Economics of Disasters and Climate Change (2023) 7:281–302
https://doi.org/10.1007/s41885-023-00130-4

RESEARCH

Droughts and Local Labor Markets. Studying Heterogenous Effects on Women and Indigenous People in Chile

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Received: 2 March 2023 / Accepted: 22 May 2023 / Published online: 2 June 2023

Abstract
Climate change is a pressing issue, affecting the lives of all people across the world. However, poorer and excluded communities are usually more affected, especially in low-income countries. Among them, women but particularly indigenous groups in rural areas seem to carry the bulk of the impacts produced by climate change and its many manifestations. We study the relationship between droughts and incomes and labor market outcomes in Chile over the period 1990–2017, focusing in particular on indigenous women. Our results show that overall indigenous women are the group most severely affected by droughts, decreasing their income, their probability of working in agriculture, and increasing their likelihood of working as an unpaid family worker or being out of the labor force. Results are robust to the use of different variables to measure droughts and to different econometric specifications. Our study corroborates the existence of marked heterogenous effects of climate change on different population groups and the vulnerability of indigenous communities to these shocks.

Keywords Droughts · Climate change · Women · Indigenous groups · Water scarcity · Chile

Introduction

Climate change is one of the most pressing global problems, involving sociocultural and institutional changes (Barnes and Dove 2015). The vulnerability to climate change in local communities is increasing around the world and is projected to increase further in coming decades. This vulnerability is also related to the reproduction and increase of several inequalities

 The work was financed with the support of the Latin America and the Caribbean Research Network of the Inter-American Development Bank. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.

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(IPCC 2014). Poorer communities are the ones who experience its impacts the most, suffering the increase in temperatures, the loss of biodiversity, droughts, and water scarcity, among other detrimental impacts. This is because these vulnerable groups are also largely excluded from the decision-making processes that affect their territories. Within these groups, women and indigenous peoples have been highlighted in recent literature for being the most affected by climate change, especially in rural contexts (Brugnach et al. 2017).

In the case of women, recent research on climate change has shown severe effects on employment, income, and increased vulnerability. Indigenous peoples, on the other hand, have experienced colonization processes that pushed a large part of the population to lands that are highly vulnerable to climate change, concentrating most of the cultivable land in non-indigenous hands. This is particularly marked in predominantly agricultural economies, where phenomena such as desertification, water scarcity and loss of biodiversity have had a strong impact on indigenous economies, increasing their levels of vulnerability and pushing these populations to the urban margins (Tsosie 2007; Sobrevila 2008). These effects become particularly relevant when we look at the condition of historical vulnerability that rural and indigenous women have had in Latin America, and in the Chilean case specifically (Denton 2002; Pearse 2017).

In Chile, one of the most relevant problems of climate change today is water scarcity and its devastating effects on the population, especially rural inhabitants. During the last decade, Chile has faced one of the longest and most extensive droughts in its history, which has impacted the replenishment of aquifers, basins, and general water availability (Cr2 2015). The increase in frequency and intensity of droughts across the globe over the last decades has been linked directly to climate change (IPCC 2022). In Chile, the consequences of this prolonged drought are compounded by a governance system that conceives water as a commodity, with a high concentration of water rights in a few hands, and where irrigation associated with agriculture and forestry accounts for 73% of consumptive water use, resulting in a strong linkage between agro-industrial exploitation and water scarcity.

Research on climate change and economic outcomes indicates that weather shocks, such as changes in temperature, rainfall, and windstorms, affect agricultural and industrial output, labor productivity, health, and conflict, among other variables (Dell et al. 2014). However, the literature on rainfall shocks, including drought and water scarcity, has focused primarily on their aggregate impacts on agricultural activities and in rural areas. Results have shown that rainfall variability decreases agricultural output (Damania et al. 2020), agricultural wages (V. A. Mueller and Osgood 2009; V. Mueller and Quisumbing 2011), local tax revenues (Sanoh 2015), and increases food prices and vulnerability to poverty (Hill and Porter 2017). Rainfall shocks also increase outmigration (Baez et al. 2017) and farm households' labor supply in non-agricultural sectors, with diversification of activities operating as a mitigation and adaptation strategy (Branco and Féres 2021). Water scarcity, defined as large sustained dry events, has also affected urban areas, decreasing employment, hourly wages, hours worked, and labor incomes, mainly through adverse impacts on health and productivity (Desbureaux and Rodella 2019).

Moreover, rainfall shocks can have long-term impacts on economic outcomes and well-being, as exposure to rainfall shocks in early childhood affects education and health later in life (Dinkelman 2017; Shah and Steinberg 2017); while increased drought frequency has long-term negative impacts on employment and wages in the agricultural, manufacturing and service sectors (Bastos et al. 2013).

As mentioned, the impacts of rainfall shocks may be heterogeneous among socio-economic groups, and stronger for groups that are more likely to be exposed to shocks, and less able to cope with them. Exploring heterogeneous impacts by gender, Mahajan

(2017) studies the effect of rainfall shocks on agricultural wages and finds that low rainfall increases the gender wage gap in agriculture. Feeny et al. (2021) find that rainfall shocks experienced in early childhood decrease the probability of formal sector employment for adult women but not for men, because they lower girls' educational attainment. On average, women appear to be less able than men to diversify into non-farm, non-agricultural activities (Afridi et al. 2022), but this varies with women's socioeconomic status and stage in the life cycle, with younger women with higher incomes and education levels being more likely to diversify away from agriculture (Huynh and Resurreccion 2014).

On the other hand, indigenous people appear to be more vulnerable to rainfall shocks and water scarcity compared to the rest of the population, because they are more likely to be exposed and are less able to adopt mitigation and adaptation strategies (Islam and Winkel 2017). In particular, rainfall shocks have been associated with a decrease in education expenditure and school enrollment, and an increase in child labor among indigenous households (Nordman et al. 2022; Pham 2022). Quandt (2019) and Azong & Kelso (2021) are among the few studies that adopt an intersectional approach to explore the differential impact of rainfall shocks on indigenous women. In Cameroon, Azong & Kelso (2021) find that women are more vulnerable to rainfall shocks regardless of their ethnicity, because of socioeconomic and cultural discrimination. Meanwhile, Quandt (2019) finds differing perceptions of livelihood resilience between genders and members of different ethnic groups in Kenya. Results show that perceptions of livelihood resilience are lower among women, but significant heterogeneity exists at the intersection of gender and ethnicity. In turn, perceptions affect the adoption of adaptation strategies. Finally, for the case of Chile, recent qualitative research has shown that changes in water availability and governance particularly impact the daily lives of Mapuche women (Bravo and Fragkou 2019).

Thus, the labor market impacts of rainfall shocks, including droughts and water scarcity, depend in part on the sectoral composition of the local production structure, and on people's access to adaptation strategies, which varies across socioeconomic groups. However, evidence on heterogeneous impacts is still scarce, especially for the Latin American context, and at the intersection of gender and ethnicity. This paper seeks to contribute to the literature on the relationship between climate change and inequality. To the best of our knowledge, this is the first study to analyze, for the case of Chile, the differential impacts of droughts on women, indigenous people, and indigenous women using an econometric approach. We use individual level information for the period 1990–2017, a fixed-effect model at the municipality level and different measures of drought to account for the fact that most of the effect could be concentrated only in the hardest hit municipalities. Our main results corroborate the hypothesis that indigenous women are the most affected by droughts in terms of income and employment status. Each one standard deviation increase in the continuous measure of droughts reduces autonomous income of indigenous women by 0.14% in the country and 0.314% in the south of Chile, where the *Mapuche* communities tend to concentrate. However, using a dichotomous measure that strictly identifies areas suffering from a drought, increases this percentage to 4.81% in absolute value for the south of the country. Similarly, as drought increases, the likelihood of working in agriculture decreases by 0.11%, and the likelihood of working as an unpaid family worker or of being out of the labor force increases by 0.03% and 0.114% respectively. Again, using a dichotomous measure identifying areas under drought increases these effects significantly (to -1.6% and 2.27% in the cases of the probability of working in agriculture and of being out of the labor force), suggesting that hard-hit areas are the ones in which these impacts are concentrated.

The rest of the paper is organized as follows. Sect. "Water governance in Chile" provides a brief context on the water governance in Chile, to understand how that governance affects indigenous and other vulnerable groups' access to water. Sect. "Data and methods" describes the data and methods used, and Sect. "Results" presents the main results. Sect. "Conclusions" concludes and presents some policy recommendations.

Water Governance in Chile

The concentration of water use for irrigation and the strong linkage between agro-industrial exploitation and water scarcity is the result of the politics of water in Chile. The current water governance system is the product of a long historical process, where governments have played different roles in water management, the generation of technical knowledge, and associated infrastructure, which have deeply affected some groups of the population more than others. In 1981, through the DFL-1122 decree, the current Water Code was established, recognizing water resources as public goods, but paradoxically giving at the same time rights in perpetuity over them to the private sector.

Water rights were initially given for free and permanently to private individuals and companies, which, until 2005, were exempt from taxes and not required to use this water for productive activities. The allocation of water rights did not consider their historical uses, causing severe impacts on the indigenous communities that had been depending on them (Bravo and Fragkou 2019). Within this context, when water rights were established (during Pinochet's dictatorship in the 80 s), indigenous communities lacked access to information about changes in water property and the inscription of water rights, and therefore were basically excluded from the process. This change in water allocation also included the ownership of groundwater which has been also privatized: as an example, in the north of Chile, a great part of water rights was registered by the mining industry, which currently owns 95% of groundwater rights (Castillo 2016).

Towards the end of the 1980s, a water market was established, which allowed renting and selling of water property rights among private actors with no Government intervention. The return to democracy in 1990, after Pinochet's dictatorship, did not mean any substantial change in laws regarding water rights. The Water Code was only modified in 2005 and recently in 2022,[1] but without altering the fundamentals of the water governance system (Peña-Torres et al. 2019).

Water governance since the 1980s has been extremely relevant for the configuration of the agriexport sector, concentrating water rights in more profitable areas. However, not only water rights were allocated under a market system, but also the irrigation infrastructure is concentrated in few hands. The main actor in this process, with a key role in the current configuration of the agriexport business, was the National Irrigation Commission (CNR, in Spanish), created in 1985.

In this context, the only public policy for drought management in Chile is the Water Scarcity Decree, a legal instrument created to operate during short periods of time, which, among other aspects, authorizes water extraction in rural areas in extreme drought conditions. According to article n° 314 of the Water Code, this instrument gives the General

[1] As main changes, the priority of human right in the use of water and the need for effective use of water is introduced. These modifications affect only the new rights (6% of the water in Chile), while the rights already granted remained intact.

Direction of Water (DGA in Spanish) the power to allocate and redistribute water resources with the purpose of "authorizing underground and surface water extraction without requiring the possession of water entitlements or limiting the volume of extraction to local ecological conditions" (MOP S/F). However, as rainfall continued to decrease over the last couple of decades, the Decree has been consistently renewed over a long period of time, especially in areas focused on agricultural activity. In turn, this has led to the overuse of water basins, generating severe water sustainability problems which affect the most vulnerable and poorer local communities (Budds 2012).

Water governance is closely related to the political-economic momentum (Romero Aravena et al. 2018). Therefore, the problem that emerges from water management is above all a "hydrosocial" issue that accounts for processes of water commodification, through hydropolitical dynamics (Ulloa and Romero 2018; Budds 2012; Damonte et al. 2020). In the Chilean context, water scarcity has much more to do with social aspects that determine how, why and by whom water is being used, than by hydroclimatic factors (Budds 2012). In this context, the situation of indigenous peoples in relation to droughts must be understood within the framework of a governance that has gradually left these groups without regular access to water, concentrating these property rights in agro-industry sector. This significantly reduces their ability to adapt to the crisis and build resilient communities.

Data and Methods

Our main data sources are the Survey of Socioeconomic Characterization (CASEN, from its name in Spanish), a cross-sectional multipurpose household survey collected at two- to three- years intervals between 1990 to 2017. CASEN, which is a representative at the regional level for every year considered, provides socioeconomic and demographic information for households. and allows us to analyze individual-level data on employment status and income. Our main sample consists of working adults between the ages of 18 and 65 who are not currently studying. With respect to our main outcomes of interest, we first analyze income using autonomous income, defined as total income minus public and private transfers; and autonomous income from agriculture, which includes agricultural wages as well as income from self-employed activities related to crops, livestock, forestry and fishing. We then analyze the following set of labor market outcomes: being unemployed, estimated for the sample in the labor force; working in agriculture and working as an unpaid family worker, each estimated for the sub-sample that is working; and being out of the labor force, estimated for the full sample of 18 to 65 years old who are not studying. We measure drought using two definitions. First, we use a continuous measure of droughts computed as a standardized index of precipitation or water flow depending on the area considered. Here, positive values identify areas with larger levels of precipitation or water flow, and therefore non-drought areas. To make our results more easily interpretable, we have multiplied the index by -1, thus in our results an increase in the index represents an increase in the measure of drought. Second, we use the technical criterion adopted by the General Direction of Water (DGA in Spanish), which is defined at the basin level, but can be easily assigned to municipalities, considering the municipalities located within each basin. According to this definition, a basin – and therefore a municipality – is experiencing drought if the cumulated precipitations or water flow, depending on the area of the country, is below a threshold of -0.84 in a standardized index of precipitations or water flow, respectively (see

DGA's Resolution 1674 of 2012).[2] We believe the continuous measure can provide us with a more general view of the impact of an increase in droughts on income and employment (similar to an extensive margin of the effect), while the dichotomous measure of droughts only considers areas under a severe drought as 'treated', and therefore informs on the magnitude of the effect in the most affected areas (similar to the intensive margin). We present both results for the main estimates.

Our focus is on analyzing heterogenous impacts of droughts for women compared to men, indigenous population compared to non-indigenous groups, and especially indigenous women compared with the rest of the population. We estimate individual-level regressions using data from CASEN, considering individuals who identify themselves as belonging to an indigenous group, and women. Our baseline regression is

$$y_{jit} = \beta T_{it} + \gamma W_{ji} + \rho I_{ji} + Z_{jit}\vartheta + \varnothing_i + \tau_t + \mu_{jit} \tag{1}$$

Where y_{jit} is the outcome of interest, T_{it} is a either continuous or dummy variable indicating the presence of drought in municipality i at time t, W_{ji} is a dummy variable with value 1 when the individual j is a woman (0 when is a man), I_{ji} is a dummy variable with value 1 when the individual belongs to an indigenous group (0 otherwise) and Z_{jit} is a vector of other individual-level characteristics, such as age, marital status, level of education, occupation and sector of employment. Finally, $\varnothing_i$ is a municipality fixed effect, to controlfor time-invariant unobserved heterogeneity, and τ_t is a time trend. After estimating this baseline model, we add interaction terms between drought, gender, and belonging to an indigenous group, to estimate the differential impact of droughts on women, indigenous groups, and indigenous women, as in Eq. (2).

$$y_{jit} = \beta T_{it} W_{ji} I_{ji} + Z_{jit}\vartheta + \varnothing_i + \tau_t + \mu_{jit} \tag{2}$$

All regressions are estimated using robust standard errors. Additional estimates using region by year fixed effects and clustered standard errors at the municipality level yield similar results. Our estimates are computed for the country as a whole and for northern and southern areas of the country, for which the CASEN survey is highly representative. Our estimates do not include weights, but estimations including individual probability weights yield similar results and are available upon request. Finally, since we are interested in several outcomes and only have one 'treatment', we have conducted a multiple hypothesis testing using the Romano Wolf test (Clarke et al. 2020). The test results, which are also available upon request, showed that our estimates are still valid and significant even after adjusting with the aforementioned test.

Our identifying assumption is that conditional on all observed variables and on time-invariant municipal level unobserved variables, the spatial distribution of droughts is as good as random. We believe that this is a reasonable assumption when droughts are measured by the volume of precipitations. The use of region by year fixed effects in robustness checks further controls for time-varying unobserved variables operating at regional level. However, when droughts are measured by water flow, we cannot rule out the existence of time-varying unobserved factors simultaneously affecting local (municipal) levels of droughts as well as incomes and labor market outcomes. For this reason, our results should be interpreted as conditional correlations rather than causal impacts.

[2] See resolutions in: https://dga.mop.gob.cl/legistlacionynormas/resoluciones/Resoluciones/1674_2012.pdf

Table 1 Overall effects of droughts on autonomous income (in logs)

	Whole Country		North		South	
	All	Ag. Workers	All	Ag. Workers	All	Ag. Workers
Drought	5.24e-05	–4.47e-05	0.000216	0.00198***	–7.36e-05	–0.000145
	(0.000124)	(0.000279)	(0.000253)	(0.000715)	(0.000189)	(0.000393)
Schooling (years)	0.0901***	0.0597***	0.0821***	0.0469***	0.0896***	0.0649***
	(0.000222)	(0.000499)	(0.000525)	(0.00127)	(0.000332)	(0.000710)
Age (years)	0.0137***	0.00917***	0.0125***	0.00816***	0.0132***	0.00932***
	(6.33e-05)	(0.000139)	(0.000140)	(0.000352)	(9.81e-05)	(0.000199)
Married = 1	–0.124***	–0.158***	–0.133***	–0.134***	–0.129***	–0.186***
	(0.00146)	(0.00312)	(0.00327)	(0.00779)	(0.00227)	(0.00454)
Mining = 1	0.447***		0.443***		0.390***	
	(0.00387)		(0.00613)		(0.0148)	
Manufacturing = 1	–0.000551		0.0122		–0.00498	
	(0.00278)		(0.00810)		(0.00391)	
Services = 1	0.0762***		0.0851***		0.0717***	
	(0.00197)		(0.00494)		(0.00289)	
Self-employed = 1	–0.810***	–0.929***	–0.701***	–0.672***	–0.842***	–0.998***
	(0.00637)	(0.0152)	(0.0146)	(0.0368)	(0.00979)	(0.0210)
Salaried = 1	–0.840***	–1.073***	–0.723***	–0.896***	–0.843***	–1.067***
	(0.00613)	(0.0148)	(0.0141)	(0.0361)	(0.00946)	(0.0207)
Military = 1	–0.439***		–0.274***		–0.411***	
	(0.00785)		(0.0186)		(0.0127)	
Domestic Work = 1	–1.197***		–1.116***		–1.201***	
	(0.00695)		(0.0167)		(0.0107)	
Rural = 1	0.00543***	–0.0442***	–0.0293***	–0.0899***	0.00316	–0.0467***
	(0.00178)	(0.00310)	(0.00460)	(0.00849)	(0.00257)	(0.00460)
Woman = 1	–0.285***	–0.274***	–0.289***	–0.200***	–0.285***	–0.330***
	(0.00159)	(0.00394)	(0.00354)	(0.00902)	(0.00250)	(0.00625)
Indigenous = 1	–0.0619***	–0.105***	–0.0407***	–0.0377***	–0.0749***	–0.118***
	(0.00239)	(0.00505)	(0.00513)	(0.0131)	(0.00324)	(0.00605)
Constant	11.31***	11.90***	11.26***	11.80***	11.17***	11.64***
	(0.0102)	(0.0282)	(0.0214)	(0.0522)	(0.0149)	(0.0342)
Observations	1,095,255	257,775	198,042	34,478	499,295	145,621
R-squared	0.439	0.345	0.440	0.365	0.392	0.318

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Results

Autonomous Income

Table 1 presents the baseline results of the relationship between droughts and autonomous income for workers in all industries and for people working in the agricultural sector specifically (both as wage workers and as self-employed, including employers), estimated

Table 2 Effects of droughts on autonomous income (in logs): heterogenous effects by gender

	Chile	North	South
Drought	–0.000125	0.000197	–0.000398*
	(0.000140)	(0.000289)	(0.000211)
Women = 1	–0.285***	–0.289***	–0.285***
	(0.00159)	(0.00357)	(0.00250)
Drought*Woman	0.000470**	5.18e-05	0.000894***
	(0.000187)	(0.000412)	(0.000277)
Schooling (years)	0.0901***	0.0821***	0.0896***
	(0.000222)	(0.000525)	(0.000332)
Age (years)	0.0137***	0.0125***	0.0132***
	(6.33e-05)	(0.000140)	(9.81e-05)
Married = 1	–0.124***	–0.133***	–0.129***
	(0.00146)	(0.00327)	(0.00227)
Mining = 1	0.447***	0.443***	0.391***
	(0.00387)	(0.00613)	(0.0148)
Manufacturing = 1	–0.000443	0.0123	–0.00471
	(0.00278)	(0.00810)	(0.00391)
Services = 1	0.0763***	0.0851***	0.0720***
	(0.00197)	(0.00494)	(0.00289)
Self-employed = 1	–0.810***	–0.701***	–0.842***
	(0.00637)	(0.0146)	(0.00979)
Salaried = 1	–0.840***	–0.723***	–0.843***
	(0.00613)	(0.0141)	(0.00946)
Military = 1	–0.439***	–0.274***	–0.411***
	(0.00785)	(0.0186)	(0.0127)
Domestic Work (Employed) = 1	–1.197***	–1.116***	–1.201***
	(0.00695)	(0.0167)	(0.0107)
Rural = 1	0.00544***	–0.0293***	0.00322
	(0.00178)	(0.00460)	(0.00257)
Indigenous = 1	–0.0619***	–0.0407***	–0.0749***
	(0.00239)	(0.00513)	(0.00324)
Constant	11.31***	11.26***	11.17***
	(0.0102)	(0.0214)	(0.0149)
Observations	1,095,255	198,042	499,295
R-squared	0.439	0.440	0.392

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

for the whole country, the northern region (from Tarapacá to Coquimbo) and the southern region (Maule to Los Lagos). We then interact the variable of interest (drought) with a dummy variable that indicates whether the individual is a woman (Table 2) or belongs to an indigenous group (Table 3). Table 4 interacts both, showing results for indigenous women.

Our baseline results indicate that, on average, droughts have no significant relationship with total incomes or on agricultural incomes for the country as a whole or in the south.

Table 3 Effects of droughts on autonomous income (in logs): heterogenous effects among indigenous and non-indigenous groups

	Chile	North	South
Drought	–8.07e-05	0.000214	–0.000154
	(0.000128)	(0.000263)	(0.000195)
Indigenous = 1	–0.0615***	–0.0407***	–0.0743***
	(0.00239)	(0.00516)	(0.00326)
Drought*Indigenous	0.00125***	1.70e-05	0.000654
	(0.000324)	(0.000657)	(0.000409)
Schooling (years)	0.0901***	0.0821***	0.0896***
	(0.000222)	(0.000525)	(0.000332)
Age (years)	0.0137***	0.0125***	0.0132***
	(6.33e-05)	(0.000140)	(9.81e-05)
Married = 1	–0.124***	–0.133***	–0.129***
	(0.00146)	(0.00327)	(0.00227)
Mining = 1	0.447***	0.443***	0.390***
	(0.00387)	(0.00613)	(0.0147)
Manufacturing = 1	–0.000540	0.0122	–0.00499
	(0.00278)	(0.00810)	(0.00391)
Services = 1	0.0762***	0.0851***	0.0717***
	(0.00197)	(0.00494)	(0.00289)
Self-employed = 1	–0.810***	–0.701***	–0.842***
	(0.00637)	(0.0146)	(0.00979)
Salaried = 1	–0.840***	–0.723***	–0.843***
	(0.00613)	(0.0141)	(0.00946)
Military = 1	–0.439***	–0.274***	–0.411***
	(0.00785)	(0.0186)	(0.0127)
Domestic Work (Employed) = 1	–1.197***	–1.116***	–1.201***
	(0.00695)	(0.0167)	(0.0107)
Rural = 1	0.00542***	–0.0293***	0.00311
	(0.00178)	(0.00460)	(0.00257)
Woman = 1	–0.285***	–0.289***	–0.285***
	(0.00159)	(0.00354)	(0.00250)
Constant	11.31***	11.26***	11.17***
	(0.0102)	(0.0214)	(0.0149)
Observations	1,095,255	198,042	499,295
R-squared	0.439	0.440	0.392

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Contrary to what we expected, in the north it seems that agricultural workers are somehow benefiting from droughts, although the effect is small (less than 0.2% with every standard deviation change in the index). However, this might be a result of the relatively small sample considered and the fact that the north of the country does not have an important agricultural industry, in contrast to the central and southern parts of the country, where the effect is zero on average.

Table 4 Effects of droughts on autonomous income (in logs): heterogenous effects among indigenous women

	Chile	North	South
Drought	–0.000298**	0.000200	–0.000625***
	(0.000145)	(0.000302)	(0.000219)
Women = 1	–0.288***	–0.299***	–0.287***
	(0.00165)	(0.00380)	(0.00263)
Indigenous = 1	–0.0701***	–0.0694***	–0.0784***
	(0.00286)	(0.00635)	(0.00379)
Woman*Indigenous	0.0236***	0.0680***	0.0128*
	(0.00465)	(0.00959)	(0.00656)
Drought*Woman	0.000592***	6.52e-05	0.00130***
	(0.000196)	(0.000439)	(0.000294)
Drought*Indigenous	0.00174***	0.000206	0.00173***
	(0.000391)	(0.000811)	(0.000485)
Drought*Woman*Indigenous	–0.00142**	–0.000537	–0.00314***
	(0.000662)	(0.00128)	(0.000863)
Schooling (years)	0.0901***	0.0822***	0.0896***
	(0.000222)	(0.000525)	(0.000332)
Age (years)	0.0137***	0.0125***	0.0132***
	(6.33e-05)	(0.000140)	(9.81e-05)
Married = 1	–0.124***	–0.134***	–0.129***
	(0.00146)	(0.00327)	(0.00227)
Mining = 1	0.447***	0.443***	0.390***
	(0.00387)	(0.00613)	(0.0148)
Manufacturing = 1	–0.000731	0.0121	–0.00497
	(0.00278)	(0.00810)	(0.00391)
Services = 1	0.0761***	0.0854***	0.0719***
	(0.00197)	(0.00494)	(0.00289)
Self-employed = 1	–0.810***	–0.701***	–0.841***
	(0.00637)	(0.0146)	(0.00979)
Salaried = 1	–0.840***	–0.723***	–0.843***
	(0.00613)	(0.0141)	(0.00946)
Military = 1	–0.439***	–0.275***	–0.411***
	(0.00785)	(0.0186)	(0.0127)
Domestic Work (Employed) = 1	–1.196***	–1.113***	–1.200***
	(0.00695)	(0.0167)	(0.0107)
Rural = 1	0.00557***	–0.0288***	0.00323
	(0.00178)	(0.00460)	(0.00257)
Constant	11.31***	11.27***	11.17***
	(0.0102)	(0.0214)	(0.0149)
Observations	1,095,255	198,042	499,295
R-squared	0.439	0.441	0.392

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

As expected, schooling level increases income, between 5 and 9%, while women, indigenous groups and people living in rural areas have significantly lower income compared to men, non-indigenous people and people living in an urban area, respectively.

Table 2 shows that in general, women's incomes are around 30% lower than men's, on average. Living in a municipality that experiences drought significantly decreases incomes in the South. Meanwhile, women living in municipalities with a drought do not appear to be significantly worse off, and, contrary to what we expected, experience very small increases incomes in the south (0.09%).

Results for the differential effect of droughts for indigenous groups (Table 3) show that they have significantly lower incomes than their non-indigenous counterparts. Droughts are associated with a slight increase in the average incomes of indigenous groups, but the results seem to be driven by the central area of the country, while no significant effect appears in the north or the south..

Now moving to our main results, Table 4 shows that indigenous women are the group most affected by droughts in terms of income, reducing their income up to 0.3% in the south of the country for each standard deviation increase in the index, controlling for the overall effect of droughts, and the average income penalty both women and indigenous groups experience in the economy. The magnitude of the effect is smaller in the country as a whole (0.14%) and close to zero in the north of the country (with a point estimate of 0.05%).

Labor Market Outcomes

We now examine the relationship between droughts and labor market outcomes, focusing again on indigenous women. We report results for the linear probability of working in agriculture (Table 5), working as an unpaid family worker (Table 6), being unemployed (Table 7), and being out of the labor force (Table 8).

While women are always less likely than men to work in agriculture, results from Table 5 show that indigenous workers are more likely to work in that economic sector. While droughts lower the likelihood of working in agriculture in general, the decrease in participation in agriculture because of droughts appears to be stronger for indigenous women, with point estimates ranging from 0.11% for country-level results to 0.224% for the south. As expected, years of schooling decrease the probability of working in agriculture, while living in a rural area increases it.

Table 6 shows that droughts increase the probability of working as an unpaid family worker, especially for indigenous women, although the magnitude of the coefficient is small in all cases. Each standard deviation increase in the drought index increases the likelihood of working as an unpaid family worker by 0.03% for the country as a whole and 0.06% in the north of the country. With respect to the probability of being unemployed, Table 7 shows that women, especially indigenous women, are always more likely to be unemployed, regardless of whether or not they live in a drought area, and droughts do not seem to increase this gap.

Finally, droughts might affect people's participation in the labor force. Traditional gender norms, assigning unpaid domestic labor to women, continue to be prevalent in Chile, especially in rural areas and among indigenous communities. Droughts tend to increase the time required to collect water and associated activities, which are typically carried out by women. Thus, by increasing demand for domestic labor, droughts might decrease women's labor force participation. We test this hypothesis in Table 8. As expected, results indicate that women are always more likely to be out of the labor force, and that droughts

Table 5 Effects of droughts on labor market status: Working in agriculture

	Chile	North	South
Drought	–0.000744***	–0.00102***	–0.000600***
	(7.50e-05)	(0.000144)	(0.000118)
Women = 1	–0.0989***	–0.0728***	–0.129***
	(0.000704)	(0.00152)	(0.00114)
Indigenous = 1	0.0481***	0.0415***	0.0507***
	(0.00157)	(0.00327)	(0.00211)
Woman*Indigenous	–0.0522***	0.0185***	–0.0701***
	(0.00223)	(0.00453)	(0.00316)
Drought*Woman	0.00252***	0.00215***	0.00305***
	(8.89e-05)	(0.000183)	(0.000138)
Drought*Indigenous	0.000618***	0.000725*	0.000667**
	(0.000212)	(0.000427)	(0.000269)
Drought*Woman*Indigenous	–0.00106***	–0.00140**	–0.00224***
	(0.000314)	(0.000591)	(0.000418)
Schooling (years)	–0.0220***	–0.0183***	–0.0230***
	(9.80e-05)	(0.000227)	(0.000149)
Age (years)	–0.000913***	–0.000703***	–0.000857***
	(2.94e-05)	(6.24e-05)	(4.67e-05)
Married = 1	0.00997***	0.00849***	0.00785***
	(0.000709)	(0.00151)	(0.00112)
Rural = 1	0.304***	0.303***	0.327***
	(0.00104)	(0.00268)	(0.00143)
Constant	0.394***	0.350***	0.432***
	(0.00343)	(0.00747)	(0.00527)
Observations	1,127,391	203,488	516,537
R-squared	0.325	0.303	0.340

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

significantly increase this probability, especially for indigenous women: The estimated effect of droughts for indigenous women is 0.11% for Chile, 0.29% for the north and 0.2% for the south.

Robustness Checks

We conducted several robustness checks on the main results. First, we replaced the continuous measure of drought with a dichotomous one, to identify more severely affected areas. Second, we use region by year fixed-effects instead of municipality fixed-effects, to control for time-varying unobservables that may be simultaneously affecting droughts and income and labor market outcomes. Third, we evaluate whether our results are driven by a large portion of the sample being from the Metropolitan Region of Santiago (MRS), where agriculture and droughts in general would have a potentially smaller impact on income and employment. To do this we estimated the main regressions excluding the MRS from the

Table 6 Effects of droughts on labor market status: Working as an unpaid family worker

	Chile	North	South
Drought	0.000217***	0.000222***	0.000246***
	(1.75e-05)	(3.91e-05)	(2.77e-05)
Women = 1	0.0104***	0.0117***	0.0119***
	(0.000238)	(0.000623)	(0.000394)
Indigenous = 1	0.00308***	0.00332***	0.00344***
	(0.000421)	(0.000961)	(0.000589)
Woman*Indigenous	0.00190**	0.00535***	0.000921
	(0.000815)	(0.00183)	(0.00117)
Drought*Woman	–0.000313***	–0.000359***	–0.000277***
	(2.73e-05)	(6.41e-05)	(4.23e-05)
Drought*Indigenous	–0.000366***	–0.000196	–0.000465***
	(6.35e-05)	(0.000125)	(8.26e-05)
Drought*Woman*Indigenous	0.000334***	0.000699***	0.000105
	(0.000119)	(0.000247)	(0.000155)
Schooling (years)	–0.000504***	–0.000717***	–0.000534***
	(2.47e-05)	(7.21e-05)	(3.78e-05)
Age (years)	–0.000132***	–0.000203***	–0.000174***
	(8.22e-06)	(2.00e-05)	(1.33e-05)
Married = 1	0.00157***	0.00148***	0.00378***
	(0.000202)	(0.000505)	(0.000337)
Rural = 1	0.00890***	0.0149***	0.0106***
	(0.000262)	(0.000856)	(0.000366)
Constant	0.0265***	0.0356***	0.0219***
	(0.00127)	(0.00303)	(0.00169)
Observations	1,132,552	204,948	518,363
R-squared	0.013	0.017	0.015

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

sample. Results from all robustness checks are presented in the Appendix Tables 9, 10, 11, 12, 13 and 14. Results for the dichotomous measurement of drought are similar to those estimated using the continuous outcome, but the estimated coefficients are larger: among indigenous women living in areas suffering from droughts, incomes decreased by 3% when the metropolitan region of Santiago is exluded, and by 4.8% in the south of Chile.

In terms of labor market outcomes, the magnitude of the point estimates increases but they are similar in terms of significance. Using the dichotomous measure, results show that, for indigenous women, living in areas suffering droughts reduces the likelihood of working in agriculture by 1.6% and increases the likelihood of being out of the labor force by 2.3%.

Our second set of estimates using region by year FE, yield basically the same results obtained before. In particular, an increase in droughts is associated with a reduction in the chances of working in agriculture (for the country as a whole) and with an increase in the chances of being out of the labor force, especially in the south of the country.

Finally, our results change little when we exclude the MRS, and overall, it seems to be more informative to analyze differences between the north and south with respect to the

Table 7 Effects of droughts on labor market status: Being unemployed

	Chile	North	South
Drought	–9.52e-05*	0.000136	–0.000294***
	(5.22e-05)	(0.000116)	(7.83e-05)
Women = 1	0.0228***	0.0114***	0.0278***
	(0.000569)	(0.00134)	(0.000907)
Indigenous = 1	0.000906	0.000570	–0.00116
	(0.00101)	(0.00231)	(0.00134)
Woman*Indigenous	0.00560***	–0.00381	0.0107***
	(0.00170)	(0.00344)	(0.00240)
Drought*Woman	–0.000283***	–0.000301*	–0.000214**
	(7.33e-05)	(0.000174)	(0.000108)
Drought*Indigenous	–0.000114	0.000898***	–0.000425***
	(0.000136)	(0.000315)	(0.000165)
Drought*Woman*Indigenous	0.000157	–0.000427	0.000418
	(0.000241)	(0.000478)	(0.000313)
Schooling (years)	–0.00308***	–0.00274***	–0.00373***
	(6.59e-05)	(0.000158)	(0.000101)
Age (years)	–0.00304***	–0.00311***	–0.00327***
	(2.23e-05)	(5.13e-05)	(3.42e-05)
Married = 1	0.0404***	0.0411***	0.0428***
	(0.000528)	(0.00121)	(0.000820)
Rural = 1	–0.0234***	–0.0269***	–0.0251***
	(0.000606)	(0.00155)	(0.000879)
Constant	0.172***	0.183***	0.187***
	(0.00268)	(0.00532)	(0.00381)
Observations	1,231,875	222,662	568,631
R-squared	0.041	0.038	0.046

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

whole country, given their different geographical and productive characteristics, than just excluding the MRS from the full sample.

Conclusions

Chile is facing a longstanding and severe drought that has caused several impacts over different outcomes, but that has mainly affected water availability for human consumption, especially for vulnerable populations. While an important part of the problem comes directly from climate change, for the specific case of Chile, it is possible to assert that water governance plays an important role in increasing the severity of the droughts, and amplifies its effects for rural inhabitants, women, and especially indigenous groups.

This paper analyzed the relationship of droughts with several measures of income and labor market outcomes at the individual level, focusing in particular on women and indigenous groups, with the hypothesis that both groups are more affected in terms of income

Table 8 Effects of droughts on labor market status: Being out of the labor force

	Chile	North	South
Drought	0.00125***	0.00104***	0.00129***
	(6.88e-05)	(0.000147)	(0.000102)
Women = 1	0.363***	0.375***	0.387***
	(0.000666)	(0.00158)	(0.000988)
Indigenous = 1	–0.0164***	0.0316***	–0.0280***
	(0.00135)	(0.00314)	(0.00175)
Woman*Indigenous	0.00917***	–0.0964***	0.0388***
	(0.00195)	(0.00456)	(0.00249)
Drought*Woman	–0.00255***	–0.00241***	–0.00245***
	(8.81e-05)	(0.000208)	(0.000125)
Drought*Indigenous	–0.000606***	–0.00115***	–0.00107***
	(0.000183)	(0.000408)	(0.000224)
Drought*Woman*Indigenous	0.00114***	0.00292***	0.00201***
	(0.000275)	(0.000619)	(0.000335)
Schooling (years)	–0.0184***	–0.0176***	–0.0192***
	(8.87e-05)	(0.000222)	(0.000127)
Age (years)	–0.00317***	–0.00423***	–0.00283***
	(2.78e-05)	(6.45e-05)	(4.03e-05)
Married = 1	0.0221***	0.00737***	0.0288***
	(0.000680)	(0.00158)	(0.000993)
Rural = 1	0.0297***	–0.00413**	0.0475***
	(0.000782)	(0.00206)	(0.00106)
Constant	0.472***	0.517***	0.432***
	(0.00374)	(0.00708)	(0.00498)
Observations	1,913,033	342,251	919,349
R-squared	0.179	0.173	0.199

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

and labor market outcomes compared to men and non-indigenous groups, respectively; and that indigenous women are the most affected group.

Overall, our results suggest that indigenous women are indeed the group most severely affected by droughts. First, droughts decrease indigenous women's probability of working in agriculture. In principle, this might be part of a process of diversification of household income sources and lead to better paid jobs. However, our results also indicate that droughts cause a larger decrease in income among indigenous women compared to other groups, suggesting that their diversification away from agriculture is not going towards higher income activities. Indigenous women in Chile, on average, have significantly lower labor force participation, incomes, and years of schooling compared to both indigenous men and non-indigenous women. Droughts appear to exacerbate this gap, increasing inequality and indigenous women's vulnerability, and adaptation and mitigation policies should consider these heterogeneities in exposure and vulnerability to the impacts of droughts and other climate change related events.

Appendix

Table 9 Variables used in the sample

Variable	Observations	Mean	Std. Dev	Min	Max
Autonomous income (logs)	1,505,352	12.08	1.15	1.39	18.25
Years of Schooling	2,268,083	9.88	4.22	0	23
Age	2,279,300	38.91	13.58	18	65
Indigenous = 1	1,921,275	0.12	0.32	0	1
Women = 1	2,279,300	0.52	0.50	0	1
Married = 1	2,279,104	0.42	0.49	0	1
Works in Agriculture = 1	1,332,151	0.25	0.43	0	1
Rural = 1	2,279,300	0.32	0.47	0	1
Unpaid Family Worker = 1	1,338,469	0.01	0.10	0	1
Unemployed = 1	1,392,536	0.08	0.27	0	1
Out of the labor force = 1	2,176,471	0.36	0.48	0	1
Drought = 1	2,279,300	0.10	0.30	0	1

Table 10 Means across areas, according to the presence of a drought

	Chile		Excluding MRS	
Variable	No drought	Drought	No drought	Drought
Autonomous income (logs)	12.06	12.28	12.03	12.25
Years of Schooling	9.80	10.55	9.69	10.46
Age	38.85	39.44	38.97	39.50
Indigenous (%)	11.72	32.17	12.78	10.93
Women (%)	51.65	49.97	51.56	52.54
Married (%)	41.72	49.31	41.43	44.21
Works in Agriculture (%)	24.64	43.09	26.37	21.02
Rural (%)	32.49	46.84	34.18	28.98
Unpaid Family Worker (%)	1.05	10.19	1.12	0.93
Unemployed (%)	8.05	27.20	8.13	8.24
Out of the labor force (%)	36.02	48.01	36.81	35.15
Observations	2,050,196	229,104	1,816,634	216,206

Table 11 Effects of droughts on autonomous income (in logs): heterogenous effects among indigenous women. Using dichotomous measure of droughts

	Chile	North	South
Drought = 1	–0.0141***	–0.00374	–0.0229***
	(0.00314)	(0.00708)	(0.00468)
Women = 1	–0.290***	–0.300***	–0.291***
	(0.00174)	(0.00399)	(0.00280)
Indigenous = 1	–0.0725***	–0.0652***	–0.0816***
	(0.00298)	(0.00655)	(0.00396)
Woman*Indigenous	0.0269***	0.0693***	0.0207***
	(0.00488)	(0.00998)	(0.00692)
Drought*Woman	0.0181***	0.0124	0.0289***
	(0.00467)	(0.0102)	(0.00693)
Drought*Indigenous	0.0155	–0.0459**	0.0144
	(0.00942)	(0.0203)	(0.0117)
Drought*Woman*Indigenous	–0.0251	–0.0124	–0.0481**
	(0.0159)	(0.0318)	(0.0207)
Schooling (years)	0.0901***	0.0823***	0.0896***
	(0.000222)	(0.000525)	(0.000332)
Age (years)	0.0137***	0.0125***	0.0132***
	(6.33e-05)	(0.000140)	(9.81e-05)
Married = 1	–0.124***	–0.134***	–0.129***
	(0.00146)	(0.00327)	(0.00227)
Mining = 1	0.446***	0.443***	0.390***
	(0.00387)	(0.00613)	(0.0148)
Manufacturing = 1	–0.000748	0.0123	–0.00509
	(0.00278)	(0.00810)	(0.00391)
Services = 1	0.0761***	0.0857***	0.0717***
	(0.00197)	(0.00494)	(0.00289)
Self-employed = 1	–0.810***	–0.701***	–0.841***
	(0.00637)	(0.0146)	(0.00979)
Salaried = 1	–0.840***	–0.723***	–0.843***
	(0.00613)	(0.0141)	(0.00946)
Military = 1	–0.439***	–0.275***	–0.411***
	(0.00785)	(0.0186)	(0.0127)
Domestic Work (Employed) = 1	–1.196***	–1.113***	–1.201***
	(0.00695)	(0.0167)	(0.0107)
Rural = 1	0.00561***	–0.0289***	0.00330
	(0.00178)	(0.00460)	(0.00257)
Constant	11.32***	11.27***	11.18***
	(0.0102)	(0.0214)	(0.0149)
Observations	1,095,255	198,042	499,295
R-squared	0.439	0.441	0.392

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 12 Effects of droughts on autonomous income (in logs): heterogenous effects among indigenous women. Results for Chile without the MRS (compared to the results presented in the manuscript)

	Chile	Excl. MRS	North	South
Drought	–0.000298**	–0.000506***	0.000200	–0.000625***
	(0.000145)	(0.000151)	(0.000302)	(0.000219)
Women = 1	–0.288***	–0.288***	–0.299***	–0.287***
	(0.00165)	(0.00176)	(0.00380)	(0.00263)
Indigenous = 1	–0.0701***	–0.0721***	–0.0694***	–0.0784***
	(0.00286)	(0.00292)	(0.00635)	(0.00379)
Woman*Indigenous	0.0236***	0.0265***	0.0680***	0.0128*
	(0.00465)	(0.00476)	(0.00959)	(0.00656)
Drought*Woman	0.000592***	0.000875***	6.52e-05	0.00130***
	(0.000196)	(0.000209)	(0.000439)	(0.000294)
Drought*Indigenous	0.00174***	0.00197***	0.000206	0.00173***
	(0.000391)	(0.000400)	(0.000811)	(0.000485)
Drought*Woman*Indigenous	–0.00142**	–0.00183***	–0.000537	–0.00314***
	(0.000662)	(0.000680)	(0.00128)	(0.000863)
Schooling (years)	0.0901***	0.0880***	0.0822***	0.0896***
	(0.000222)	(0.000234)	(0.000525)	(0.000332)
Age (years)	0.0137***	0.0133***	0.0125***	0.0132***
	(6.33e-05)	(6.69e-05)	(0.000140)	(9.81e-05)
Married = 1	–0.124***	–0.123***	–0.134***	–0.129***
	(0.00146)	(0.00155)	(0.00327)	(0.00227)
Mining = 1	0.447***	0.448***	0.443***	0.390***
	(0.00387)	(0.00400)	(0.00613)	(0.0148)
Manufacturing = 1	–0.000731	–0.00471	0.0121	–0.00497
	(0.00278)	(0.00295)	(0.00810)	(0.00391)
Services = 1	0.0761***	0.0734***	0.0854***	0.0719***
	(0.00197)	(0.00206)	(0.00494)	(0.00289)
Self-employed = 1	–0.810***	–0.793***	–0.701***	–0.841***
	(0.00637)	(0.00678)	(0.0146)	(0.00979)
Salaried = 1	–0.840***	–0.819***	–0.723***	–0.843***
	(0.00613)	(0.00653)	(0.0141)	(0.00946)
Military = 1	–0.439***	–0.392***	–0.275***	–0.411***
	(0.00785)	(0.00825)	(0.0186)	(0.0127)
Domestic Work (Employed) = 1	–1.196***	–1.195***	–1.113***	–1.200***
	(0.00695)	(0.00745)	(0.0167)	(0.0107)
Rural = 1	0.00557***	–0.00370**	–0.0288***	0.00323
	(0.00178)	(0.00186)	(0.00460)	(0.00257)
Constant	11.31***	11.32***	11.27***	11.17***
	(0.0102)	(0.0106)	(0.0214)	(0.0149)
Observations	1,095,255	978,203	198,042	499,295
R-squared	0.439	0.425	0.441	0.392

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 13 Effects of droughts on labor market status: Chile. Using dichotomous measure of droughts

	Agriculture	Unpaid	Unemployed	Out of labor
Drought = 1	–0.0140***	0.00372***	0.000708	0.0235***
	(0.00162)	(0.000334)	(0.00111)	(0.00152)
Women = 1	–0.105***	0.0112***	0.0237***	0.370***
	(0.000749)	(0.000258)	(0.000601)	(0.000700)
Indigenous = 1	0.0476***	0.00324***	0.00114	–0.0139***
	(0.00164)	(0.000442)	(0.00105)	(0.00141)
Woman*Indigenous	–0.0487***	0.00133	0.00519***	0.00506**
	(0.00235)	(0.000863)	(0.00179)	(0.00205)
Drought*Woman	0.0478***	–0.00589***	–0.00651***	–0.0528***
	(0.00209)	(0.000556)	(0.00173)	(0.00217)
Drought*Indigenous	–0.00410	0.000674	–0.00109	–0.0167***
	(0.00506)	(0.00147)	(0.00324)	(0.00438)
Drought*Woman*Indigenous	–0.0160**	0.00256	0.00192	0.0227***
	(0.00730)	(0.00269)	(0.00560)	(0.00668)
Schooling (years)	–0.0220***	–0.000504***	–0.00308***	–0.0184***
	(9.80e-05)	(2.47e-05)	(6.59e-05)	(8.87e-05)
Age (years)	–0.000913***	–0.000132***	–0.00304***	–0.00317***
	(2.94e-05)	(8.22e-06)	(2.23e-05)	(2.78e-05)
Married = 1	0.00997***	0.00158***	0.0404***	0.0220***
	(0.000709)	(0.000202)	(0.000528)	(0.000680)
Rural = 1	0.304***	0.00890***	–0.0235***	0.0297***
	(0.00104)	(0.000262)	(0.000606)	(0.000782)
Constant	0.396***	0.0260***	0.171***	0.469***
	(0.00344)	(0.00126)	(0.00269)	(0.00375)
Observations	1,127,391	1,132,552	1,231,875	1,913,033
R-squared	0.325	0.013	0.041	0.179

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 14 Effects of droughts on labor market status: Chile. Results for Chile without the MRS

	Agriculture	Unpaid	Unemployed	Out of labor
Drought	–0.000904***	0.000219***	–0.000109**	0.00131***
	(7.96e-05)	(1.85e-05)	(5.48e-05)	(7.21e-05)
Women = 1	–0.103***	0.0108***	0.0237***	0.371***
	(0.000767)	(0.000261)	(0.000609)	(0.000704)
Indigenous = 1	0.0485***	0.00336***	0.00117	–0.0130***
	(0.00161)	(0.000438)	(0.00103)	(0.00138)
Woman*Indigenous	–0.0513***	0.00194**	0.00516***	0.00323
	(0.00230)	(0.000849)	(0.00174)	(0.00199)
Drought*Woman	0.00269***	–0.000329***	–0.000283***	–0.00267***
	(9.74e-05)	(2.97e-05)	(7.89e-05)	(9.38e-05)
Drought*Indigenous	0.000463**	–0.000396***	–0.000129	–0.000610***
	(0.000219)	(6.63e-05)	(0.000140)	(0.000188)
Drought*Woman*Indigenous	–0.000939***	0.000357***	0.000148	0.00117***
	(0.000327)	(0.000125)	(0.000249)	(0.000282)
Schooling (years)	–0.0225***	–0.000500***	–0.00314***	–0.0186***
	(0.000106)	(2.68e-05)	(7.04e-05)	(9.38e-05)
Age (years)	–0.000952***	–0.000135***	–0.00308***	–0.00315***
	(3.17e-05)	(8.88e-06)	(2.37e-05)	(2.93e-05)
Married = 1	0.00989***	0.00193***	0.0406***	0.0224***
	(0.000765)	(0.000219)	(0.000560)	(0.000717)
Rural = 1	0.311***	0.00946***	–0.0247***	0.0308***
	(0.00109)	(0.000276)	(0.000632)	(0.000812)
Constant	0.407***	0.0271***	0.175***	0.465***
	(0.00368)	(0.00134)	(0.00280)	(0.00386)
Observations	1,008,095	1,012,528	1,102,172	1,728,609
R-squared	0.324	0.014	0.042	0.182

All regressions include municipality fixed effects and a time trend. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Author Contributions All authors conceive the idea, the project design and wrote and edit the manuscript. Rodrigo and Chiara were in charge of the statistical analysis. Rodrigo coordinated the project.

Funding This research has been funded by the Inter-American Development Bank through the "Implications of Climate Change and Natural Disasters for Latin America" Project.

Data Availability All data used is publicly available from its original sources. CASEN surveys are available in http://observatorio.ministeriodesarrollosocial.gob.cl/encuesta-casen, Population Census are available from https://www.ine.gob.cl/estadisticas/sociales/censos-de-poblacion-y-vivienda/censo-de-poblacion-y-vivienda, Agricultural Census are available from https://www.ine.gob.cl/estadisticas/economia/agricultura-agroindustria-y-pesca/censos-agropecuarios, and climate-related data are available from https://www.cr2.cl/bases-de-datos/ and from https://snia.mop.gob.cl/BNAConsultas/reportes. Information collected in our field work are available from the corresponding author on reasonable request.

Declarations

Competing Interests The authors declare they have no financial interests to report.

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