (Cobbing et al., 2022). Rwanda's intent to ban *caguwa* imports was made public in 2016, through an East Africa Community[6] common project to raise tariffs on second-hand clothing imports (Wolff, 2021). Faced with threats of exclusion from the Africa Growth and Opportunity Act[7]'s apparel section, all EAC countries abandoned the project, except Rwanda. The tariff increase[8] was implemented in 2016 and Rwanda was suspended from AGOA in 2018. In the meantime, there was no sizeable substitution of domestic production to these imports, as shown by the resolution to not implement further tariff hikes beyond 2.50 USD /kg as initially planned[9].

The measure was implemented 6 months from the first EAC-wide proposal and was efficient in curbing imports of second-hand clothes: Figure 1 and Figure 2 represent, respectively, the evolution of new and used clothing imports in Rwanda (volume and value) and the ratio of clothing prices over the general consumer price index for urban and rural areas. We can see that after 2016, the volume of used clothes imported by Rwanda decreased persistently, consistently with the per kg. tariff. Unit prices for new clothes also decreased slightly for 2017, but their average unit value is about four times that of used clothing: new clothing does not represent a direct substitute for used clothing demand after the shock. As a result of the measure, the years-long decreasing trend of clothing prices relative to other goods' prices came to a halt (Figure 2). The stop is quicker in urban than in rural areas, consistent with to stocks depleting faster in the former or slower supply chains for the latter. The tariff had impacts on country-level measures such as imports and prices,

[5] the official language of Rwanda

[6] Customs Union comprising Kenya, Rwanda, Uganda, Burundi, Tanzania, with the DRC and South Sudan having joined after 2016

[7] AGOA, a program allowing selected African countries to export certain goods to the US duty-free

[8] From 0.5 to 5 dollars/kg on used shoes and 2.5 dollars/kg on used clothing according to the government framework, *RWANDA VISION 2020* (2000)

[9] Strategy For The Transformation Of Textile, Apparel And Leather Sectors in Rwanda, MINICOM 2022

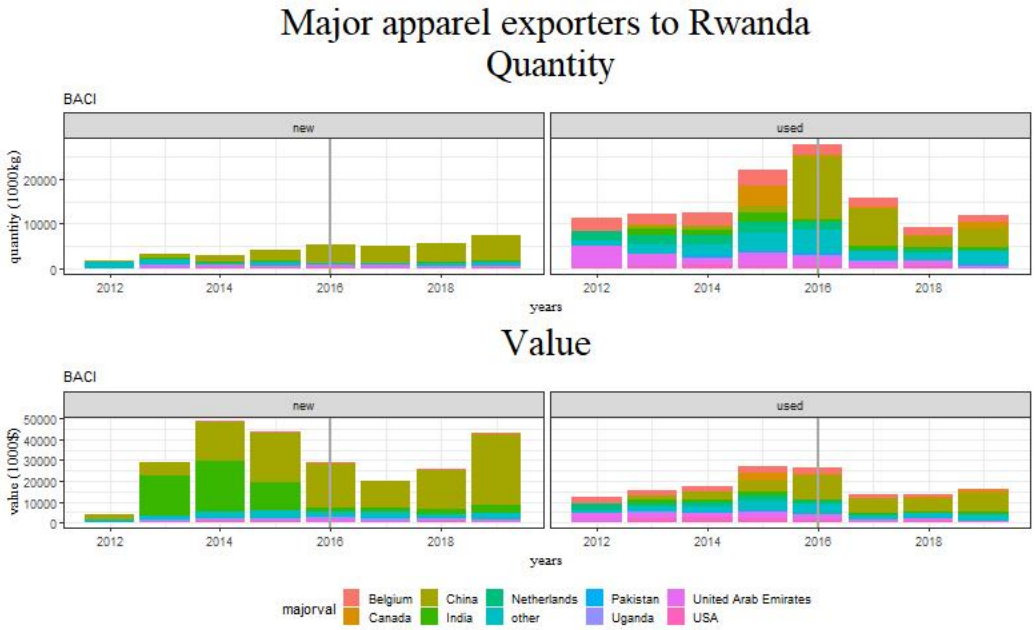

Figure 1: Import volumes and values

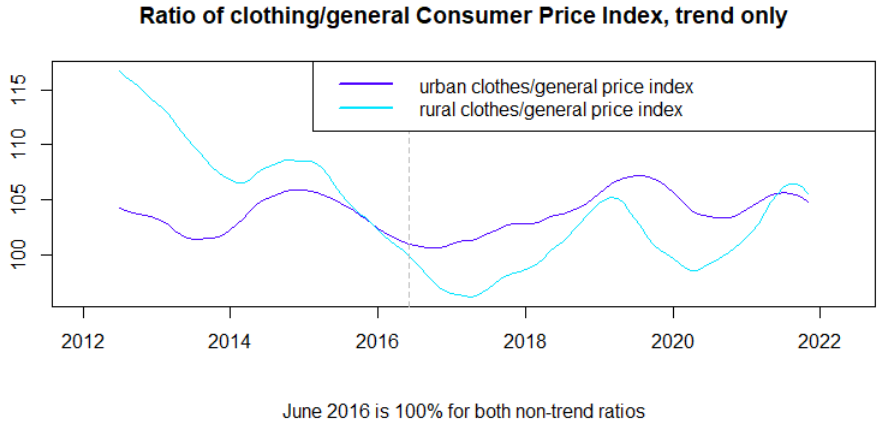

Figure 2: Prices

and suggests strong enough effects for individual adaptation responses.

The used clothing sector in the labor market: number of workers, supply chain, working conditions

Used clothing is a prevalent industry employing many of the urban areas' workforce in African countries. The industry creates as much as 121,000 in Kenya (Wolff, 2021), and pre-shock Census data on the universe of Rwandan firms reveals that $caguwa$ retail represents up to 1/8 of the retail sector in the most exposed districts (EC 2014). The used clothing supply chain remains to be examined with customs and administrative data, but qualitative accounts of used clothing trade in neighboring countries (Brooks and Simons, 2012; Brooks, 2012; Mesa, 2021) or of the $caguwa$ import tariff (Behuria, 2019) describe a supply chain made of a few wholesalers importing bales of clothing and reselling them to many more retailers. This process holds characteristics that set it apart from new clothing retail: first, although the bales can sorted and classified by categories, the specific pieces of clothing cannot be observed before purchase, and this adds uncertainty to the retailers' livelihoods - especially when bales are not adapted to local meteorological conditions or tastes (Cobbing et al., 2022). Most importantly, the structure of the supply chain, with plane- or truck-dependent international arrivals at wholesalers' precincts, means that supply is fragmented: replenishing stock might not always be possible once a retailer went through their bales (also mentioned by Mesa (2021) in the DRC). Additionally, most $caguwa$ retailers work on temporary premises and have limited power to build inventory: when Kenya installed a temporary, Covid-driven ban on $caguwa$, retailers declared only having about a month's worth of inventory, consistent with the fast CPI rise in Rwanda.

Table 1 presents summary statistics about $caguwa$ firms compared to other firms in the retail sector and to other firms more broadly.[10]. $Caguwa$ firms are more likely to be women, to only have one worker (including the manager), and to be operating on temporary premises. This can intensify the fragmented nature of the used clothing supply chain and is consistent with the fact that, before the shock, independent retailers were working more jobs per week and working fewer hours than other workers despite higher hourly wages at that occupation (IHLCS, 2013).

2 Data

My empirical strategy combines geographical variation in ex-ante exposure to the $caguwa$ trade with individual-level variation in ex-ante self-employed retail work. First, I describe the Establishment and Population Censuses which allow for building the spatial exposure index, before turning to the household survey data from which I get individual variation and outcomes.

Spatial index of $caguwa$ intensity: the Establishment Censuses and the 2012 Housing and Population Census

The Establishment Census is a census of the universe of formal and informal establishments collected every

[10]Here, the statistics are derived from the 2017 version of the Census, for which workers characteristics could be observed along with the name of the firm, allowing to isolate firms with $caguwa$ in their name. It was impossible to show such statistics from the pre-shock data for data privacy reasons

	Caguwa Retail	outside Caguwa	Other
Operating in market	0.81	0.18	0.05
	(0.39)	(0.39)	(0.23)
Woman manager	0.50	0.38	0.27
	(0.50)	(0.49)	(0.45)
Firm age	3.12	2.40	4.55
	(4.29)	(3.87)	(10.74)
Less than 3 workers	1.00	0.98	0.84
	(0.00)	(0.13)	(0.36)
Total workers	1.07	1.40	5.07
	(0.26)	(4.32)	(67.83)
Observations	127	90381	99780

Source: Establishment Census (2017)

Table 1: Summary statistics on Caguwa establishments

3 years by the National Institute of Statistics of Rwanda. It has around 100 000 to 200 000 observations each round. Because used clothing retail is too disagregate a category for me to access it through ISIC codes, I use the fact that the word $caguwa$ describes only this activity, and access to a licensed enumerator-written variable that describes the main economic activity for all rounds, in particular 2014 which is the last pre-shock round. Creating an indicator for whether $caguwa$ is written in the establishment description is a lower-bound for $caguwa$ retail, as enumerators often write "clothing retail" without further detail. Therefore, one can only use it assuming that, conditional on being a $caguwa$ retailer, the enumerator specifying writing $caguwa$ in the establishment description is orthogonal to other establishments characteristics we are interested in (for example, the manager's sex). Discussions with the NISR confirmed that no specific directions were given in the description of the main economic activity concerning clothing retail. I construct a dummy variable for $caguwa$ appearing in a business' description and integrate it in a ratio of the total number of workers working in $caguwa$ establishments in a given zone over the total active population of that zone (Housing and Population Census, 2012), at the district level (30):

$$Exp = \frac{\text{Caguwa workers}(EC)_{2014}}{\text{Active population}_{HPC,2012}}$$

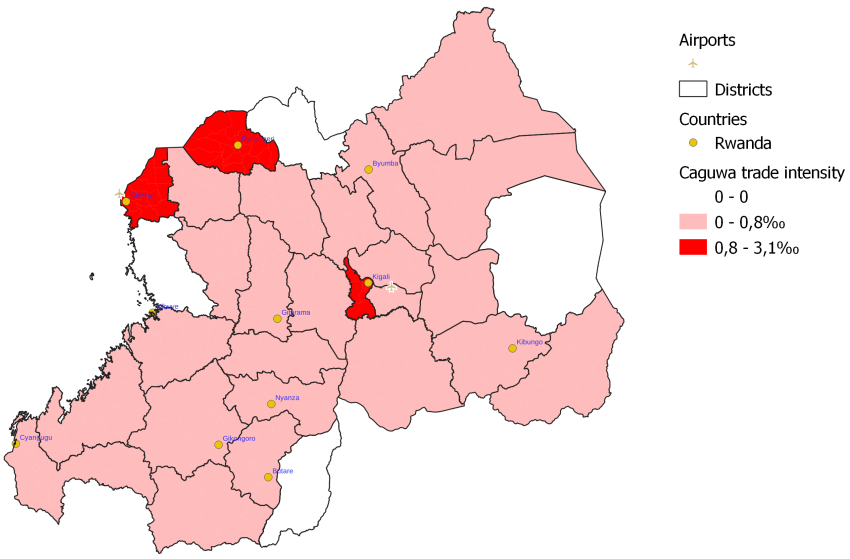

Figure 3: District-level *caguwa* exposure

Figure 3 shows district-level exposure to the used clothing trade. Exposure is correlated to airports, major cities, and roads, but imperfectly so. Sellers' location[11], and thus spatial exposure to the shock is expected to be very polarized for two reasons. First, used clothing retail is usually concentrated in specific markets (Brooks and Simons, 2012). Second, taste for pre-owned garments is concentrated in urban zones in most countries (Brooks, 2019). To ensure that *caguwa* intensity does not proxy for other dynamics related to supply chains, regional culture, smuggling, etc., I include district $\times$ urban fixed effects in all specifications. The results are robust to discretizing the spatial exposure variable, only isolating the districts in dark red, or to using a predictor of *caguwa* rather than the word, to solve for 0 density in some districts [12].

Workers' earnings, adaptation strategies, and time use: the Integrated Household Living Conditions Survey

The second database set I use is the 2013 and 2016 rounds of the Integrated Household Living Condition Survey. This survey takes place from October to the next September, is at the job level, and asks about the whole year leading to the interview. It represents 60,000 individuals (30,000 working age, 75,000 jobs) each round, and has the added advantage of allowing to link spouses and family members, which I later use to explore intra-household dynamics. The IHLCS also contains my controls and outcomes of interest: earnings and income, labor supply, and time use. Earnings and income are taken respectively at the job and individual levels, and represent exposure to the shock - how much retail jobs' earnings are hit by the shock - and resilience - how much this change translates into impacts on individual income across all earnings sources this week. Labor supply is measured at the job - hours worked at a job, leaving one's job - and individual - hours worked in total across the week, going into unemployment - levels, and serves to examine adaptation strategies. Time use encompasses indicators for market work - working status of the main job of the week -

[11] given sellers' socio-economic status, it is unlikely that they live very far away from where they work

[12] My classifie misses 5% of establishments for which the enumerator wrote Caguwa and includes 3.5% of establishments for which the enumerator did not write caguwa - an upper bound for inclusion error, as one establishment could be caguwa without it being written.

and non-market, domestic work, at the individual level. I also check for migration within and across districts.

3 Empirical Strategy

My empirical analysis relies on a triple-difference strategy that exploits two sources of variation in shock exposure. The first source of variation is living, before the shock, in a region more exposed to the tariff increase, in line with the regional effects of shocks literature (Topalova, 2010; Dix-Carneiro and Kovak, 2017; Kovak and Morrow, 2022). When looking at a shock only hitting one industry, however, we might be worried that individuals in less exposed zones are not on similar earnings, migration, or sectoral reallocation trends due to differences in industry composition across regions. Also, in my household data, I can only see retail workers, not $caguwa$ retailers per se. For this reason, I also use variation in pre-shock independent retail experience, with a dummy for working in retail with a start date anterior to the June 2016 tariff shock [13]. This triple-difference design relies on the assumption that the trend in the retail-non-retail gap in more exposed zones was parallel to the trend in the retail-non-retail gap in less exposed zones, for every value of the exposure index (Olden and Møen, 2022). The baseline estimating equation is:

$$\begin{aligned} Y_{i,j,d,t} =& \alpha + \beta_{\mathbf{1}} \mathbf{Post_t} \times \mathbf{Expo._{d(i,t-1)}} \times \mathbf{IndRetail_{j(i)}} + \beta_2 Post_t \times IndRetail_{j(i)} + \\ & \beta_3 Expo._{d(i,t-1)} \times IndRetail_{j(i)} + \beta_4 IndRetail_{j(i)} + \beta_5 X_{i,d,t} + \gamma_{t,d} + trim_t + \varepsilon_{i,d,t} \end{aligned} \tag{1}$$

For job j of individual i living in district d at time t. $IndRetail_{j(i)}$ is being an independent retail job with a start date before the whock. $Expo._{d(i,t-1)}$ is the z-score of district-level pre-shock $caguwa$ exposure in the district individuals lived in a year ago, to avoid migration-driven reverse causality. $X_{i,d,t}$ controls include age, student, living in a rural location, and recent migrant status (except in the migration equations), education, gender, marital status, and role in the household, a dummy for being in sales and another one for being self-employed (except in equations looking at the working status and occupational code of jobs held by individuals). Trimester fixed effects (starting at the dry season in December rather than in January) avoid seasonality-related biases in earnings, migration, and labor outcomes. Finally, time-district fixed effects absorb time-variant district characteristics and alleviate concerns about increasing smuggling in border districts. The coefficient of interest β_1 captures the additional effect of being a retail job in the post period for retail jobs 1 s.d. more exposed to $caguwa$ trade before the shock - under our assumption, this is the causal effect of the policy.

First, I look at the direct effect of the shock on retail jobs: daily and hourly earnings, and turnover and non-labor expenditures using the non-farm business module of the household survey. Then, I examine margins of shock adaptation at the job- and individual- level, examining change of hours at the retail job and in total across the week along several margins for potential attrition - keeping the retail job, going unemployed, and migrating. For the individual-level equations, I simply take Equation 1 at the individual level, with

[13] I chose to exclude those who started doing self-employed retail after June 2016, because it was not clear whether they did so knowing about the changed working conditions, and the link between spatial exposure and likelihood of doing $caguwa$ could have been different. The results are the same keeping them in control or dropping them

	Log(daily earnings)	*Log(hourly earnings)*	*Log(turnover)*	*Log(non-L exp.)*
Post × IndRetail × Expo	-0.085**	-0.103**	-0.117***	-0.074***
	(0.04)	(0.04)	(0.02)	(0.03)
R-squared	0.471	0.397	0.296	0.267
N	23638	23619	5212	3999
Time-district FE	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 2: Average effects of $caguwa$ shock on retail jobs

$IndRetail_i$ having been a self-employed retail seller within the year. Using the individual-level specification, I look at shock resilience - the last weekly and hourly income across all earnings sources last week. I also consider total hours worked this week. Having both weekly and hourly income allows me to distinguish workers who have substitution responses from those for whom the income effect dominates. Finally, I study household-level consumption, using consumption data from the IHLCS and a similar specification as **??**, with $IndRetail_i$ whether any household member was a retailer starting before June 2016.

The paper also explores mechanisms through several heterogeneity analyses. I will implement quadruple-differences based on gender, on having a spouse, and on having a paid/unpaid collaborating spouse at the retail firm. These heterogeneity analyses will be detailed in their respective sections.

Standard errors are clustered at retail-job × district level (or individual, or household, depending on the level of the specification), as the treatment is being a retail job in a district 1 s.d. more exposed to $caguwa$ pre-shock.

4 Main results

4.1 Retailers' exposure to a policy-driven cost shock

Table 2 presents the effect of the policy on retail businesses' earnings, turnover, and expenses. The estimates of $Post \times IndRetail \times Expo$ represent the evolution of the independent retail job premium, compared to all other jobs, compared to the trend in this premium in non-intensive areas is controlled for through the other triple-difference coefficients. Col. (1) shows that earnings of independent retail jobs grew 8.5% slower than those of non-independent retail jobs in districts 1 s.d. more exposed to $caguwa$ before 2016. This is even larger for hourly earnings, where growth in the retail premium was 10.3% slower in exposed districts than in non-exposed districts. The last 2 columns indicate that the channels through which the policy impacted retail earnings worked through a decrease in the value of sales to end customers (turnover, col. (3)) that was even larger than the decrease in expenditures (col (4)) induced by the price hike in of used clothing bales wholesalers.

Discussion of effect size: Is a 10% slower growth in the retail premium of more exposed states a credible

	Log(daily earnings)	*Log(hourly earnings)*	*Log(turnover)*	*Log(non-L exp.)*
Post × IndRetail × ZDE	-0.195***	-0.220***	-0.164***	0.085**
	(0.05)	(0.05)	(0.03)	(0.04)
R-squared	0.471	0.398	0.295	0.267
N	23638	23619	5212	3999
Time-district FE	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓

Table 3: Spillovers estimation - $caguwa/retail$ intensity as spatial index - main results

effect size? Governmental estimates[14] point to a 30% clothing bale price increase at the wholesalers. In the top exposed districts, $caguwa$ retailers represent up to 1/8 of the retail sector (EC 2013). Assuming perfect pass-through and no spillovers in that simplistic discussion[15], the shock would need to induce a 80% relative decrease in our $caguwa$ workers' hourly earnings for the coefficient on the whole of the retail sector to be 10%. A pre-shock estimate using the IHLCS indicate that non-labor costs can represents on average 70% of turnover for retailers in exposed areas. So if costs have indeed decreased 30%, retailers operating on such narrow margins could have experienced much more drastic hourly profit decreases [16].

Discussion of effect validity: alternative indexes, pre-trends, spillovers An important concern is that of spillovers. Because the household survey only isolates independent retailers, some of the businesses receiving customers' reallocated demand (for example, retailers of new clothing), or retailers' reallocated labor hours (for example, firms that hire the displaced workers and gain markdown power from the shock) could be in the treated group and bias estimates. To estimate the direction of this effect, I use the fact that we know from the Establishment Census the size of the $caguwa$ sector relative to the retail sector. In districts where $\frac{caguwa}{retail}$ is very large, the sector was more badly hit with limited outside options for customer demand and reallocating $caguwa$ retailers, leaving less space for potential spillovers. To estimate this, we estimate our regression using $\frac{caguwa}{retail}$ as our new exposure variable. If anything, the additional coefficient on retail jobs earnings, turnover, and expenditures are larger with this proxy, which suggests that spillovers to other sectors are limiting the effect of the policy.

We could also be worried that, because of migration or structural transformation, the retail premia in $caguwa$-intensive zone was already going down before the shock. I check for pre-trends in Table 4, using the 2010 wave of the IHLCS[17]. Although not all of the 2010 to 2013 effects are indistinguishable from the null, in all cases where the trends are significant, the pre-trends are going to the opposite direction.

Finally, our estimates could be biased by differential job or district exit. In order to address these concerns and to examine adaptation strategies, I turn to the examination of these variables.

[14] Strategy For The Transformation Of Textile, Apparel And Leather Sectors in Rwanda, MINICOM 2022

[15] An exercise below finds that spillovers within retail amplify the effects if anything

[16] a New York Times article also refers to $caguwa$ workers not making enough money to keep doing things on the side anymore, although no precise estimates come of it: `"C:2ID-Updates024_09-africa-2024.dta"`

[17] this wave is coded differently than the others, and notably does not have trimester fixed effects. For this reason, I don't run all the specifications with it

	Log(daily earnings)	*Log(hourly earnings)*	*Log(turnover)*	*Log(non-L exp.)*
2010 × IndRet × ZDE	-0.035	-0.066*	-0.096**	-0.098
	(0.03)	(0.04)	(0.04)	(0.09)
2016 × IndRet × ZDE	-0.086*	-0.098*	-0.105***	-0.097**
	(0.04)	(0.05)	(0.03)	(0.05)
R-squared	0.423	0.363	0.308	0.327
N	35384	35218	8429	6953
district_urban FE	✓	✓	✓	✓

* p<0.05, ** p<0.01, *** p<0.001 Expo: Z-score district exposure to caguwa at t-1. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 4: Pre-trends on main results

4.2 Adaptation to the shock: job-leaving, migration, formality, unemployment response

	hours/week	*log(hours/week)*	*Kept job*	*Unemployed*	*Migration*
Post × IndRetail × Expo	-0.027	0.002	-0.001	0.002	-0.001
	(0.31)	(0.01)	(0.00)	(0.00)	(0.02)
R-squared	0.230	0.142	0.005	0.047	0.058
N	53429	53429	53459	61001	66232
Time-district FE	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 5: Policy effects on margins of shock adaptation

Table 5 presents how workers adapted to the shock. Column one is the estimate of the policy effect on hours worked at the retail job, col. 2 looks at the log of these hours, col. 3 looks at whether retail jobs are more likely to have stopped being done at the time of the interview, and col. 4 and 5 look at differences in individual-level unemployment and migration rates. A striking fact is the absence of a response along all of these margins. This comes in contrast with evidence of displacement for salaried workers in richer settings and raises the question of why workers are so immobile, in particular in self-employment where they would arguably have more power over both hours worked across the week and reallocation to other forms of businesses within self-employment. The lack of effects on migration comes in concordance with the literature (Topalova, 2010; Dix-Carneiro and Kovak, 2019; Borusyak et al., 2022), although these results have to be qualified in the light of recent debates (Borusyak et al., 2022) as they do not necessarily mean that migration is not a potential reallocation response.

This lack of mobility comes at a cost for affected workers. I turn to individual-level consequences on personal income and household consumption in order to evaluate the toll of factor immobility.

	log(inc.)	*log(tot hours)*	*log(hourly inc.)*	*log(cons.)*
Post × IndRetail × Expo	-0.064**	0.035***	-0.098***	0.000
	(0.02)	(0.01)	(0.03)	(0.01)
R-squared	0.481	0.158	0.411	0.234
N	29980	53684	29969	27961
Time-district FE	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 6: Individual and household-level consequences of $caguwa$ shock

4.3 Resilience: income, consumption

Table 6 presents estimates of the policy's impact on total income, hours across the week, hourly income, and household consumption. Retailers in zones 1 s.d. more exposed to $caguwa$ pre-shock experience a 6% lower growth in their overall income across all earnings sources, in spite of an increase in hours worked in other jobs than in independent retail. In spite of this, the measure of of household-level consumption does not change, which could indicate mitigation strategies on the part of other household members.

The consequences of the shock are also related to time use: to mitigate the effects of the shock, retailers take on other occupations, and change their occupational choice. These new variables are explored in the Appendix.

5 Theoretical framework

In this section, I build a simple theoretical framework to aid in thinking about my results. I begin with a simple model of time allocation between leisure, self-employment in retail, and other jobs in case the worker can access them. The model formalizes a setting with multiple job holdings, one emanating from a production function, one at a fixed rate. I then discuss the implications of having employment options outside of self-employed retail for elasticity to a shock, and show that an increase in input costs at the business will not automatically lead to a decrease in hours worked in the case in which there are no other jobs to substitute hours to. After presenting suggestive evidence that there are gendered differences in the quality of available outside options, I check the framework's predictions by studying the change in men's and women retailers' trajectories, among other geographical and individual sources of unequal outside options.

I begin with a basic setup: our agent is in retail, and has time $\bar{T}$ to allocate between leisure and work: retail (1) and, potentially, another job (0), respectively paying profit $Ah_1^{\alpha}\iota^{\beta} - g\iota$ (ι bales of clothing) or $h_0 w_o$[18]. The remaining time that they have is considered leisure. The agent maximizes utility from consuming a

[18] I don't account for the fact that workers can leave their self-employed retail job, which they never do in the results. This is equivalent to saying that the first unit of work in retail is always more profitable than an hour at wage w

unitary good with a price of 1, and leisure:

$$\underset{h_0,h1,c,\iota}{max}\ Dc^M(\bar{T}-h_0-h_1)^N\ \ st\ \ c=w_0h_0+Ah_1^{\alpha}\iota^{\beta}-g\iota \tag{2}$$

With $\alpha+\beta<1$ and $0<\alpha,\beta<1$. Solving for the first order conditions will yield the prediction that marginal utilities of each job equate $w_0 = A\alpha h_1^{\alpha-1}\iota^{\beta}$ and that the ratio of inputs used in the production function $\frac{h_1}{\iota}$, depends on the price of bales and the shadow price of labor and their relative productivity $\frac{g\alpha}{wo\beta}$. If a shock increases g, the technology at the firm will use more labor compared to inputs. Solving the model for labor at the firm (in the Appendix) yields

$$h_1 = g^{\frac{-\beta}{1-\beta-\alpha}}\frac{\alpha(\frac{1}{b})^{\frac{\alpha-1}{1-\beta-\alpha}}(\frac{w_0}{\alpha})^{\frac{\alpha}{1-\beta-\alpha}}A^{1-\beta-\alpha}}{w_0\beta}$$

and workers will reduce the amount of time they put into the firm as clothing prices increase.
However, in our setting, a lot of workers could be excluded from wage labor, and not have the marginal value of their work anchored in this way to the market. To predict the responses of such workers to shocks, I introduce the same model but in which there is noh_0. This is similar in spirit to a separation failures like those exemplified by Kaur (2019), and replicates the extreme response from having extremely low-paying wage options, or having a very high search cost. Let us consider this model :

$$\underset{h1,c,\iota}{max}\ Dc^M(\bar{T}-h_1)^N\ \ st\ \ c=Ah_1^{\alpha}\iota^{\beta}-g\iota$$

With the same production function. Here, there is no w_0 pinning down the value of work, and the marginal value of an hour of work at the firm, $A\alpha h_1^{\alpha-1}\iota^{\beta}$, will equate the relative benefits of a unit of extra consumption versus an hour of lost leisure, $\frac{N}{M}\frac{c}{(\bar{T}-h_1)}$ (see model in the Appendix). As a result, optimal amount of labor (without a consumption floor) will not depend on g, and only inputs purchases and consumption will adjust in case of an inputs price increase.

$$h_1 = \frac{\alpha M\bar{T}}{(N(1-\beta)+\alpha M)}$$

Although simplistic, taking off the wage options has the value of rationalizing the absence of responses inspite of an income decrease that we witness in the results. It further generates some useful predictions as to the ways agents will adjust their labor supply differently depending on whether they have an outside wage option or not. This setting can be extended to include an outside self-employment option which comes at reallocation costs, lower instead of fewer employment options, or consumption floors. The predictions from this model are that, in case a shock increases the price of inputs at a self-employed firm, inputs purchases will always decrease, but labor supply responses will depend on consumption floors and outside options. In the case where consumption binds, in the absence of an outside options, there can exist a negative labor supply wage elasticity. At the opposite, where agents have an opportunity to substitute their labor, there will be a more conventional negative labor supply response at the firm, and a positive labor supply response at other jobs, following the shocks. Considering the extensive margin in addition, agents with more outside options will be more likely to take on another job after a input cost shock.

For two agents differing only by the quality of their outside options, the predictions are thus that

To test the validity of this model, I check these predictions relative to outside options and reallocation patterns using two type of populations that are excluded from wage work: women and workers in low-opportunity areas. First, armed with descriptive statistics and insights from the gender gap in self-employment and wage employment literature focused on low-income countries, I argue that the outside option and bargaining power difference between men (m) and women (w) can lead to differential reallocation responses and notably, to sex-specific trends in hours worked in retail being less elastic to wage decreases in retail for women than for men (or even, elasticities of contrasting signs). These different reallocation responses are precisely what our results disentangled by gender show.

5.1 Descriptive evidence on gendered outside options in the labor market

Insights from the literature on gender-dependent market power Two facts describe the working environment in which most working women of the developing world operate: a universal over-representation in self-employment, and yet, higher income gender gaps in self-employment gaps there than in any other working status (Heath et al., 2015). I explore the causes for this gap providing descriptive evidence of women's lack of salaried employment opportunities, and higher within-industry concentration in self-employed occupations, following closely the argumentation in Hardy and Kagy (2020). Relative to my framework, I conclude that women have a lower level of outside options in retail than men, and that testing for this heterogeneity can serve as a test for the importance of outside options.

First, I argue that self-employed women having fewer outside employment options than men leave them having relatively less market power, and therefore less profits, in the labor markets they operate in, following the intuition set by Hardy and Kagy (2020). Political science accounts of used clothes markets in other sub-Saharan African countries, such as Mozambique in Brooks (2019), mention product segmentation - women selling women's clothes - and similar labor markets such as the garments market in Ghana (Hardy and Kagy, 2020) also feature customer segmentation - women shopping from women. With either of these characteristics, the fact that women operate in more crowded markets will make a negative earnings shock weigh more on women - which we observe in our earnings regressions.

The framework's prediction is that a relative lack of outside options could induce a lower ability to exit toward other occupations - a mechanism illustrated in Sharma (2023) in the case of salaried textile workers in Brazil, with men exiting the profession relatively more when wages decrease exogenously. Caldwell and Oehlsen (2022) do not find evidence of more elasticity to price surges among women, in contrast to these other studies, which points to potential asymmetry by direction of hourly earnings change. I will bring evidence to the first strand of papers on elasticity to negative shock, first presenting descriptive statistics showing that self-employed women operate in fewer industries (cross-industry concentration) and that the industries that they do operate in are more crowded (within-industry concentration), relative to self-employed men, closely following Hardy and Kagy (2020), before testing empirically for the importance of these outside options on trajectories.

Descriptive evidence on gendered within- and cross-industry concentration I present job-spell level descriptive statistics, closely following Hardy and Kagy (2020) in their argumentation that women operate in

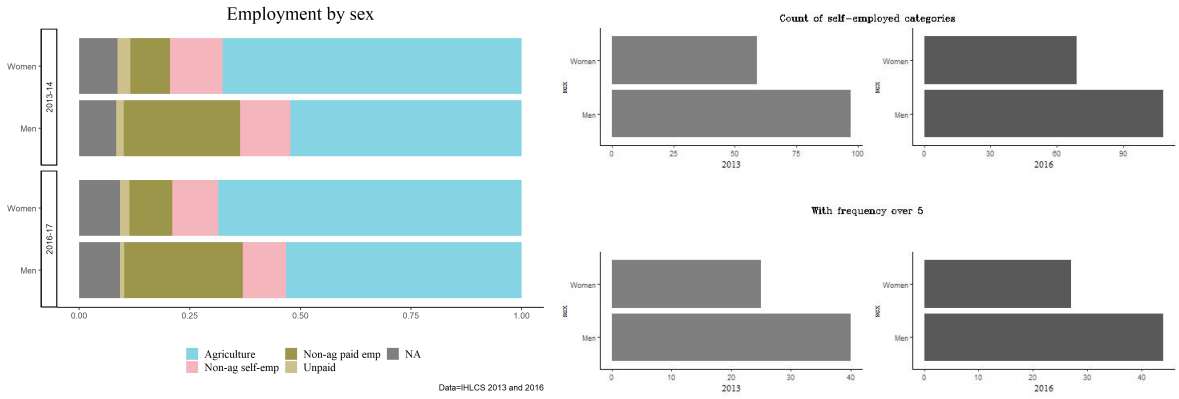

Figure 4: Type of and number of self-employment categories declared by sex (2013-2016)

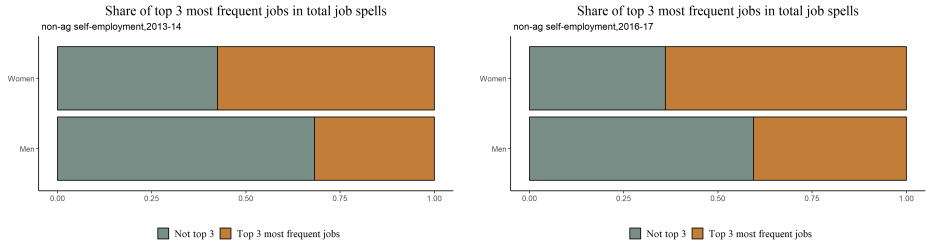

Figure 5: Share of self-employment obs held in top 3 occupations, by sex

more crowded industries than men.

The structure of employment differs greatly by gender, which is primarily due to lower access to paid non-agricultural employment (Figure 4). As stated in Heath et al. (2015), the higher prevalence of self-employment among women in developing countries can be partly explained is explained partly by hiring discrimination preventing them from entering non-farm wage work. In the context of Rwanda, there is a comparable share of men and women in non-agricultural self-employment job spells. However, when looking at the variety of these job spells, in terms of the number of ISIC3 classifications declared (Figure 4), it appears that women operate in fewer occupations than men, and even more so when only looking at occupations where more than 5 women or men say they operate. The fact that a lower number of industries provide suitable jobs is characterized in Sharma (2023), in the case of salaried work, as a higher cross-industry concentration for women. In our setting, while self-employed men outside of agriculture declared almost 100 occupations (40 with more than 5 men declaring to work in that sector) in 2013, only 55 (respectively 25) industries were cited by women (Figure 4). This result is constant across time, and remains the same when considering wage jobs.

Beyond being kept in a few sectors, the industries women do work in are relatively more crowded. Looking at the number of people declaring a to work in a given ISIC3 sector in Figure 5, we can see that more than 50% of women's non-agricultural self-employed job spells are concentrated in 3 industries only[19], while men face less polarized self-employment labor markets. As a result, in 2013, men operated in sectors where 783

[19]These industries are, in order, retail sales via stalls and markets, retail sales not in stores, stalls or market, and wholesale of food, beverages, and tobacco, with retail sales of food, beverages, and tobacco also a predominant industry in 2016.

other people worked, on average (2013), versus 556 for men, and in 2016, these numbers were respectively 858 and 577.

The consequence of this discrepancy in within and cross-industry crowding is, first, that men's earnings react relatively less to shocks - adverse in our case, but also to positive shocks in the case of Hardy and Kagy (2020). Men in the self-employed retail sector are making more profits than women pre-shock, which could indicate them having more customers and being able to operate at fuller capacity, or to charge higher prices, because of that differential crowding and of product or customer segmentation. While these are two plausible channels that our data does not allow us to investigate, we will be focusing responses to a given exposure to the shock, which can indeed vary by gender.
Secondly, this gender difference in the availability of suitable occupations implies that a given impact level has more persistence on women's income. With fewer outside options, owing either to geographical or amenities preferences or norms of "acceptable occupations" for women (Sharma, 2023), women will not reallocate as quickly. In the event that women suffer a larger shock on their earnings (lower $1-\gamma$ in the framework) than men, which follows from the higher concentration, a lower reallocation response such as the one I shed light upon is all the more telling as to the outside options available to them.
After presenting descriptive evidence supporting considering women as having lower outside options than men, I then turn to heterogeneity results and check my model's predictions.

6 Ability to reallocate away from a shock-affected job: outside options

6.1 Outside options and gender

Table 7 presents the result of our heterogeneity analysis on gender. There are two ways of interpreting the results. First, $PostIndRetailExpo$ is the effect of being a man retailer in a zone 1 s.d. more exposed to $caguwa$ before the shock, and $PostIndRetailFExpo$ denotes the additional effect for women retailers. Alternatively, the difference between $PostIndRetailFExpo$ and$PostIndRetailExpo$ is the effect on women retailers in exposed areas compared for women retailers in less exposed areas. Because $caguwa$ retail is an occupation in which women are over-represented, women could also be disproportionately affected by the shock, leading to a gender composition effect that is netted out in the latter interpretation.

In line with the predictions from the framework, women have less elasticity to the earnings decrease, and this is the case even though their earnings are more negatively affected by the policy - by the time we consider the main job of the week, the effect for men's earnings has become insignificant (coef. 1, col. 1-2). While men retailers react to the shock by decreasing hours put into the retail job (coef. 1, col. 3), this is the opposite for women, who on average put 1.5 hours more than less exposed women retailers (coef 2 - coef 1, col. 3). Another important result is that although women do end up going into unemployment relatively more often, there are no differential trends in the extent to which $caguwa$ workers leave their $caguwa$ job (col. 4). There are persistent negative consequences to these reallocation choices, as women earn less income than men and less exposed women retailers, even a year after the reform (col 6).
I also explore which jobs women are abandoning in Table 8 and Table 9. Although I focus on the main job of

	log(earnings)	log(earnings/hour)	hours/week	still working	no job	log(tot. inc.)
Post × IndRetail × Expo	-0.008	0.004	-1.897***	0.001	-0.004	-0.001
	(0.02)	(0.03)	(0.58)	(0.00)	(0.00)	(0.02)
Post × IndRetail × F × Expo	-0.147***	-0.198***	3.379***	-0.003	0.014**	-0.104**
	(0.05)	(0.04)	(0.76)	(0.00)	(0.01)	(0.05)
R-squared	0.475	0.402	0.233	0.006	0.052	0.484
N	23638	23619	53429	53459	61001	29980
Time-district FE	✓	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 7: Heterogeneity on gender - shock exposure, adaptation, and resilience

	Main job of the week					
	W(f)	W(nf)	Unp. fam.	Formal	Retail	Sales, no ret.
Post × IndRetail × F × ZDE	0.004	-0.006	-0.028*	0.007	-0.012	-0.003**
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Post × IndRetail × ZDE	0.006	0.007	0.006	0.014**	0.017*	0.005***
	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
R-squared	0.074	0.230	0.183	0.204	0.433	0.013
N	71665	71665	71665	71766	71766	71766
Time-district-sex FE	✓	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 8: Reallocation of workers across genders - occupational choice

the week, results are constant across all jobs, including those where individuals work beyond their main job of the week. Consistent with the gender inequality in outside options in this context, women's reallocation strategies take the form of abandoning unpaid jobs to free up time and put more hours into their retail job, while men adapt by taking advantage of other paid opportunities. As a result, women go more formal because they increasingly tend to have their self-employed retail job as their main job of the week rather than being an unpaid family contributor. Formality also increases for men, but this is because they tend to go from their self-employed job towards wage jobs. This comes in contrast with the literature on trade shocks and formality (Ponczek and Ulyssea, 2021; McCaig and Pavcnik, 2018) which documents increases in informality as a buffer for trade shocks-driven unemployment. First, in settings where workers have limited outside options and are at self-employed retail jobs, they do not get displaced and instead work more at these jobs. Second, when workers do reallocate away from self-employed jobs, this can come with an increase in formality level even though this job was a second-best option pre-shock. In low-income settings, especially those where formality within self-employment is not costly, informality and self-employment do not overlap completely, highlighting the fact that formality responses are not automatic in all settings.

	No job	Tot.hrs/job	Av. duration	Paid jobs/week	Jobs/w
Post × IndRetail × F × ZDE	0.014**	3.362***	0.162	-0.009	-0.048***
	(0.01)	(0.80)	(0.11)	(0.01)	(0.02)
Post × IndRetail × ZDE	-0.004	-1.030	0.120	0.025**	0.022
	(0.00)	(0.71)	(0.11)	(0.01)	(0.02)
R-squared	0.052	0.230	0.373	0.233	0.240
N	61001	42004	71766	71766	66232
Time-district-sex FE	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 9: Reallocation of workers across genders - extensive margin

While these results match descriptive evidence on women's lack of outside options in Rwanda as well as the predictions of the framework, there could be other reasons beyond outside options why policy effects should differ by gender: women could be less well educated for other opportunities or have more time constraints due to being the sole breadwinners in their households, for example. In subsection B.1, I explore these two channels. Interacting with these explanatory variables does not change the result that women's earnings and income are more exposed to the shock than men's. Hours responses are driven by women with at least a primary school diploma, and the negative effects of the shock on overall income are driven by workers that belong to households where there are other breadwinners in the house, consistent with income effects driving our hours results.

It still remains that norms about women working outside or within the household, or some other factors besides outside options could explain the results. To strengthen this explanation, I turn to a second decomposition based on the geographical distribution of job opportunities.

6.2 Outside options and local wage employment opportunities

In this section, I split the districts of Rwanda in two: those with less than the mean number of wage jobs represented in the whole districts (less than 50 different wage occupations in the IHLCS pre-shock) and those with more. The idea behind this decomposition is that, while self-employment can be started in all places, wage jobs will only be present if firms supply them. In this context, the representation of wage jobs is very spatially polarized, including in districts with some $caguwa$ retail representation. To check that these area do behave in line with my framework, which predicts less reactivity to a given shock on earnings when there are fewer options available, I decompose both by gender and a variable for living in a high-opportunity area.

Table 10 presents the results from decomposing policy effects by gender and local outside options. Although there are no statistically significant effects on hourly earnings at the time where the jobs are exposed, between the two periods, workers still have reallocated in a non-gendered way: while there are still insignificant effects on women's hours, pointing to a modest gender-specific effect remaining, all of workers in high-opportunity districts substitute away from their retail jobs, and all workers in low-opportunities areas invest more in their jobs. As this behaviors could themselves lead to changes in hourly earnings, in the

	Hourly earnings, j	*Hours, j*	*log hours*	*log inc., all jobs*	*log(tot.hours)*
Post × IndRetail × ZDE	-0.451	7.800	0.358**	-0.199	0.194***
	(0.56)	(5.31)	(0.16)	(0.22)	(0.06)
Post × IndRetail × F × ZDE	-0.532	-2.665	-0.148	-0.055	-0.012
	(0.66)	(5.04)	(0.23)	(0.25)	(0.10)
Post × IndRetail × high_opp=1 × ZDE	0.465	-11.163**	-0.437**	0.188	-0.240***
	(0.56)	(5.35)	(0.16)	(0.22)	(0.07)
Post × IndRetail × F × high_opp=1 × ZDE	0.326	7.092	0.230	-0.060	0.104
	(0.66)	(5.16)	(0.24)	(0.25)	(0.10)
R-squared	0.17	0.15	0.09	0.27	0.12
N	23627	53473	53473	29969	53684
District-Time FE	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 10: Heterogeneity on living in a high-opporutnity area

presence of decreasing scale economies, I take the coefficients on hours at the job to still be effects of the policy-driven change in productivity. Through this additional test, I conclude that there is an outside options channel that explains the intensity of job exit following a hourly earnigns decrease. Additionally to this local outside options channel, women still seem more negatively exposed to the shock, and less elastic (col. 3, women experience less of the substitution effect in high-opportunity areas, and less of the income effect in low-opportunity areas). This points to other mechanisms that compromise women's adaptation strategies, which I explore in the next section.

7 Intra-household margins of adaptation and ability to mitigate shock exposure

I have shown evidence that outside options on the labor market influenced reallocation patterns, keeping policy effect on hourly earnings constant. However, self-employed workers are different from salaried workers in that they have more decision-making power over whether a given cost shock translates into a earnings shock. In other contexts, firms have different ways of adapting to shocks without changing their labor demand, including product quality change, sourcing changes, or other organizational changes. In our setting where products are very homogenous and there are few bales wholesalers, a major dimension of within-firm adaptation to a shock could happen within the household. Spouses have different roles whether they operate at the same business as the self employed worker: we first look at all spouses as a diversification device, before diving into the specifics of spousal participation at the firm.

The literature (Zhang, 2014) points to a shock-sheltering effect of having a spouse: because they work at other jobs, spouses act as a portfolio diversification strategy. To investigate this point, I first conduct a heterogeneity analysis of the impact of the shock, depending on having a spouse or unmarried partner - In_couple_i for conciseness.

	Earnings, job-level	*Earnings/hr, job-level*	*Hours, job-level*	*Inc., all jobs*
Post × IndRetail × ZDE	-0.089*	-0.109	-1.262	-0.056
	(0.05)	(0.07)	(1.09)	(0.04)
Post × IndRetail × F × ZDE	0.027	-0.038	4.111***	0.018
	(0.05)	(0.06)	(1.12)	(0.04)
Post × IndRetail × in_couple=1 × ZDE	0.105	0.164**	-1.549	0.046
	(0.07)	(0.08)	(1.11)	(0.06) *
Post × IndRetail × F × in_couple=1 × ZDE	-0.214**	-0.187	-1.050	-0.124
	(0.10)	(0.11)	(1.04)	(0.08)
R-squared	0.35	0.30	0.23	0.35
N	23638	23619	53429	29980
District-Time FE	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓

p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndTr/SpouseTr = indiv./spouse in retail × self-emp. × start date < 06/2016. SE clustered at the district*indiv/spouse treat level

Table 11: Heterogeneity analysis on having a spouse

Table 11 presents the heterogeneity analysis results on shock exposure, adaptation, and resilience. Relative to non-independent retail jobs, single men retail jobs' earnings grew 8.9% slower in districts 1 sd. more exposed to $caguwa$. Importantly, when allowing for trade policy effect to differ by marital status, gender inequality vanishes for the singles: the shock harmed single workers's earnings ($Post \times IndRetail \times Expo$), regardless of their sex (no supplementary effect on $Post \times IndRetail \times F \times Expo$). It does not, however, disappear for couples: married men have a positive coefficient that cancels out this negative effect ($Post \times IndRetail \times In\_couple \times Expo$), although this is significant only at the 12% level in the earnings equation. However, women are not benefiting from being married the same as men are (coefficients countered by negative point estimates on $Post \times IndRetail \times F \times In\_couple \times Expo$, significant for earnings and significant only at the 10.1% level for hourly earnings). Finally, while marriage cancels the effect of shock exposure on earnings, adaptation strategies remain the same, and all women exhibit Giffen-good like labor supply responses to earnings decrease: while marriage modifies men's shock exposure, it does not change outside options, and there is thus no obvious reason for it to change adaptation strategy to a given hourly earning decrease.
In subsection C.1, we check that this differential effect of having a spouse is not driven by positive selection on wealth for married individuals - interacting further with education does not eliminate the negative effect on single retailers' hourly earnings, and the positive effect of married men retailers' ones.

In the context of a trade-driven negative productivity shock on a self-employed labor market, married individuals drive most of the gender inequality in shock exposure. This result raises the question of what men gain from marriage that women do not. I implement a new specification on married business owners to explore intra-household and intra-business organization of production further.

7.1 Domestic-market labor porosity - the insurance value of spousal unpaid labor

There are several reasons why men independent retailers could benefit from marriage differently than women. The first one is domestic labor: in our pre-shock sample, being married is correlated with a 40% increase in domestic work hours for women, and a 30% decrease for men. The other reason is specific to business owners: business structure differs starkly across genders for married individuals. Married women are more likely to work alone (80% of married women's businesses, resp. 70% for men), and much less likely to benefit from unpaid help from their spouse (5% businesses, resp. 19% for men).
Both domestic work and unpaid productive work could theoretically explain our result from Table 11 that having a spouse protects men's businesses from productivity shocks. To rationalize the fact that women being paid or unpaid at the firm determines their occupational choices - paid women at the firm have other paid jobs, and non-participating or unpaid women do not - we can think of a model in which the household maximizes utility from each member's leisure, and consumption, including consumption from work at a family firm. At this firm, if the wife is paid, she faces a trade-off between wage opportunities and work at the firm, same as the man:

$$\underset{h_0^f,h_1^f,h_0^m,h_1^m,c,\iota}{max} U(C, \bar{T} - h_0^f - h_1^f, \bar{T} - h_0^m - h_1^m) \ st \ c = w_0^m h_0^m + w_0^f h_0^f + A(h_1^m)^\alpha (j_1^f)^\gamma \iota^\beta - g\iota$$

While if the worker is not paid, she can only work at the firm or at home. As a consequence, a worker whose spouse's business is affected by an input price increase can increase domestic production at home so that the spouse can increase labor supply. In the case where domestic and market labor are porous, domestic labor can also have a productivity-enhancing function - here, for example, ironing clothing and increase their perceived quality. The model thus becomes:

$$\underset{h_0^f,d^f,h_0^m,h_1^m,c,\iota}{max} U(C, \bar{T} - h_0^f - d^f, \bar{T} - h_0^m - h_1^m) \ st \ c = w_0^m h_0^m + (A(d^f))(h_1^m)^\alpha (j_1^f)^\gamma \iota^\beta - g\iota$$

The difference between choosing to mitigate a family shock through extra work on the market, at the firm - be it paid or unpaid - or through domestic work is the variables on which these mitigation strategies will show: mitigation elsewhere will compensate for consumption losses, but not losses at the earnings losses at the firm. Working more hours at the firm for pay could mitigate total earnings losses, but at the price of more hours, and will not lead to less productivity losses. Working for no pay at the firm will show in hours in retail, and will increase men's productivity by an accounting artifice, but not really - it thus does should not enter men's decision to leave the firm or not. Domestic work is different in that, if the rewards from it are self-employment specific, workers who benefit from this productivity-enhancing domestic work will leave the firm less easily, especially if domestic work is countercyclical.
Fortunately, fine-level data allows me to decompose business structure according to whether the spouse works at all in the firm, for pay or for no pay, and to simultaneously observe time use in domestic work for both waves. When a member of the couple has a business, I create indicator variables that determine if they are

working alone, working with their spouse without paying them ($HasUnpaidHelp$), or working with their spouse and paying them ($HasPaidHelp$). In doing so, I can distinguish between the effect of having a spouse for earnings sources diversification and domestic work, having a collaborating spouse who is paid, and the value of unpaid spousal productive work. Because benefiting from paid or unpaid productive help is specific to business owners, I take the baseline regression to the married business owners subsample, estimating:

$$\begin{aligned} Y_{i,d,t} =& \alpha + \beta_{\mathbf{1}}\mathbf{Post_t} \times \mathbf{Expo._{d(i,t-1)}} \times \mathbf{IndRetail_i} + \beta_{\mathbf{2}} + \mathbf{Post_t} \times \mathbf{Expo._{d(i,t-1)}} \times \mathbf{IndRetail_i} \times \mathbf{HasPaidHelp} + \\ & \beta_{\mathbf{3}} + \mathbf{Post_t} \times \mathbf{Expo._{d(i,t-1)}} \times \mathbf{IndRetail_i} \times \mathbf{HasUnpaidHelp} \\ & + \beta_4 Post_t \times IndRetail_i + \beta_5 Post_t \times HasUnpaidHelp_i + \beta_6 Post_t \times HasPaidHelp_i + \\ & \beta_7 Expo._{d(i,t-1)} \times HasPaidHelp_i + \beta_8 Expo._{d(i,t-1)} \times HasUnpaidHelp_i + \beta_9 HasUnpaidHelp_i + \\ & \beta_{10} HasPaidHelp_i + \beta_{11} IndRetail_i + \beta_{12} X_{i,d,t} + \gamma_{t,d} + trim_t + \varepsilon_{i,d,t} \end{aligned} \tag{3}$$

The coefficients in bold are the coefficients of interest - β_1 is the effect of being a married independent retailer in an area 1 s.d. more exposed to $caguwa$ before the shock, compared to married non-retail business owners: it is a translation of our baseline equation to the married business owner subsample [20] β_2 is the additional effect of the shock on retailers who work with their spouses under equal status, compared to working alone, while β_3 is the additional effect for workers who work with their spouses without paying them, compared to working alone. I estimate this equation separately on men and women. The controls and clusters are unchanged.

Additionally, I estimate the mirror equation on spouses of business owners, decomposing by a dummy for being paid help -$IsPaidHelp$ and being unpaid help -$IsUnpaidHelp$, which allows us to see what spouses are doing to adapt to their spouses' shock. For this set of two equations, I consider earnings, hours and income, similarly to previous analyses, and I also add domestic work variables, which correspond to the time use module of the IHLCS[21].

7.2 Affected retailers and spousal participation in the firm

Table 12 presents the results on the causal effect of the policy on earnings and labor supply. All married women business owners suffer from hourly earnings decreases (coef 1 - col (5) and (6)) compared to retail business women in less exposed areas, which matches our result on the sample of all women. Strikingly, only men who work with women under equal status suffer from the same negative earnings effect (coef 1+2 - col (1) and (2)). While this could be interpreted as the consequence of a lack of earnings diversification in the face of the shock, this explanation would imply similar shock exposure for men working with their spouses for no pay, which is not the case. Men with unpaid spouses seem more similar in their exposure to men with non-participating wives, suggesting that being excluded from the paid labor market determines

[20] In subsection C.2, I show proof that the previous results from the paper also work in this subsample of married business owners - the sign and significance level of our coefficients does not change compared to our baseline specification.

[21] The variables for chores on the 2013 and the 2016 round are not the same, except for cooking. While there is no reason to think that this change in categories would lead to different effects in married women depending on pay status and district, taking only the variables that are on both waves does not change the results either.

	Men self-emp retailers				*Women self-emp retailers*			
	log(earn)	log(earn/hr)	hrs/wk	log(hrs/wk)	log(earn)	log(earn/hr)	hrs/wk	log(hrs/wk)
2016 × IndRetail × Expo	-0.030	0.044	-2.689***	-0.070**	-0.095***	-0.154***	0.102	-0.049**
	(0.05)	(0.05)	(0.75)	(0.03)	(0.03)	(0.03)	(0.43)	(0.02)
2016 × PaidHelp × IndRetail × Expo	-0.405**	-0.461***	-3.777	-0.056	-0.128	-0.195	2.596	0.212**
	(0.15)	(0.13)	(4.44)	(0.12)	(0.13)	(0.19)	(2.44)	(0.09)
2016 × UnpaidHelp × IndRetail × Expo	0.201	0.061	2.194	0.081	-0.120	-0.132	1.742	0.035
	(0.17)	(0.17)	(2.50)	(0.07)	(0.19)	(0.30)	(5.86)	(0.27)
R-squared	0.300	0.272	0.301	0.279	0.279	0.235	0.357	0.342
N	4288	2963	3176	3176	3542	2159	2425	2425
district*Post FE	✓	✓	✓	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndTr/SpouseTr = indiv./spouse in retail × self-emp. × start date < 06/2016. SE clustered at the district*indiv/spouse treat level

Table 12: Heterogeneity of shock effect by intra-familial business structure - affected workers

spouses' reactions more than being at the firm or not. Adaptation strategies also vary, as men working with paid help decrease involvement in the firm (col (3) + (4), coefs 1 + 2) compared with men working with unpaid help (col 1 + 3). As spousal status within the firm and on the paid labor market is driving labor responses and shock exposure, I now turn to an examination of spouses of affected retailers' responses.

7.3 Spouses of affected retailers

Table 13 presents results on the husbands and wives of affected retailers. I first look at the causal effect of the shock on spousal domestic labor, using time use variables from the household survey. The results show contrasting responses across sexes: while all wives to self-employed retailers increase the hours of domestic work they provide in response to the shock, husbands decrease them, except for husbands working at the family firm with their wives under equal status. This increase in domestic work comes at the cost of stopping to work at the family firm and being unemployed more often for unpaid wives (coefficient 1+3, col. (6-8)), while paid wives keep on working at the firm, do not decrease hours and do not increase domestic work as much as the rest, although this coefficient is imprecisely estimated.

These results suggest that intra-household shock adaptation strategies are also dictated by outside options. Workers and their spouses adapt to shocks by either increasing domestic production or market work. Which margin they choose depends on their access to each of these markets: wives, whose relative lack of outside options has been documented in a previous section, increase domestic work, while husbands of similarly affected wives decrease their domestic work input - and might increase market labor in response, as shown by a slight hourly earnings increase for unaffected husbands of retailers. The only category of wives who do not increase domestic labor as a result of their husbands' shock are wives for whom paid work is an option: wives who have a paid business themselves. For these women, domestic work does not increase as much and is matched in part by an increase in their husband's domestic work.

	Men married to self-emp retailers				*Women married to self-emp retailers*			
	log(hrs chores)	hrs retail	log hrs retail	No job	log(hrs chores)	hrs retail	log hrs retail	No job
2016-17 × SpouseTr × Expo	-0.125**	-0.870	-0.036	0.001	0.058***	0.771	0.000	0.005
	(0.05)	(0.71)	(0.03)	(0.01)	(0.02)	(0.96)	(0.04)	(0.01)
2016-17 × HelpsPaid × SpouseTr × Expo	0.267**	-0.630	0.042	-0.025	-0.086	-3.416	-0.046	-0.023
	(0.12)	(4.03)	(0.12)	(0.02)	(0.09)	(5.82)	(0.22)	(0.02)
2016-17 × HelpsUnpaid × SpouseTr × Expo	2.392	0.407	0.010	-0.001	0.040	-4.072***	-0.188***	0.045***
	(1.95)	(2.57)	(0.12)	(0.02)	(0.05)	(1.32)	(0.07)	(0.01)
R-squared	0.171	0.259	0.232	0.065	0.430	0.253	0.189	0.138
N	1451	4470	4470	3450	3851	4872	4872	3931
district, urban FE	✓	✓	✓	✓	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓	✓	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female.
IndTr/SpouseTr = indiv./spouse in retail × self-emp. × start date < 06/2016. SE clustered at the district*indiv/spouse treat level

Table 13: Heterogeneity of shock effect by intra-familial business structure - spouses of affected workers

7.3.1 Discussion of alternative explanations for the role of spousal status

We could be worried that being paid is covering for something else, like having created the firm, having more say over household decisions, or being more skilled, which could be driving the results. This would mean that the effect on men's earnings is not driven by women's status, but is instead caused by an omitted variable causing both women to be paid and reallocation strategies to be less successful. However, decomposing our effects by having created the firm (having longer tenure at the firm than the husband), being older or more educated than the husband, does not explain the effects and does not kill the effect of paid status on men's earnings.

Another explanation could be that husbands collaborate with unequal-status wives to hide part of the profits from them. I model dissimulating income as lying to one's spouse about the parameters of the production function (for example, lowering the hourly turnover parameter). Statically, spouses who are being lied to should provide less labor than spouses who know the real parameters, and dynamically, because they provide less labor, they should decrease labor supply less than paid spouses. This is not what we see happening, as unpaid spouses decrease labor supply much more than paid spouses.

7.4 Conclusion

Adaptation to shocks is key for workers to be resilient to shocks and for structural transformation to happen. Using an exogenous trade-driven increase in the sole input of self-employed workers and detailed data linking business structure and in-household work, I exhibit a novel adaptation mechanism to permanent sectoral shocks and put forward two reasons why self-employed workers could be more slow to move away from affected jobs than salaried workers. The first one is linked to opportunities outside of self-employment: in a context where self-employment is often a survival strategy in rationed labor markets, decreases in hourly wages can translate into increases in labor input at the same occupation, while rigidity in wages and hours

often prevent these responses from happening in salaried settings. Secondly, as self-employed workers benefit directly from spousal unpaid domestic and productive work, while these benefits would would be retained by the business owners in the case of salaried work, self-employed men can use novel margins to mitigate the effect of a shock on their productivity. Although unpaid productive work only increases men's productivity in an accounting sense, spousal productivity-enhancing domestic work plays the role of an insurance against shocks and slows down transitions out of affected jobs,keeping both men and women in non-wage working arrangements.

As countries develop, self-employed workers transition to wage employment, and unpaid workers integrate the formal labor force. It is with this objective in mind that countries implement policies aimed at increasing firm size and formality levels. These results point to a need to consider female (paid) labor participation and men's access to wage employment not separately, but as a nexus that benefits from specific shock adaptation margins, and can thus be especially difficult to eliminate through policy. This will be the object of future work using harmonized data on linked productive and domestic labor within the household.

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A Time allocation model without and with a wage alternative

Without a wage job, the worker's allocation problem is

$$\underset{h1,c,\iota}{max}\ Dc^M(\bar{T}-h_1)^N\ \ st\ \ c = Ah_1^{\alpha}\iota^{\beta} - g\iota$$

And the associated program and FOC are

$$\lambda(h_1, c, \iota, \mu) = Dc^M(\bar{T}-h_1)^N + \mu(c - Ah_1^{\alpha}\iota^{\beta} - g\iota)$$

$$\frac{\delta\lambda}{\delta h_1} = -NDc^M(\bar{T}-h_1)^{N-1} - \mu A\alpha h_1^{\alpha-1}\iota^{\beta} = 0 \Leftrightarrow -NDc^M(\bar{T}-h_1)^{N-1} = \mu A\alpha h_1^{\alpha-1}\iota^{\beta} \quad (4)$$

$$\frac{\delta\lambda}{\delta c} = MDc^{M-1}(T-h_1)^N + \mu = 0 \Leftrightarrow MDc^{M-1}(T-h_1)^N = -\mu \quad (5)$$

$$\frac{\delta\lambda}{\delta\iota} = \mu(\beta A h_1^{\alpha}\iota^{\beta-1} - g) = 0 \Leftrightarrow \beta A h_1^{\alpha}\iota^{\beta-1} = g \tag{6}$$

$$\frac{\delta\lambda}{\delta\mu} = 0 \Leftrightarrow c = A h_1^{\alpha}\iota^{\beta} - g\iota \tag{7}$$

Solving for it yields

$$\frac{(4)}{(5)} \Leftrightarrow \frac{-NDc^M(\bar{T}-h_1)^{N-1}}{MDc^{M-1}(T-h_1)^N} = \frac{\mu A\alpha h_1^{\alpha-1}\iota^{\beta}}{-\mu} \Leftrightarrow \frac{N}{M}\frac{c}{(\bar{T}-h_1)} = A\alpha h_1^{\alpha-1}\iota^{\beta} \tag{8}$$

$$A\alpha h_1^{\alpha-1}\iota^{\beta} = \beta A h_1^{\alpha}\iota^{\beta-1} \times \frac{\iota\alpha}{\beta h_1} = \text{(using (3))}\ g \times \frac{\iota\alpha}{\beta h_1} \tag{9}$$

$$\text{(9) into (10)} \Leftrightarrow \frac{N}{M}\frac{c}{(\bar{T}-h_1)} = g \times \frac{\iota\alpha}{\beta h_1} \Leftrightarrow c = g\frac{\iota\alpha M(\bar{T}-h_1)}{N\beta h_1} \tag{10}$$

$$(6)\ : \beta A h_1^{\alpha}\iota^{\beta-1} = g \Leftrightarrow \iota = [\frac{g}{\beta A h_1^{\alpha}}]^{\frac{1}{\beta-1}} \tag{11}$$

(7) and (10)

$$c = A h_1^{\alpha}\iota^{\beta} - g\iota = g \times \frac{\iota\alpha M(\bar{T}-h_1)}{\beta h_1 N} \Leftrightarrow A h_1^{\alpha}\iota^{\beta-1} - g = g \times \frac{\alpha M(\bar{T}-h_1)}{\beta h_1 N} \tag{12}$$

but $g = \beta A h_1^{\alpha}\iota^{\beta-1}$ (6), so

$$\frac{g}{\beta} - g = g \times \frac{\alpha M(\bar{T}-h_1)}{\beta h_1 N} \Leftrightarrow \frac{1-\beta}{\beta} = \frac{\alpha M(\bar{T}-h_1)}{\beta h_1 N} \Leftrightarrow (1-\beta)h_1 N = \alpha M(\bar{T}-h_1) = \alpha M\bar{T} - \alpha M h_1$$
$$\Leftrightarrow h_1(N(1-\beta)+\alpha M) = \alpha M\bar{T} \Leftrightarrow h_1 = \frac{\alpha M\bar{T}}{(N(1-\beta)+\alpha M)} \tag{13}$$

Here, work at the firm and leisure only depend on fixed parameters , and only consumption and input purchase will adjust (upwards) to an increase in input prices. $\iota = [\frac{g}{\beta A h_1^{\alpha}}]^{\frac{1}{\beta-1}}$ et $c = A h_1^{\alpha}\iota^{\beta} - g\iota$.

Adding a wage option If we add in another job that the worker can do, we are in a model in which the marginal value of an hour of work at the firm is equated with the value of wage work, leading to input prices effectively influencing time spent working through the modification of the value of work at the firm.

$$\max_{h_0,h1,c,\iota} Dc^M(\bar{T}-h_0-h_1)^N \ \ st\ \ c = w_0 h_0 + A h_1^{\alpha}\iota^{\beta} - g\iota$$

$$\lambda(h_0,h_1,c,\iota,\mu) = Dc^M(\bar{T}-h_0-h_1)^N + \mu(c - w_0 h_0 - A h_1^{\alpha}\iota^{\beta} + g\iota)$$

$$\frac{\delta\lambda}{\delta h_0} = -NDc^M(\bar{T}-h_0-h_1)^{N-1} - \mu w_0 = 0 \Leftrightarrow -NDc^M(\bar{T}-h_0-h_1)^{N-1} = \mu w_0 \tag{14}$$

$$\frac{\delta\lambda}{\delta h_1} = -NDc^M(\bar{T}-h_0-h_1)^{N-1} - \mu A\alpha h_1^{\alpha-1}\iota^\beta = 0 \Leftrightarrow -NDc^M(\bar{T}-h_0-h_1)^{N-1} = \mu A\alpha h_1^{\alpha-1}\iota^\beta \quad (15)$$

$$\frac{\delta\lambda}{\delta c} = MDc^{M-1}(T-h_0-h_1)^N + \mu = 0 \Leftrightarrow MDc^{M-1}(T-h_1)^N = -\mu \quad (16)$$

$$\frac{\delta\lambda}{\delta \iota} = \mu(\beta A h_1^\alpha \iota^{\beta-1} - g) = 0 \Leftrightarrow \beta A h_1^\alpha \iota^{\beta-1} = g \quad (17)$$

$$\frac{\delta\lambda}{\delta \mu} = 0 \Leftrightarrow c = w_0 h_0 + A h_1^\alpha \iota^\beta - g\iota \quad (18)$$

$$(14)\ and\ (15)\ : w_0 = A\alpha h_1^{\alpha-1}\iota^\beta \quad (19)$$

$$(17)\ and\ (19)\ : g = w_0\frac{\beta h_1}{\alpha\iota} \Leftrightarrow \frac{h_1}{\iota} = \frac{g\alpha}{wo\beta} \quad (20)$$

$$\frac{(14)}{(16)} : \frac{-NDc^M(\bar{T}-h_0-h_1)^{N-1}}{MDc^{M-1}(T-h_0h_1)^N} = \frac{\mu w_0}{-\mu} \Leftrightarrow \frac{Nc}{M(T-h_0-h_1)} = w_0 = \text{(using (16))}\ A\alpha h_1^{\alpha-1}\iota^\beta \quad (21)$$

$$(17)\ and\ (20)\ : \beta A h_1^\alpha \iota^{\beta-1} = w_0\frac{\beta h_1}{\alpha\iota} \Leftrightarrow h_1^{\alpha-1} = \frac{w_0}{A\alpha\iota^\beta} \Leftrightarrow h_1 = [\frac{w_0}{A\alpha\iota^\beta}]^{\frac{1}{\alpha-1}} \quad (22)$$

$$\begin{aligned} &(22)\ : h_1 = [\frac{w_0}{A\alpha\iota^\beta}]^{\frac{1}{\alpha-1}} = (20)\ : \frac{g\alpha\iota}{w_0\beta} \Leftrightarrow \iota^{\frac{-\beta-\alpha+1}{\alpha-1}}[\frac{w_0}{A\alpha}]^{\frac{1}{\alpha-1}} = \frac{g\alpha}{w_0\beta} \\ &\Leftrightarrow \iota^{\frac{1-\beta-\alpha}{\alpha-1}} w_0^{\frac{-\alpha}{\alpha-1}} \alpha^{\frac{-\alpha}{1-\alpha}} A^{\frac{1}{1-\alpha}} = \frac{g}{\beta} \Leftrightarrow \iota^{\frac{1-\beta-\alpha}{\alpha-1}} = \frac{g}{\beta}(\frac{w_0}{\alpha})^{\frac{\alpha}{\alpha-1}} A^{\frac{1}{\alpha-1}} \\ &\Leftrightarrow \iota = (\frac{g}{b})^{\frac{\alpha-1}{1-\beta-\alpha}}(\frac{w_0}{\alpha})^{\frac{\alpha}{1-\beta-\alpha}} A^{1-\beta-\alpha} \end{aligned} \quad (23)$$

And now we can get h_1, h_0, c and l.

$$(20) h_1 = \frac{g\alpha\iota}{w_0\beta} = \frac{g\alpha(\frac{g}{b})^{\frac{\alpha-1}{1-\beta-\alpha}}(\frac{w_0}{\alpha})^{\frac{\alpha}{1-\beta-\alpha}} A^{1-\beta-\alpha}}{w_0\beta} = g^{\frac{-\beta}{1-\beta-\alpha}}\frac{\alpha(\frac{1}{b})^{\frac{\alpha-1}{1-\beta-\alpha}}(\frac{w_0}{\alpha})^{\frac{\alpha}{1-\beta-\alpha}} A^{1-\beta-\alpha}}{w_0\beta} \quad (24)$$

B robustness outside option

B.1 Alternative explanatory channels

	Earnings, job-level	*Hours, job-level*	*Income across all jobs*
Post × IndRetail × Expo	0.035	-0.273	-0.000
	(0.07)	(1.56)	(0.03)
Post × IndRetail × F × Expo	-0.201***	0.032	-0.113**
	(0.05)	(1.89)	(0.05)
Post × IndRetail × Has diploma × Expo	-0.082	-2.686	-0.023
	(0.10)	(1.71)	(0.08)
Post × IndRetail × F × Has diploma × Expo	0.116	5.626**	0.063
	(0.13)	(2.36)	(0.09)
R-squared	0.39	0.23	0.39
N	23638	53429	29980
District-Time FE	✓	✓	✓
Trimester FE	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 14: Heterogeneity analysis on sex and education

	Earnings, job-level	*Hours, job-level*	*Income across all jobs*
Post × IndRetail × Expo	-0.025	-2.160**	-0.060**
	(0.04)	(0.96)	(0.03)
Post × IndRetail × F × Expo	-0.148***	3.026***	-0.034
	(0.03)	(1.08)	(0.05)
Post × IndRetail × Sole breadwinner × Expo	0.072	1.854	0.169*
	(0.12)	(1.75)	(0.10)
Post × IndRetail × F × Sole breadwinner × Expo	0.035	0.818	-0.128
	(0.15)	(2.18)	(0.15)
R-squared	0.48	0.23	0.35
N	23638	53429	29980
District-Time FE	✓	✓	✓
Trimester FE	✓	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 15: Heterogeneity on being the sole breadwinner and sex

	daily earnings	hourly earnings
Post × IndRetail × ZDE	-0.172*	-0.253*
	(0.09)	(0.12)
Post × IndRetail × F × ZDE	-0.012	0.124
	(0.06)	(0.10)
Post × IndRetail × in_couple=1 × ZDE	0.194**	0.315***
	(0.08)	(0.10)
Post × IndRetail × F × in_couple=1 × ZDE	-0.291***	-0.466***
	(0.10)	(0.11)
Post × IndRetail × diploma=1 × ZDE	0.036	0.195
	(0.10)	(0.13)
Post × IndRetail × F × diploma=1 × ZDE	-0.024	-0.260**
	(0.10)	(0.12)
Post × IndRetail × in_couple=1 × diploma=1 × ZDE	-0.154	-0.254**
	(0.12)	(0.10)
Post × IndRetail × F × in_couple=1 × diploma=1 × ZDE	0.304**	0.474***
	(0.14)	(0.14)
R-squared	0.32	0.31
N	57541	32225
District-Time FE	✓	✓
Trimester FE	✓	✓

* p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndRetail =retail × self-emp. × start date < 06/2016. SE clustered at the district × retail level.

Table 16: Horserace between skill proxy and couple

C robustness intra-household

C.1 Testing for selection into marriage explaining differential shock exposure

C.2 Checking that results still hold in the married business owners subsample

	Earnings, job-level	*Hours, job-level*	*Income., all jobs*	*Log inc., all jobs*
2016-17 × Indiv in IndRetail × exp	-0.056	-1.959**	0.028	0.072
	(0.04)	(0.79)	(0.05)	(0.04)
2016-17 × Women × Indiv in IndRetail × exp	-0.151***	2.090**	-0.151	-0.161*
	(0.04)	(0.83)	(0.12)	(0.09)
R-squared	0.32	0.27	0.32	0.27
N	11204	11494	5642	5639
District-Time FE	✓	✓	✓	✓
Trimester FE	✓	✓	✓	✓

p<0.10, ** p<0.05, *** p<0.01 Expo: Z-score district exposure to caguwa at t-1. post: 2016-2017 round. F: female. IndTr/SpouseTr = indiv./spouse in retail × self-emp. × start date < 06/2016. SE clustered at the district*indiv/spouse treat level

Table 17: Average and gendered effect on subsample of married business owners